Southern Electricity Supply Company of Odisha Limited (SOUTHCO)

TENDER NOTICE NO
SOUTHCO/RLTAP-INSTALLATION / 03 /2013-14

FOR

Turnkey Contract (Supply & Erection)

- DATE OF OPENING OF TENDER: 29.10.2013
- TIME: 04.00 PM
- Last date of Submission of Bid : 29.10.2013
- TIME: 02.00 PM
- Date of Pre-bid meeting: 26.10.2013 at 11.00 AM
PLACE: EXECUTIVE ENGINEER CONSTRUCTION DIVISION. JEYPORE CIRCLE, JEYPORE

TENDER NOTICE NO: SOUTHCO / RLTAP – INSTALLATION/ 03/2013-14

For and on behalf of Southern Electricity Supply Company of Odisha Ltd. (SOUTHCO), the undersigned invites sealed bids in duplicate on two part bidding system from qualified and eligible bidders, who comply with the terms and conditions for the following works to be executed in the licensed area in the State of Odisha.

<table>
<thead>
<tr>
<th>Name of Package</th>
<th>Scope of Work (13-14)</th>
<th>Estimated Cost (Rs. in Lakh.)</th>
<th>Earnest Money Deposit (Rs. in Thousands)</th>
<th>Non refundable Cost of Bid document</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Construction of new 33/11 kv s/s at Machkund with 2X3.15 MVA &amp; 33KV linking from Lamtaput(Tusuba) proposed 33/11KV S/s under RGGVY to Machkund -25km</td>
<td>24986124.00</td>
<td>249860.00</td>
<td></td>
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<tr>
<td>B</td>
<td>Construction of 33KV line with 100mm2 AAAC -10Mtr PSC pole -30km(from Jaynagar grid s/s to Lamtaput) and 33 KV line on 132 KV tower -10km.</td>
<td>43897613.00</td>
<td>438980.00</td>
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<tr>
<td>D</td>
<td>33KV Bay extension&amp; construction of 33kv line of 100 mm2 AAAC using 10 mtr long PSC pole -17 km from sunabeda 132/33 kv grid S/s to OMP Koraput</td>
<td>8337787.00</td>
<td>83380.00</td>
<td></td>
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<tr>
<td>G</td>
<td>Uprating of 33KV line conductor from 34 mm2 to 100mm2 AAAC - 34 KM(05 Nos Intermediate pin point pole &amp; 01 cut point pole for each km) with 02 Nos 33kv DP fromp Umerkote to Raigarh</td>
<td>9847366.00</td>
<td>98480.00</td>
<td></td>
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</tbody>
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<table>
<thead>
<tr>
<th>Name of Package</th>
<th>Scope of Work (2014-2015)</th>
<th>Estimated Cost (Rs. in Lakh.)</th>
<th>Earnest Money Deposit (Rs. in Thousands)</th>
<th>Non refundable Cost of Bid document</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Replacement of AB Cable 3X55 + 1X35 mm2 -15 km with</td>
<td>3133221.00</td>
<td>31340.00</td>
<td></td>
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intermediate pole (8 mtrs)-100 Nos under section –II, Jeypore of Jalaput area

Replacement of AB Cable 3X55 + 1X35 mm2 -08 km with intermediate pole (8 mtrs)-60 Nos under section –II, Jeypore of Machkund area.

Replacement of AB Cable 3X55 + 1X35 mm2 -13.5 km with intermediate pole (8 mtrs)-80 Nos under section –II, Jeypore of Onkadil area.

Uprating of conductor from 55 to 100 mm2 AAAC from Laxmipur to Naryyana patna -25 km

01 No 2X1.6 MVA 33/11KV S/s at Balipeta under Narayana patna block with 33 KV line -11 KM

| K | intermediate pole (8 mtrs)-100 Nos under section –II, Jeypore of Jalaput area | 1690932.00 | 16910.00 |
| L | Replacement of AB Cable 3X55 + 1X35 mm2 -08 km with intermediate pole (8 mtrs)-60 Nos under section –II, Jeypore of Machkund area. | 2790711.00 | 27910.00 |
| M | Replacement of AB Cable 3X55 + 1X35 mm2 -13.5 km with intermediate pole (8 mtrs)-80 Nos under section –II, Jeypore of Onkadil area. | 2790711.00 | 27910.00 |
| N | Uprating of conductor from 55 to 100 mm2 AAAC from Laxmipur to Naryyana patna -25 km | 7819968.00 | 78200.00 |
|   | 01 No 2X1.6 MVA 33/11KV S/s at Balipeta under Narayana patna block with 33 KV line -11 KM | 14328899.00 | 143290.00 |

The intending bidders can also download the tender document from our website [www.southcoodisha.com](http://www.southcoodisha.com). However the bidder has to furnish a Demand Draft drawn on any Scheduled Bank in favour of “Southern Electricity Supply of Odisha Ltd” payable at Berhampur for the cost of the Tender Paper indicated above, along with his bid, failing of which the bid will be rejected outright. In the event of any specified date for the sale, submission or opening of bids being declared as holiday for SOUTHCO, the bids will be sold / received / opened up at the appointed time on the next working day. SOUTHCO also reserves the right to accept or reject any or all tenders without assigning any reason thereof, if the situation so warrants.

For detail Tender Specification & Terms and Conditions, please visit our website [www.southcoodisha.com](http://www.southcoodisha.com)
SECTION – I

INVITATION FOR BIDS (IFB)
1.0 SOUTHCO invites sealed tenders from reputed Electrical Contractors with required license, either in individual capacity or as part of a joint venture agreement / consortium for carrying out various Electrical Installation works on ‘Turnkey’ basis in the jurisdiction of his licensed area. The bidder must fulfill all the qualification requirements as specified in clause 2.0 below. The sealed envelopes shall be duly super scribed as “TENDER NOTICE No: SOUTHCO / RLTAP - INSTALLATION/ 03 /2013-14 Due date of opening 29.10.2013”.

2.0 Bidders to be considered as eligible (to bid) should meet the following qualifications;

(a) Bidder may quote for any one package or for multiple packages mentioned in the tender notice; however, bidder must quote for the entire quantum of works specified under each such package(s).

(b) The bidder should have installed and commissioned quantum of work as specified below as qualifying criteria (Work experience)

(i) For construction of new 33/11 KV S/S, the bidder (s) should have executed/constructed at least one no. 33/11 KV S/S on “Turnkey basis”.

(ii) For construction of 33 KV Lines, the bidder(s) should have executed at least 50% quantity of the 11 KV line or higher voltage lines on “Turn Key basis”.

(c) If the bidder(s) participate in multiple packages, the qualifying requirement for work experience shall be considered /evaluated independently/separately for each package.

(d) The minimum average Annual Turnover of the bidder in any best three financial years out of last five financial years should not be less than 50% of the estimated value of all the package(s) quoted by the bidder(s).

(e) Bidder shall be financially sound and stable having liquid assets as stated in the enclosed format and/or access to credit facility of not less than one fifth of estimated cost of the package(s) for which he has submitted the bid.

NB: 1) Only cash at bank / in hand & fixed deposit mentioned in the audited balance sheet of last FY shall be considered for accessing the Liquid Asset.

(f) Two or more like minded Electrical contractor(s) and/or manufacturer(s) of electrical items, which are under scope of supply of the contractor as per this tender specification, may form a
joint venture/ consortium agreement amongst themselves and apply against this tender specification, provided they qualify the criteria. The sample format of joint venture / consortium agreement is enclosed at Section – IV of this tender specification as Annexure - VI.

NOTE: 1) Joint Venture/Consortium Partner shall be limiting to 04 (Four) Members.

2) One of the Members should be an Electrical Contractor who will be the Lead member of the JV/Consortium having valid HT License.

3) Work Order shall be issued in favour of the Lead Partner only

However, if the bidder is quoting against one or more package(s) in his individual capacity, he cannot be a part of joint venture / consortium agreement to participate in same package(s) as notified against this tender specification & vice versa.

(g) If the work experience of one partner is not meeting the entire qualifying criteria, the work experience of the other partner (s) specified in the scope of work shall be added for qualifying the bid in total.

Lead Partner should have minimum 50% of Turn Over & 50% of work experience and other partner(s) together shall have balance 50% Turn over & Work experience.

h) One of the partners shall be nominated as Lead Partner and the lead partner shall be authorized to incur liabilities and receive instructions for and on behalf of all partners of the joint venture / consortium and entire execution of the contract including receipt of payments shall be done exclusively through the lead partner. This authorization shall be evidenced by submitting by a Power of Attorney signed by legally authorized signatories of all partners.

(i) All partners of joint venture / consortium shall be liable jointly and severally for the execution of contract in accordance with the contract terms and a copy of the agreement entered into by the joint venture / consortium partners having such a provision shall be submitted with the Bid. A statement to this effect shall be included in the authorization mentioned as above as well as in the Bid form and in Contract form (in case of a successful bid).
(J) a) In addition to above the bidder(s)/Lead Partner of the bidder(s) should submit the following documents in part-I bid as qualifying terms.

i. Valid electrical (HT) license for electrical works.

ii. EPF registration

iii. PAN & TIN No.

b) The bidder(s)/Lead Partner of the bidder(s) shall have to furnish service tax registration, ESI, Labor license, Registration under Building & other Construction workers welfare cess within 45 days of receipt of the order.

(k) The bidders who have earlier failed to execute the work order(s) of SOUTHCO shall not be eligible to participate in this tender.

(l) SOUTHCO reserves the right to waive minor deviation, if they do not materially affect the capacity of the bidder to perform the contract.

3.0 Bids specification document can be obtained from the office of the undersigned on payment of Rs. 6,000/- towards non-refundable cost of bid documents plus 5 % VAT (Total Rs. 6300/-) through Bank DD drawn in favour of “Southern Electricity Supply Company of Odisha Ltd.” payable at Berhampur, during office hours of EE Const. Division Jeypore from Dated _ 08.10.2013 by 11.00 am to 5.00 pm till Dtd 28.10.13.

4.0 The tender documents can also be downloaded from the following websites www.southcoodisha.com. In case tender papers are downloaded from website, then the bidder has to enclose a Demand Draft, drawn on any Scheduled bank in favour of “Southern Electricity Supply Company of Odisha Ltd. payable at Berhampur, covering the cost of bid documents as stated above in a separate envelope with suitable superscription “Cost of Bid Documents: Tender Notice No: SOUTHCO / RLTAP -INSTALLATION/ 03/2013-14”. This envelope should accompany the Bid Documents.

5.0 The Bids shall be submitted and received in the office of the undersigned on all office working days up to 2.00 PM of Date 29.10.13 In the event the date of opening is a holiday, the next working day shall be treated as the date of opening. .
6.0 The bidders may attend pre-bid meeting to be held on 26.09.2013 at 11.00 AM at construction Division Jeypore office SOUTHCO for any clarification on the tender.

6.0 **Part-I of the bid (Technical Bid) will be opened on Dated 29.10.13 at 4.00 PM**, in the presence of the authorized representatives of the Bidders. Bidders shall depute only one representative to attend tender opening if they wish to be represented. The undersigned reserves the right to reject any or all tenders if the situations so warrants.

7.0 All correspondence with regard to the above shall be made to the following address:

Executive Engineer (Elect.)
Construction Division
Southco, Jeypore
Email – bksijeypore@gmail.com
SECTION – II

GENERAL CONDITIONS OF CONTRACT (GCC)
1.0 GENERAL: -

SOUTHCO hereinafter referred to as the “Owner” is desirous of construction of various System Improvement Works under the RLTAP Scheme, on ‘turnkey’ basis in their licensed area in the state of Odisha as described below:

(i) Construction of New 33 KV HT Three Phase Line with AAA Conductor.
(ii) Construction of new 33/11 KV Primary Substation with civil work.
(iii) Up gradation of 33 kv line conductor 100mm2 AAAC.
(iv) Replacement of AB Cable & installation of intermediate pole.

2.0 Scope of Work: -

2.01 The scope shall include supply and installation of all materials & equipment’s to complete the works.

2.02 The detailed scope of the work shall include;

i. Detailed survey of substation, line and preparation of SLD / BOQ to be done by the bidder
ii. Complete manufacture, including shop testing & supply of materials from the approved vendor (materials which are to be supplied by the bidder) on subsequent approval of the owner.
iii. Providing Engineering drawing, data, operational manual, etc for the Owner’s approval;
iv. Packing and transportation from the manufacturer’s works to the site.
v. Receipt, storage, preservation and conservation of equipment at the site.
vi. Pre-assembly, if any, erection testing and commissioning of all the equipment;
vii. Reliability tests and performance and guarantee tests on completion of commissioning;
viii. Loading, unloading and transportation as required.
ix. Erection of equipment’s in Sub-station including civil works.
x. Erection of lines of specified voltage.
xi. Testing, Commissioning of substations and lines / installations
xii. Storing before erection
xiii. Getting the substations & lines inspected by Electrical Inspector after completion of work.
xiv. Transportation and transit insurance of all free issue materials to be supplied from Owner’s nearest stores to site and as well as all other required materials (under the scope of supply
by bidder) from supplier’s premises to work site, construction of new electrical / civil structures, etc.

xv. Dismantling of existing electrical structures and return of these dismantled items at the Owner’s stores, safe custody of the items and return of unused Owner’s supplied materials to the Owner’s stores.

3.0 DEFINITION OF TERMS

(i) The ‘Contract’ means the agreement entered into between the Owner and the Contractor as per the Contract Agreement signed by the parties, including all attachments and appendices there to and all documents incorporated by reference therein.

(ii) ‘Owner’ shall mean SOUTHCO and shall include its legal representatives, successors and assigns.

(iii) ‘Contractor’ shall mean the Bidder whose bid will be accepted by the Owner for the award of the Works and shall include such successful Bidder’s legal representatives, successors and permitted assigns.

(iv) ‘Sub-Contractor’ shall mean the person named in the Contract for any part of the works or any person to whom any part of the Contract has been sublet by the contractor with the consent in writing of the Owner and will include the legal representatives, successors and permitted assigns of such person.

(v) ‘Engineer in Charge’ shall mean the officer appointed in writing by the Owner to act as Engineer from time to time for the purpose of the Contract.

(vi) “Project Manager” shall mean the officer appointed in writing by the Owner to act as Engineer from time to time for the purpose of the Contract.

(vii) ‘Specifications’ shall mean the specifications and Bidding Document forming a part of the Contract and such other schedules and drawings as may be mutually agreed upon.

(viii) ‘Site’ shall mean and include the land and other places on, into or through which the works and the related facilities are to be erected or installed and any adjacent land, paths, street or reservoir which may be allocated or used by the Owner or Contractor in the performance of the Contract.

(ix) ‘Inspector’ shall mean the Purchaser or any person nominated by the Owner from time to
time, to inspect the equipment; stores or Works under the Contract and/or the duly authorized representative of the Owner.

(x) ‘Notice of Award of Contract’/ ‘Letter of Award’ shall mean the official notice issued by the Owner notifying the Contractor that his bid has been accepted.

(xi) ‘Date of Contract’ shall mean the date on which notice of Award of Contract/ Letter of Award has been issued.

(xii) ‘Performance and Guarantee Tests’, shall mean all operational checks and tests required to determine and demonstrate capacity, efficiency, and operating characteristics as specified in the Contract Documents.

(xiii) The term ‘Final Acceptance’/ ‘Taking Over’ shall mean the Owner’s written acceptance of the works performed under the Contract, after successful commissioning/ completion of Performance and Guarantee Tests, as specified in the accompanying Technical Specifications or otherwise agreed in the contract.

(xiv) ‘Commercial Operation’ shall mean the condition of operation in which the complete equipment covered under the Contract is officially declared by the Owner to be available for continuous operation at different loads up to and including rated capacity. Such declaration by the Owner, however, shall not relieve or prejudice the Contractor of any of his obligations under the Contract.

(xv) Words imparting ‘Person’ shall include firms, companies, corporations and associations or bodies of individuals, whether incorporated or not.

(xvi) Terms and expressions not herein defined shall have the same meaning as are assigned to them in the Indian Sale of goods Act (1930), failing that in the Indian Contract Act (1872) and failing that in the General Clauses Act (1897) including amendments thereof, if any.

(xvii) In addition to the above the following definition shall also apply

a) ‘All equipment and materials’ to be supplied shall also mean ‘Goods’

b) ‘Constructed’ shall also mean erected and installed.


4.0 SUBMISSION OF TENDER: -
4.01 Sealed tenders in two parts each in duplicate, each complete in all respects in the manner hereinafter specified are to be submitted at Office of the Executive Engineer (Elect.) Construction Division Southco, Jeypore Pin - 764001 on or before the date and time specified in the notice inviting the tenders. Bids shall be submitted as per format provided in Section – III, Annexure -I. Each copy of the bids (original and duplicate) shall be submitted in separate double sealed envelopes superscripted on each of the covers the tender specification number and the due date of opening of the bids on the right hand top side of the envelop. On the left top side original/ duplicate as is relevant shall be written.

4.02 The tenders are required to be submitted in Two Parts each in separate double sealed covers.

- Part - I: Super scribed as “Technical and commercial bid” shall contain EMD, Cost of Bid Documents and Techno commercial documents.
- Part - II, Super scribed as “Price Bid”. The Part - II should contain only Price bid.

4.03 Fax and Telegraphic tenders shall not be accepted.

4.04 Receipt of bids/ revised bids after the cut off time and date as specified in the Tender specification shall not be permitted and such bids shall be rejected outright. The Owner shall not be responsible for any delay in transit in post / courier etc. in this regard.

5.0 VALIDITY: -

The offer shall be valid for a period not less than 180 days from the date of bid opening.

6.0 PRICE: -

Bidders are required to quote firm price as per the prescribed format enclosed with the tender as BOQ/Price schedule. The quoted price shall be firm and inclusive of all taxes, duties, freight & insurance and other levies, if any. **Owner shall not be liable to pay anything extra over and above the quoted price.**

7.0 RECEIPT AND OPENING OF THE BID: -

7.01 Bids in duplicate as described under clause 4.0 shall be received in the office of the Owner and shall be opened on the scheduled date and time. The Owner’s authorized representatives shall
open bids in the presence of Bidders’ representatives on the date and time for opening of bids as specified in the Invitation to Bid or in case any extension has been given thereto, on the extended bid opening date and time notified.

7.02 Maximum one representative for each bidder shall be allowed to witness the opening of bids. The representative must produce suitable authorization in this regard to be eligible to witness the bid opening on behalf of the bidder. Bidders’ representatives who are present shall sign in a register evidencing their attendance.

7.03 The Bidders’ names, bid prices, modifications, bid withdrawals and the presence or absence of the requisite bid guarantee and such other details as the Owner, at its discretion, may consider appropriate will be announced at the opening. No electronic recording devices will be permitted during bid opening.

7.04 Information relating to the examination, clarification, evaluation and comparison of Bids and recommendations for the award of a contract shall not be disclosed to Bidders or any other persons not officially concerned with such process. Any effort by a Bidder to influence the Owner’s processing of Bids or award decisions may result in the rejection of the Bidder's Bid.

8.0 EVALUATION OF BIDS & AWARD OF CONTRACT:

8.01 To assist in the examination, evaluation and comparison of Bids, the Owner may, at its discretion, ask the Bidder for a clarification of its Bid. All responses to requests for clarification shall be in writing and no change in the price or substance of the Bid shall be sought, offered or permitted.

8.02 Owner will examine the Bids to determine whether they are complete, whether any computational errors have been made, whether required sureties have been furnished, whether the documents have been properly signed, and whether the Bids are generally in order.

8.03 Arithmetical errors will be rectified on the following basis. If there is a discrepancy between the unit price and the total price per item that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price per item will be corrected. If there is a discrepancy
between the Total Amount and the sum of the total price per item, the sum of the total price per item shall prevail and the Total Amount will be corrected.

8.04 Prior to the detailed evaluation, Owner will determine the substantial responsiveness of each Bid to the Bidding Documents including production capability and acceptable quality of the Goods offered. A substantially responsive Bid is one, which conforms to all the terms and conditions of the Bidding Documents without material deviation.

8.05 The Owner’s evaluation of a Bid will take into account, in addition to the Bid price, the following factors, in the manner and to the extent indicated in this Clause:
(a) Work Schedule
(b) Deviations from Bidding Documents

8.06 The Owner will award the Contract to the successful Bidder whose Bid has been determined to be the lowest - evaluated responsive Bid. When the lowest bidders is not ready and/or capable to undertake the entire work envisaged, then the Owner may explore the possibility of the execution of works through other bidders if they are willing to execute at L₁ rate. Such exploration shall be carried out in a sequential order starting with L₂ bidder then with L₃ bidder and so on.

8.07 In case of omission of any item in the price bid or the price for the item has not been quoted by the firm, then zero cost shall be loaded to the bid and the contract shall be awarded with zero cost that means the firm will have to bear the cost of that item entirely as the item price shall be considered as inclusive anywhere in other items. The bidder shall have to give an undertaking to the effect that prices for any item not quoted shall be treated as free supply or to be done free of cost.

9.0 EARNEST MONEY DEPOSIT (EMD):-

9.01 The Tender must be accompanied by Earnest Money Deposit as described in the Tender Notice in shape of Bank Guarantee issued by a Scheduled Bank (valid for 30 days beyond the validity of bid) only and en-cashable at Berhampur or in shape of Demand Draft drawn on any scheduled bank in favour of “Southern Electricity Supply Company of Odisha Ltd.” payable at Berhampur. Bids without EMD deposit will be rejected out rightly. The Bank
Guarantee for EMD shall be strictly as per the format [Annexure – XV(A)] prescribed by the Owner. In case of any deficiency such as the ownership of the security bond (other than the issuing bank), deviation from the approved format, absence of signature of witness etc. found in the EMD Bank Guarantee, the same shall be liable for rejection upfront.

NB: 1) The validity of EMD BG shall be minimum for 30 days over and above the validity of the tender/bid (180 days) i.e., 210 days from the date of opening of the tender.
   2) In case of Joint Venture / Consortium, EMD in shape of BG/DD shall be provided by the Lead Partner.

9.02 No adjustment of any previous deposit or any amount payable from Purchaser shall be entertained for EMD. EMD amount so submitted shall not carry any interest payable to the bidder.

9.03 The Earnest Money so deposited shall be forfeited:
   (a) if the Bidder:
       i) withdraws its bid during the period of bid validity specified by the Bidder in the Bid Form; or
   (b) in the case of a successful Bidder, if the Bidder fails:
       (i) to accept the LOA/Work order within the period specified in the LOA/Work order.
       (ii) to furnish the required Contract Performance Bank Guarantee.

9.04 The EMD of unsuccessful bidders shall be returned within 30 days from the date of finalization of the order.

10.0 OWNER’S RIGHT TO VARY QUANTITIES AT TIME OF AWARD:

   While placing orders and / or during execution of contract, Owner reserve the right to increase or decrease the quantity of goods and services specified in the Schedule of Requirement up to 20% of the tender quantity without any change in unit price or other terms and conditions.

11.0 INSPECTION AND TESTING:-
11.1 All the materials shall be inspected by the Project Manager or any authorized representative of the Project Manager or jointly by the Project Manager / Project Manager’s Authorized Representatives with the Third Party Inspection Evaluation Agency (TPIEA) engaged by SOUTHCO (If any) as per relevant ISS at the Contractor’s or its Sub-Vendors manufacturing works. They shall give the advance notice in writing about the place of Inspection and or testing at least 15 days before the schedule date on which the materials will be ready for Inspection & Testing.

11.2 The Project Manager shall be entitled at all reasonable times during manufacture / installation to inspect examine and test the materials at the contractor’s premises / erection site about workmanship of the materials to be supplied under this contract. If the said materials are being manufactured in other premises, the contractor shall provide unhindered clearance, giving full rights to the purchaser to inspect, examine and test as if the materials were being manufactured in his premises. Such inspection / examination and testing shall not relieve the contractor of his obligations to execute the contract by letter and spirit. The contractor shall give the purchaser advance notice in writing of the Date and the Place at which the materials will be ready for testing.

12.0 COMPLETION AND COMPLETENESS OF THE EQUIPMENT:

12.01 Time being the essence of the contract; the work shall be completed within as follows from the date of issue of work order.
   i) Construction of New 33/11 KV Substation – 6 months
   ii) Construction of new 33 KV line – 4 months
   iii) Up gradation of 33 kv line conductor 100mm2 AAAC. ------2 months
   iv) Replacement of AB Cable & installation of intermediate pole ----3 months

12.02 The work shall be treated as complete when the entire work as per scope of the order shall be complete in all respects with all mountings, fixtures and standard accessories which are normally supplied even though not specifically detailed in the specification. No extra payment shall be payable for such mounting, fittings, fixtures and accessories which are needed for safe
operations of the equipment as required by applicable code of the country though this might not have included in the contract.

12.03 All similar components and/or parts of similar equipment supplied shall be inter-changeable with one another. Various equipment’s supplied under this contract shall be subject to Owner’s approval.

12.04 Project Manager however reserves the right to re-schedule the completion period, if required.

13.0 **REJECTION OF MATERIALS: -**

In the event of the materials supplied by the contractor and/or the installation works are found to be defective in quality and the workmanship is poor or otherwise not in conformity with the requirements of the contract specification as per section-IV (Technical specification), Owner/Project Manager shall reject such materials / services and ask the contractor in writing to replace / rectify the defects. The contractor on receipt of such notification shall rectify or replace the defective materials and/or re-install the work already executed, free of cost to the Owner. If the contractor fails to do so the Owner/Project Manager may at his option take the following actions which could be on concurrent basis.

   A) Replace or rectify such defective materials and recover the extra cost so involved plus 25% from the Contractor.
   B) Terminate the contract for balance supply and erection with enforcement of penalty as per contract.
   C) Acquire the defective materials at reduced price considered acceptable under the circumstances.
   D) Forfeit the Contract Performance Bank Guarantee.

14.0 **DEVIATION FROM SPECIFICATION: -**

The bidders are requested to study the specification and the attached drawings thoroughly before tendering so that if they make any deviations, the same are prominently brought on a separate sheet under the headings “Deviations” as per formats provided under Section IV, Annexure – VII & VIII. All such deviations to the technical & commercial terms of the
specification shall be indicated in a separate list as indicated above. In absence of such deviation schedule, it will be presumed that the bidder has accepted all the conditions stipulated in the tender specification, notwithstanding any deviations mentioned elsewhere in the Bid. However the acceptance of deviation is not binding on the Owner.

15.0 CONTRACTOR TO INFORM HIMSELF FULLY: -

The contractor shall examine the instructions, general conditions of the contract, specifications and the schedule of quantity and delivery to satisfy himself as to all the terms and conditions and circumstances affecting the contract price. He shall quote prices according to his own judgment and shall understand that no additional cost except as quoted shall only be considered.

16.0 PATENT RIGHT: -

The contractor shall indemnify the Owner against all claims, actions, suits and proceedings for the alleged infringement any patent design or copy right protected either in country of origin or in India by the use of any equipment supplied by the contractor but such indemnity shall not cover any use of the equipment other than for the purpose indicated by or reasonable to be informed from the specification.

17.0 GUARANTEE PERIOD: -

18.01 The materials to be supplied by the contractor as well as installation of the same (i.e., entire work including materials supplied by contractor) shall be guaranteed for satisfactory operation against defects in design and workmanship for a period of 24 months from the date of handing over the completed installations after commercial operation at required voltage level.

18.02 The above guarantee certificate shall be furnished in triplicate to the Project Manager for his approval. Any defects noticed during the above period should be rectified by the Contractor free of cost to the Utility provided such defects are due to faulty design, bad workmanship or bad materials used on receipt of written notice from the Project Manager. The Contractor as notified by the Project Manager shall rectify any such defects within one month failing which the Owner/ Project Manager will set right the defects through other agency and recover the cost so incurred either from any pending Invoices or Bank Guarantee.
19.0 PENALTY FOR DELAY IN COMPLETION OF CONTRACT: -

19.01 If the contractor fails to complete the works by the scheduled period or any extension granted thereby, the contractor shall be liable for payment of penalty amounting to 0.5% (half percent) of the contract price per week of un-finished works subject to the maximum of 5% (five percent) of the total contract price and subject to force majeure conditions.

19.02 Penalty amount can be realized from the proceeds of the Contract Performance Bank Guarantee, if the situation so warrants.

19.03 Extension of delivery period could be with / without levy of penalty with the discretion of Owner/ Project Manager.

20.0 RIGHT OF WAY:

Right of way issues, if any, arising during execution of the works shall have no liability on the Owner. These issues shall be settled at the sole discretion of the Contractor. The Project Manager shall however extend all possible help to the Contractor including discussion with the local authorities for early resolution of these issues.

21.0 CONTRACTOR'S DEFAULT:

21.01 If the Contractor neglects to execute the works with due diligence and expedition or refuses or neglects to comply with any reasonable order given to him, in writing by the Engineer in charge with the works or contravenes the provisions or the contract, the Owner/ Project Manager may give notice in writing to the Contractor to make good the failure, neglect or contravention complained of. If the Contractor fail to comply with the notice within thirty (30) days from the date of serving the notice, the Owner/ Project Manager shall be at liberty to employ other workmen and forthwith execute such part of the works as the contractor may have neglected to do or if the Owner/ Project Manager thinks fit, without prejudice to any other right, he may have under the Contract to take the work wholly or in part out of the Contractor’s hands and re-contract with any other person or persons to complete the works or any part thereof and in that event the Owner/ Project Manager shall have free use of all Contractor’s equipment that may have been at the time on the Site in connection with the works without being responsible to the
Contractor for fair wear and tear thereof and to the exclusion of any right of the Contractor over the same, and the Owner /Project Manager shall be entitled to retain and apply any balance which may otherwise be due on the Contract by him to the Contractor, or such part thereof as may be necessary, to the payment of the cost of executing the said part of works or of completing the works as the case may be. If the cost of completing of works or executing part thereof as aforesaid shall exceed the balance due to the Contractor, the Contractor shall pay such excess. Such payment of excess amount shall be independent of the liquidated damages for delay which the Contractor shall have to pay if the completion of works is delayed.

21.02 In addition, such action by the Owner/ Project Manager as aforesaid shall not relieve the Contractor of his liability to pay liquidated damages for delay in completion of works.

21.03 Such action by the Owner/ Project Manager as aforesaid the termination of the Contract under this clause shall not entitle the Contractor to reduce the value of the Contract Performance Guarantee nor the time thereof. The Contract Performance Guarantee shall be valid for the full value and for the full period of the Contract including guarantee.

22.0 TERMINATION OF CONTRACT ON OWNER’S INITIATIVE:

22.01 Owner reserves the right to terminate the Contract either in part or in full due to reasons other than those mentioned under clause entitled ‘Contractor’s Default’. The Owner shall in such an event give fifteen (15) days’ notice in writing to the Contractor of his decision to do so.

22.02 The Contractor upon receipt of such notice shall discontinue the work on the date and to the extent specified in the notice, make all reasonable efforts to obtain cancellation of all orders and Contracts to the extent they related to the work terminated and terms satisfactory or the Owner, stop all further sub-contracting or purchasing activity related to the work terminated, and assist Owner in maintenance, protection, and disposition of the works acquired under the Contract by the Purchaser. In the event of such a termination the Contractor shall be paid compensation, equitable and reasonable, dictated by the circumstance prevalent at the time of termination to be determined by the arbitrator without stopping the work but to carry out the left over work to other agency.
22.03 If the Contractor is an individual or a proprietary concern and the individual or the proprietor dies and if the Contractor is a partnership concern and one of the partners dies then unless the Owner is satisfied that the legal representatives of the individual Contractor or of the proprietor of the propriety concern and in the case of partnership, the surviving partners, are capable of carrying out and in the case of partnership, the surviving partners, are capable of carrying out and completing the Contract the Owner shall be entitled to cancel the Contract as to its uncompleted part without being in any way liable to payment of any compensation to the estate of deceased Contractor and/or to the surviving partners of the Contractor’s firm on account of the cancellation of the contract. The decision of the Owner that the legal representatives of the deceased Contractor or surviving partners of the Contractor’s firm cannot carry out and complete the contract shall be final and binding on the parties. In the event of such cancellation the Owner shall not hold the estate of the deceased Contractor and/or the surviving partners of the Contractor’s firm liable to damages for not completing the Contract.

23.0 **FORCE MAJEURE:**

The Contractor shall not be liable for any penalty for delay or for failure to perform the contract for reasons of Force Majeure such as “acts of God, acts of the Public enemy, acts of Govt., Fires, Flood, Epidemics, Quarantine restrictions, Strikes, Freight Embargos and provided that the Contractor shall within ten (10) days from the beginning of such delay notify the Owner/Project Manager in writing of the cause of delay. The Owner/Project Manager shall verify the facts and grant extension as facts justify.

24.0 **EXTENSION OF TIME:**

If the delivery of the equipment’s / materials is delayed due to reasons beyond the control of the Contractor, the Contractor shall immediately inform within 3 days to the Owner/Project Manager in writing of his claim for an extension of time. The Owner/Project Manager on receipt of such notice may agree to extend the contract period as may be reasonable but without prejudice to other terms & conditions of the contract.

25.0 **SAFETY PRECAUTIONS:**
The agency shall observe all applicable regulations regarding safety at the Site. Any compensation due on account of accident at site shall be to the contractor’s account.

26.0 STORE:-

Storing of materials from supply to erection shall be arranged by the contractor at his own cost. No compensation shall be made by the Owner for any damage or loss of materials during storing, transit transportation and at the time of erection.

27.0 INSURANCE: - Contractor shall arrange adequate Transit-cum-storage-cum-erection policy and shall submit the copy of the same to the Owner. The policy shall initially remain valid for a period of sixty days over & above of the contractual guarantee period and shall be extended as required till handing over. Contractor shall be responsible for lodging of claim with the insurer as well as for all required follow up with the insurer for settlement of claim in case of loss/damage/theft of material during transit/storage/erection till the completed works is handed over to the Purchaser and is accepted by the authorized representative of the Purchaser in writing.

Contractor shall also arrange adequate cover for his employees / labourers engaged in the works as well as arrange third party insurance cover to indemnify any possible damages to public at large not connected with the works process. Any claim(s) pertaining to this shall be the responsibility of the Contractor.

The contractor shall undertake free replacement of the materials damaged or lost during transit, which will be intimated by the Consignee within 30 days of receipt of the materials at Owner’s stores.

28.0 PROJECT MANAGER & ENGINEER IN CHARGE:-

The Executive Engineer (Elect.) & Asst. Engineer (Elect.), Construction Division of the Circle shall be the Engineer in charge for the Project.

29.0 CONTRACT PERFORMANCE BANK GUARANTEE:-
29.01 Within 15 days of issue of the Work Order or Letter of Award, whichever is earlier, the Contractor shall submit Contract Performance Bank Guarantee issued by a scheduled Bank, in favour of the Owner, covering 10% of the total value of the work order,

NB: In case of Joint Venture/Consortium, Lead Member shall submit Contract Performance BG covering 10% of Order value & every member of the Consortium/JV shall submit additional Performance BG covering 1% of the value of the order.

29.02 The said Bank Guarantee shall be prepared in the prescribed proforma as attached in Section IV, Annexure - III. The Bank Guarantee furnished shall be executed on Non-judicial Stamp paper worth of Rs 100/- (Rupees Hundred only), purchased in the name of the issuing bank, as per the prevalent rules. The Bank Guarantee so provided shall be en-cashable on the Berhampur branch of the issuing Bank.

29.03 The Contract Performance Bank Guarantee shall remain valid for a period not less than 90 days over and above the guarantee period, basing on stipulated completion period in the W.O. towards security and acceptance thereof, failing which the work orders (W.O) will be liable for cancellation without any further notice with forfeiture of E.M.D.

29.04 No interest shall be allowed by the Owner on the above Performance Security Deposit.

30.0 TERMS OF PAYMENT:

30.01 80% (Eighty percent) of contract price along with taxes and duties shall be paid progressively for each completed items of work certified by the Jr. Manager (in charge of concerned Section) & Engineer in charge against each calendar month by first week of the succeeding months along with utilization certificate. No payment shall be released if the accounts for utilization of materials unless follow with proper certification by the concerned Jr. Manager (in charge of concerned Section) & Engineer in charge.

30.03 Balance 20% (twenty percent) of contract price shall be paid after completion of all works, envisaged under this package including any additions and alterations, testing & commissioning, return of dismantled materials/ un-used free supply material, taking over certificate and entire
stretch is fully ready for commercial operation. The payments shall be subjected to clearance from electrical inspectorate.

31.0 PAYING OFFICER:

Owner shall notify the paying officer for the project.

32.0 OWNER’S RIGHTS:

The Owner reserves the right to accept any bid or reject any or all bids or cancel / withdraw invitation of bid or to vary the quantity for placement of order without assigning any reason to such decision. Such decision by the Owner shall bear no liability.

33.0 DISTINCT MARK ON EQUIPMENT AND MATERIALS:

All the equipment’s and materials required for the works shall have distinct mark of Owner either by way of punching on metal part(s) and/or in built during casting and/or painting as per common practice and/or as mutually agreed. This should be clearly visible in day light in naked eye.

34.0 DISPUTE RESOLUTION AND JURISDICTION:

(a) Any disputes arising out of this contract shall be referred to the MD, SOUTHCO who shall decide the case as sole Arbitrator.

(b) For the purpose of dispute resolution, this agreement shall be governed by the provision of Arbitration and Conciliation Act, 1996.

(c) All disputes shall be subjected to exclusive jurisdiction of the Courts at Berhampur and the writ jurisdiction of Hon’ble High Court of Odisha at Cuttack.

35.0 TRANSFER AND SUB-LETTING

The Contractor shall not sublet, transfer, assign or otherwise part with the Contract or any part thereof, either directly or indirectly, without prior written permission of the Owner.

36.0 FREE ISSUE OF MATERIALS
36.01 Purchaser shall issue materials such as Power & Distribution Transformer, VCB, Conductor to the Contractor as per the works schedule agreed at the time of award of works as stated in the scope of work. However, this shall be subject to the actual progress of the work as certified by the Engineer in charge.

36.02 Before issue of the free issue materials the Contractor at its own cost shall arrange suitable stores adjacent to the works site and shall offer the same for inspection to the Engineer in charge.

36.03 The contractor shall furnish Indemnity bond for an amount equivalent to the estimated value of the free supply materials as certified by Engineer in charge. The Contractor shall submit Indemnity Bond in the prescribed format as per Annexure – XIII.

36.04 Subject to compliance of above clauses, the Contractor shall be permitted to draw the materials from the designated stores of the Owner. The Contractor shall duly acknowledge the materials along with copies of the notification to the Insurer regarding such transit of material from designated stores of the Owner to the stores of the Contractor.

36.05 After completion of the works all surplus materials shall be returned to the Purchaser’s stores. For any shortage with regard to materials supplied by the Purchaser, the Purchaser shall be entitled to recover 125% of the purchase cost of such materials or present market cost, whichever is higher, from the dues of the Contractor.

37.0 SUBMITTALS REQUIRED AFTER AWARD OF CONTRACT

37.01 Within 30 days of the effective date of contract the contractor shall provide three copies of an outline program of production, inspection, testing, delivery, survey, erection, pre-commissioning and commissioning in chart form to the Project Manager. Included in the program will be the detailed schedule of drawing to be submitted.

37.02 The periodic progress report as required by the Owner shall be submitted by the contractor as per the format prescribed by the Engineer in Charge.

38.0 DRAWINGS
Within 15 days of contract commencement the contractor shall submit, for approval by the Project Manager, a schedule of the drawings to be produced. The schedule shall also provide a program of drawing submission, for approval by the Engineer in Charge. All drawings and design should be submitted to Project Manager within the period specified above.

39.0 **APPROVAL PROCEDURE OF SUB VENDORS & DRAWINGS OF BOUGHT OUT MATERIALS**

39.01 The contractor shall submit all drawings, documents and type test reports, Name of Sub vendor, samples (as applicable), Survey report, actual BOM as per survey etc., to the Project Manager within 15 days of award of LOA/WO for approval. If modifications to be made if such are deemed necessary, the contractor has to resubmit them for approval without delaying the initial deliveries or completion of the contract work.

39.02 Three copies of all drawings, GTP shall be submitted for approval and three copies for any subsequent revision.

39.03 If the drawings will be as per the technical specifications, the competent authority of the Purchaser will return the drawings & documents to the contractor marked with “Approved” stamp.

40.0 **TAKING OVER**

40.1 Upon successful completion of all the tests to be performed at site on equipment / materials supplied, erected and commissioned by the contractor, the Junior Manager shall issue to the contractor a taking over certificate as a proof of the final acceptance of the equipment / materials on a written request within 10 days of commercial operation. Such certificate shall not be un-reasonably withheld nor will the engineer delay the issuance thereof on account of minor omission or defects, which do not affect the commercial operation and / or cause any serious to the equipment/material. The conditional Taking over Certificate can be issued if any minor omission or defects pointed by the Engineer-in-Charge/Electrical Inspector. The Contractor should rectify those defects within a month of conditional T.O.C failing which Owner will rectify those by replacing those materials or engaging other agencies. The amount so involved will be fully recovered from the Contractor’s bill. Such certificate shall, however, not relieve
the contractor of any of his obligations which otherwise survive by the terms & conditions of the contract after issuance of such certificate.

40.2 For the satisfaction of Owner about quality, the Owner shall have unreserved right for arrangement of testing of equipment/ materials and the complete system independently by self or any other agency chosen by the Owner. The contractor is expected to agree and extend necessary help during such test if necessary.

41.0 LATENT DEFECT WARRANTY

41.1 The period of latent defect warranty in terms of this bidding documents, shall be limited to five (05) years from the date of completion of Guarantee period.

42.0 EMBossing / Punching / casting / PAINTING

42.1 The all equipment’s and materials supplied /erected under the RLTAP Programme shall bear distinct mark of “Name of the Purchaser, RLTAP, PO Order No. & Date” by a way of embossing / punching / casting / painting etc. This should be clearly visible to naked eye.

43.0 INDEMNIFY

43.1 The Contractor, its successor and assignee shall indemnify the Owner, its successor and assignee from all current & future liabilities that may arise out of Turn Key Contract(s) entered into between the Owner & the Contractor under this RLTAP Programme.
SECTION - III

ANNEXURE
ANNEXURE – I

BID PROPOSAL LETTER

Electrical Installation of Works under SOUTHCO

Bidder’s Name and Address:
(in case of JV/Consortium, Name of JV/Consortium)
Bid Proposal Reference:
Person to be contacted:
Designation:
Telephone No. : E-mail: Fax No. :

To
Executive Engineer (Elect)
Construction Division
Southco, Jeypore

Dear Sir,

We the undersigned bidder have read and examined the detailed specification and bidding documents for execution of various electrical installations works and do herewith submit our bid for the following packages:

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<th>Sl. No.</th>
<th>Name of the Owner</th>
<th>Name of the Package</th>
<th>Estimated Cost (Rs. in Cr.)</th>
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We declare the following:

1.0 PRICES AND VALIDITY:
1.01 All the prices and price components stated in our bid proposal are firm and not subject to any price adjustment, in line with the bidding documents. All the prices and other terms and
conditions of this proposal are valid for a period of 180 days from the date of opening of the
bids. We further declare that prices stated in our proposal are in accordance with “Instructions
to Bidders” of bidding documents.

1.02 We do hereby confirm that our bid prices as quoted in attached Schedules include all import
duties and levies including license fees lawfully payable by us on imported items and other
taxes, duties and levies applicable on bought – out components, materials, equipment and
other items and confirm that any such taxes, duties and levies additionally payable shall be to
our account.

1.03 We confirm that the Sales tax on Works Contract, Turnover Tax or any other similar taxes
under the Sales Tax Act, as applicable, are included in our quoted bid price and there shall not
be any liability on this account to the Purchasers. We understand that Owner shall, deduct
such taxes at source as per the rules and issue TDS Certificate to us.

1.04 We confirm that, in our Bid Price, we have considered service tax in line with lawful
prevalent practice.

1.05 Price components of various items are indicated in the B.O.Q. for the respective works.

1.06 We further declare that while quoting the price, the due credit under MODVAT scheme, re-
christened as CENVAT scheme, as per relevant Government policies wherever applicable,
have been taken into account.

1.07 We, having studied the bidding document in three volumes relating to taxes & duties and
hereby, declare that if any income tax, charge on income tax or any other corporate tax is
attracted under the law, we agree to pay the same.

1.08 We are aware that the Price schedules do not generally give a full description of the supplies
to be made and work to be performed under each item and we shall be deemed to have read
the Technical Specifications and other bidding documents and drawings to ascertain the full
scope of work included in each item while filling in the related and prices. We agree that the
entered rates and prices shall be deemed to include the full scope as aforesaid, including
overheads and profits.
1.09 We understand that in the price schedule, if there is discrepancy between the unit price and total price, the same shall be corrected as per relevant provisions.

1.10 We declare that prices for items left blank in the schedules will be deemed to have been included in other items. The TOTAL for each schedule and the TOTAL of Grand summary shall be deemed to be the total price for executing the facilities and sections thereof in complete accordance with the contract, whether or not each item has been priced.

2.0 CONSTRUCTION OF THE CONTRACT

2.01 We declare that we are making the offer on the basis of indivisible supply-cum- Erection contract on a single source responsibility basis.

3.0 BID SECURITY (EMD)

We are enclosing Bank Draft / Bank Guarantee No. dtd. amounting to Rs.-------- (Rupees only) issued by Bank -------------------branch, payable on Berhampur towards Bid Security against our above Bid. The Bid Security amount has been computed by adding the Estimated Cost of the package no.s ----------------- for which we are submitting our bid.

4.0 EQUIPMENT PERFORMANCE GUARANTEE

We declare that the ratings and performance figures of the equipment to be furnished and erected by us are guaranteed. The Guaranteed particulars of different equipment’s are enclosed along with our bid.

5.0 BID PRICING

We further declare that the prices stated in our proposal are in accordance with your ‘Instruction of Bidders of Conditions of Contract, Volume-1 of the bid documents.

6.0 PRICE ADJUSTMENT

We declare that all the prices and price components stated in our offer are on FIRM price basis.
7.0 QUALIFICATION

We confirm having submitted the Qualification Data in original plus one copy, as required by you under clause 6.0 ‘Invitation for Bids’. Further we have filled in the information for qualification requirements. In case you require any further information in this regard, we agree to furnish the same in time.

8.0 DEVIATIONS

8.01 We declare that the contract shall be executed strictly in accordance with the specifications and documents except for the variations and deviations all of which have been detailed out exhaustively in the following schedules, irrespective of whatever has been stated to the contrary anywhere else in our proposal.

a) Commercial Deviations Schedule
b) Cost of withdrawal of Deviations on Critical
c) Technical Deviation Schedule

8.02 We confirm that specified stipulation of following critical clauses is acceptable to us and no deviations/exceptions are taken on any account whatsoever in the following clauses:

(a) Payment Terms :
(b) Bid Guarantee :
(c) Contract Performance Guarantee :
(d) Liquidated Damages for delay :
(e) Prices and Price Adjustment :
(f) Guarantee / Warrantees :

8.03 Further, we agree that the additional conditions, deviations, if any, found in our bid proposal documents other than those stated in attached Deviation Schedules, save that pertaining to any rebates offered, shall not be given effect to.

9.0 ADDITIONAL INFORMATION
We have included with this proposal additional information listed. We further confirm that such additional information does not imply any additional deviation beyond those covered in appropriate schedules and in case of any contradiction between these additional information and other provisions of Bid, the latter prevail.

10.0  **GURANTEE DECLARATION**

We guarantee that the equipment offered shall meet the rating and performance requirements stipulated in this specification. The Guarantee Declaration which shall attract levy of liquidated damages for non-performance is indicated in the relevant schedule.

11.0  **BOUGHT-OUT AND SUB-CONTRACTED ITEM**

We are furnishing herewith at appropriate Schedule, the detail of all major item of supply, which were propose subletting giving detail of the name of sub-contractor/sub-vendor and quantity for each item.

12.0  **WORK SCHEDULE**

If this proposal is accepted by you, we agree to submit engineering data, provide services and complete the entire work from time to time, in accordance with schedule indicated in the proposal. We fully understand that the time schedule stipulated in this proposal is the essence of the contract, if awarded. The completion schedule of the various major key phases of the work is indicated in the designated schedule.

13.0  **CONTRACT PERFORMANCE GUARANTEE**

We further agree that if our Bid is accepted we shall provide an irrevocable Bank guarantee towards Contract Performance Guarantee, of value equivalent to ten percent (10%) of the Contract Price initially valid up to the end of ninety (90) days after the end of the contract warranty period in the form of Bank Guarantee in your favour within 15 (fifteen) days from the date of ‘Notice of Award of Contract’/Work Order.

(For Joint Venture/consortium only) We, the Partners of joint venture/ consortium submitting their Bid, do agree and confirm that in case of Award of the Contract on the joint venture, we
shall be jointly and severally responsible for the execution of the contract in accordance with contract terms and conditions.

We, hereby declare that only the persons or firms interested in this proposal as principals are named herein and that no other persons or firms other that those mentioned herein have any interest in this proposal or in the contract to be entered into if we are awarded the contract, and that this proposal is made without any connection with any other person, firm or party likewise submitting a proposal and that this proposal is in all respect for and in good faith, without collusion or fraud.

Dated this ……………………….day of ……………………………………20…..

Thanking you,

Yours faithfully,

(Signature of the Authorized Signatory)

Name…………………………

Designation……………………

Seal of the company………..

(To be signed by lead partner in case of Joint Venture) Signature of other partner (s) in case of Joint Venture)

Name ........................

Designation ........................

Date : ........................

Place : ........................

(Written power of Attorney of all signatories of the bid to commit the Bidder must be enclosed with the Bid. In case of joint venture, the written Power of Attorney of all signatories from respective partners must be enclosed with the Bid.)

ANNEXURE – II
DECLARATION FORM

To
Executive Engineer (Elect)
Construction Division
Southco, Jeypore

Sir,

Having examined the above specifications together with the Tender terms and conditions referred to therein

1 – I / We the undersigned do hereby offer to execute the contract covered there on in complete shape in all respects as per the rules entered in the attached contract schedule of prices in the tender.

2 – I / We do hereby under take to have executed the contract within the time specified in the tender.

3 – I / We do hereby guarantee the technical particulars given in the tender supported with necessary reports from concerned authorities.

4 – I / We do hereby certify to have purchased a copy of the tender specifications by remitting Cash / Demand draft & this has been duly acknowledged by you in your letter No………….Dt………….

5 – I / We do hereby agree to furnish the composite Bank Guarantee in the manner specified / acceptable by SOUTHCO & for the sum as applicable to me / us as per clause No.29 of GCC of this specification within fifteen days of issue of Letter of intent / Work Order, in the event of Work order being decided in my / us favour , failing which I / We clearly understand that the said LOI / W.O. shall be liable to be withdrawn by the Owner.

Signed this…………….Day of……………………20…

Yours faithfully

(Signature of Bidder with Seal of Company)

ANNEXURE – III
PROFORMA FOR CONTRACT PERFORMANCE BANK GUARANTEE

(To be executed on Rs. 100/- Non-judicial Stamp Paper purchased in the name of the BG Issuing Bank)

This Guarantee Bond is executed this ___ day of __________________________ by us, ____________________________ Bank at ___________________
P.O.________ P.S. _______ Dist _____________ State ________

Whereas Southern Electricity Supply Company of Odisha Ltd.(SOUTHCO) ,Corporate Office: Courtpeta, Berhampur, Ganjam -760004 registered under the Company Act 1956 (here in after called “Owner”) has placed Work Order No._________ Dt.___________ (hereinafter called “Agreement”) with M/s____________________ (hereinafter called “the Contractor”) for supply and installation of ________________ (description of the works) and whereas Owner has agreed (1) to exempt the Contractor from making payment of security deposit, (2) to release 100% payment of the cost of materials as per the said agreement and (3) to exempt from performance guarantee on furnishing by the Contractor to Owner a composite Bank Guarantee of the value of 10% (ten percent) of the Contract price of the said Agreement.

1. Now, therefore, in consideration of Owner having agreed (1) to exempt the Contractor for making payment of security deposit, (2) to release 100% payment to the Contractor and (3) to exempt from furnishing performance guarantee in terms of the said Agreement as aforesaid, we the __________________________ Bank, Address __________________________ (code No. ________) (hereinafter referred to as “the Bank”) do hereby undertake to pay to the Owner an amount not exceeding Rs._____________ (Rupees ______________________) only against any loss or damage caused to or suffered by the Owner by reason of any breach by the said Contractor(s) of any of the terms or conditions contained in the said Agreement.

2. We, the __________________________ Bank do hereby undertake to pay the amounts due and payable under the guarantee without any demur, merely on a demand from Owner stating that the amount claimed is due by way of loss or damage caused to or suffered by Owner by reason of any breach by the said Contractor(s) of any of the terms or conditions contained in the said Agreement or by the reason of any breach by the said Contractor’s failure to perform the said Agreement. Any such
demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this Guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs.___________ (Rupees ___________________________) only.

3. We, the ________________________ Bank also undertake to pay to Owner any money so demanded notwithstanding any dispute or dispute raised by the Contractor(s) in any suit or proceeding instituted/ pending before any court or Tribunal relating thereto our liability under this Agreement being absolute and irrevocable. The payment so made by us under this bond shall be valid discharge of our liability for payment thereunder and the Contractor(s) shall have no claim against us for making such payment.

4. We, the _________________________ Bank further agree that the guarantee herein contain shall remain in full force and effect during the period that would be taken for the performance of the said Agreement and it shall continue to remain in force endorsable till all the dues of Owner under by virtue of the said Agreement have been fully paid and its claim satisfied or discharged or till Purchaser certifies that the terms and conditions of the said Agreement have been fully and properly carried out by the said Contractor(s) and accordingly discharge this guarantee and will not be revoked by us during the validity of the guarantee period.

Unless a demand or claim under this guarantee is made on us or with our Berhampur branch at ________________________ (Name, address of the Berhampur branch and code No.) in writing on or before ________________ (date) we shall be discharged from all liability under this guarantee thereafter.

5. We, the _________________________ Bank further agree that Owner shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Agreement or to extend time of performance by the said Contractor(s) and we shall not be relieved from our liability by reason of any such variation or extension being granted to the said Contractor(s) or for any forbearance act or omission on part of Owner or any indulgence by Owner to the said Contractor(s) or by any such matter or thing
whatsoever which under the law relating to sureties would but for this provisions have effect of so relieving us.

6. The Guarantee will not be discharged due to change in the name, style and constitution of the Bank and or Contractor(s).

7. We, the _________________________ Bank lastly undertake not to revoke this Guarantee during its currency except with the previous consent of the Owner in writing.

Dated ___________ the __________ day of Two thousand __________.

Notwithstanding anything contained herein above.

Our liability under this Bank Guarantee shall not exceed Rs.______________ (Rupees __________ ____________________________ ) only.

The Bank Guarantee shall be valid up to _____________________ only.

Our ……………………… branch at Berhampur (Name & Address of the Berhampur branch) is liable to pay the guaranteed amount depending on the filing of claim and any part thereof under this Bank Guarantee only and only if you serve upon us at our Berhampur branch a written claim or demand and received by us at our Berhampur branch on or before Dt.__________ otherwise bank shall be discharged of all liabilities under this guarantee thereafter.

For ____________________________ (Indicate the name of the Bank)

N.B.:
(1) Name of the Contractor:
(2) No. & date of the Work order/ agreement:
(3) Amount of W.O:
(4) Name of Work:
(5) Name of the Bank:
(6) Amount of the Bank Guarantee:
(7) Name, Address and Code No. of the Berhampur Branch of the Issuing Bank:
(8) Validity period or date up to which the agreement is valid:
(9) Signature of the Constituent Authority of the Bank with seal:
(10) Name & addresses of the Witnesses with signature:
(11) The Bank Guarantee shall be accepted only after getting confirmation from the issuing Branch / from main branch/specified branch at Berhampur of issuing Bank.
FORM OF POWER OF ATTORNEY FOR JOINT VENTURE
(On Non-Judicial Stamp Paper of Appropriate value
to be Purchased in the Name of Joint Venture)

KNOW ALL MEN BY THESE PRESENTS THAT WE, the Members whose details are given hereunder......................... have formed a joint Venture/Consortium and having our Registered Office (s)/Head Office (s) at .........................(hereinafter called the ‘Joint Venture/Consortium’ which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators and assigns) do hereby constitute, nominate and appoint M/s……………………………………………. a company/Electrical Contractor incorporated under the laws of .............and having its Registered/Head Office at ...............as our duly constituted lawful Attorney (hereinafter called “Attorney” (hereinafter called Lead Member) to exercise all or any of the powers for and on behalf of the joint venture/Consortium in regard to Tender Notice No................. for construction of ............... (name of the package) of SOUTHCO (hereinafter called the “Owner”) for which bids have been invited by the Owner, to undertake the following acts:

(i) To submit proposal, participate and negotiate in respect of the aforesaid Bid – Specification of the Owner on behalf of the “Joint Venture / Consortium”.

(ii) To negotiate with Owner the terms and conditions for award of the contract pursuant to the aforesaid Bid and to sign the contract with the Owner for and on behalf of the “Joint Venture / Consortium”.

(iii) To do any other act or submit any document related to the above.

(iv) To receive, accept and execute the contract for and on behalf of the “Joint Venture / Consortium”.

(v) To submit the Contract performance security in the form of an unconditional irrecoverable Bank Guarantee in the prescribed format and as per terms of the contract.
It is clearly understood that the Lead Member shall ensure performance of the contracts(s) and if one or more Member fail to perform their respective portion of the contracts(s), the same shall be deemed to be a default by all the Members.

It is expressly understood that this power of Attorney shall remain valid, binding and irrevocable till completion of the Defect of liability period in terms of the contract.

The Joint Venture / Consortium hereby agrees and undertakes to ratify and confirm all the whatsoever the said Lead Member quotes in the bid, negotiates and signs the Contract with the Owner and / or proposes to act on behalf of the Joint Venture / Consortium by virtue of this Power of Attorney and the same shall bind the Joint Venture / Consortium as if done by itself.

IN WITNESS THEREOF the Members Constituting the Joint Venture / Consortium as aforesaid have executed these presents on this .......... day of ........ under the Common Seal (s) of their Companies

for and on behalf of
the members of Joint Ventures/Consortium

The Seal of the above Partners of the Joint Venture / Consortium:

The Seal has been affixed there unto in the presence of:

WITNESS

1. Signature ........................................
   Name ........................................
   Designation .................................
   Occupation .................................

2. Signature ........................................
   Name ........................................
   Designation .................................
FORM OF JOINT VENTURE/ CONSORTIUM AGREEMENT

(To be executed on non-judicial stamp paper of appropriate value to be purchased in the name of executants or as required by the Jurisdiction in which executed)

THIS Joint Venture/Consortium Agreement executed on this .......... day of ............ Two thousand ................ by:

M/s. ......................... a company/Partnership Firm/Sole Proprietorship Organization incorporated under the ......................... Act/Laws and having its Registered Office/Head Office at .............. ......................... .............. (hereinafter called the "Lead Member/First Member" which expression shall include its successors), and

M/s. ......................... a company/Partnership Firm/Sole Proprietorship Organization incorporated under the ......................... Act/Laws and having its Registered Office/Head Office at .............. ......................... .............. (hereinafter called the "Second Member" which expression shall include its successors), and

M/s. ......................... a company/Partnership Firm/Sole Proprietorship Organization incorporated under the ......................... Act/Laws and having its Registered Office/Head Office at .............. ......................... .............. (hereinafter called the "Third Member" which expression shall include its successors), and

M/s. ......................... a company/Partnership Firm/Sole Proprietorship Organization incorporated under the ......................... Act/Laws and having its Registered Office/Head Office at .............. ......................... .............. (hereinafter called the "Fourth Member" which expression shall include its successors).

The Lead Member/First Member, Second Member, the Third Member and the Fourth Member shall collectively hereinafter be called as the “Joint venture/Consortium Members” for the purpose of submitting a bid proposal to Southern Electricity Supply Company of Odisha Ltd. (hereinafter
referred to as SOUTHCO) being a company incorporated under the Companies Act. 1956 having its Corporate Office at Courtpata, Berhampur, Ganjam – 760004 (hereinafter called the “Owner”) in response to the invitation of bids (hereinafter called as “Tender Notice No…………….“ Document) dated…………….. for supply, erection, Testing & Commissioning as per the scope of work ………………..(hereinafter called as “the Transaction”)

WHEREAS Clause-2 of the Invitation for Bids (IFB), stipulates that two or more bidder(s) may form a joint venture/Consortium among them and apply against this tender specification, provided they fulfill the following eligible criteria;

1. They should have legally valid Consortium agreement as per the prescribed format for the purpose of participation in the bidding process. The total no of a Consortium shall be limited to four members.

2. One of the Joint Venture/Consortium members should be a Electrical Contractor having valid HT License.

3. Consortium as a whole shall meet the qualifying norms specified in the tender, they participate.

4. The lead member of the Consortium should meet at least 50% of the qualifying norms in respect to the work experience & Turn Over requirement.

5. Besides the lead member, other member(s) of the Consortium together shall meet the balance 50% of the qualifying norms in respect to the work experience & Turn Over requirement.

6. All the Consortium member(s) shall authorize the lead partner by submitting a power of Attorney as per the prescribed format duly signed by the authorized signatories. The lead partner shall be authorized to receive instructions for and on behalf of all partners of the Consortium and entire execution of the contract.

7. The Consortium and its members shall be jointly and severally responsible and be held liable for the purpose of guaranteed obligation and any other matter as required under the contract.

8. Any member of the Consortium member(s) shall not be eligible either in an individual capacity or part of any other Consortium to participate in the tender, where the said Consortium participates.
9. Work Order(s) will be placed to lead members of the Consortium.

10. In addition to the above the Lead Member of the bidder(s) should submit the following documents in part-I bid as qualifying terms.
   i. Valid electrical (HT) license for Electrical Works.
   ii. PAN & TIN No.
   iii. EPF registration.

11. The Lead Member of the Bidder(s) shall have to furnish service tax registration, ESI, Registration under Building & other Construction workers welfare cess & Labour license within 45 days of receipt of the order.

12. The prescribed format for Power of Attorney (Annexure-IV) is provided in the tender specification as enclosures.

AND WHEREAS the members of the Joint Venture/Consortium together shall strictly comply the eligible criteria of the Clause-2 of the Invitation for Bids (IFB).

AND WHEREAS bid has been proposed to be submitted to the Owner by Lead Member based on this Joint Venture/Consortium agreement all the members, signed by all the members.

NOW THIS INDENTURE WITNESSETH AS UNDER:

In consideration of the above premises, in the event of the selection of Joint Venture/Consortium as successful bidder, all the parties to this Joint Venture/Consortium Agreement do hereby agree abide themselves as follows:

1. M/s …………………………….. Shall act as Lead Member for and on behalf of Joint Venture/Consortium Members. The said Joint Venture/Consortium members further declare and confirm that they shall jointly and severally be bound and shall be fully responsible to the Owner for supply, erection, Testing & commissioning as per the scope of work and successful performance of the works, obligations under the same by the Lead Member are as follows:
   i) Despite any breach by the Lead Member or other Member(s) of the Joint Venture/Consortium agreement, the Member(s) do hereby agree and undertake to ensure full and effectual and
successful performance of the contract with the Owner and to carry out all the obligations and responsibilities under the said Contract in accordance with the requirements of the Contract.

ii) If the Owner suffers any loss or damage on account of any breach in the Contract or any shortfall in the performance of the equipment in meeting the performance guaranteed as per the specification in terms of the Contract, the Members (s) of these presents undertake to promptly make good such loss or damages caused to the Owner, on its demand without any demur. It shall not be necessary or obligatory for the Owner to proceed against Lead Member to these presents before proceeding against or dealing with the other Members(s). The obligation of each of the member is absolute and not independent of the Joint Venture/Consortium or any member.

iii) The financial liability of the Members of this Joint Venture/Consortium agreement to the Owner, with respect to any of the claims arising out of the performance of non-performance of the obligations set forth in the said Joint Venture/Consortium agreement, read in conjunction with the relevant conditions of the Contract shall, however, not be limited in any way so as to restrict or limit the liabilities of any of the Partners of the Joint Venture/Consortium agreement. The liability of each Member is absolute and not severable.

iv) It is expressly understood and agreed between the Members to this Joint Venture/Consortium agreement that the responsibilities inter se amongst the Members shall not in any way be a limitation of joint and several responsibilities and liabilities of the Members to the Owner. It is clearly understood that the Lead member shall ensure performance under the agreements and if one or more Joint venture/Consortium Member(s) fail to perform its/their respective obligations under the agreement(s), the same shall be deemed to be a default by all the Joint Venture/Consortium Members. It will be open for the Owner to take any steps, punitive and corrective action including the termination of contract in case of such default also.

v) This Joint Venture agreement shall be construed and interpreted in accordance with the laws of India and the courts of Odisha shall have the exclusive jurisdiction within Berhampur in all matters arising there under.

vi) In case of an award of a Contract, all the Members to the Joint Venture/Consortium agreement do hereby agree that Lead Partner shall furnish Performance Bank Guarantee for value of 10% of the Contract Price and additional 1% by the other Joint Venture/Consortium Member in the
form of an unconditional irrecoverable Bank Guarantee in the prescribed format and as per terms of the contract.

vii) It is further agreed that the Joint Venture/Consortium agreement shall be irrevocable and shall form an integral part of the Contract, and shall continue to be enforceable till the Owner discharges the same. It shall be effective from the date first mentioned above for all purposes and intents.

viii) Capitalized terms used but not defined herein shall have same meaning as assigned to them in the Tender Documents and/or the agreements.

ix) In case of any dispute amongst the members of the Joint Venture/Consortium, Owner shall not be in any way liable and also the Consortium members shall not be absolved from the contractual obligation in any manner.

IN WITNESS WHEREOF the Members to the Joint Venture/Consortium agreement have through their authorized representatives executed these presents and affixed Seals of their companies, on the day, month and year first mentioned above.

1. For Lead Member/First Member
   (Signature of authorized representative)
   Name... ..............................
   Signature... ........................
   Designation ........................

2. For Second Member
   (Signature of authorized representative)
   Name... ..............................
   Signature... ........................
   Designation ........................

2. For Third Member
   Signature of authorized representative)
   Name... ..............................
LETTER OF COMPLIANCE OF QUALIFYING REQUIREMENT  
(In case of Bidder being a Single Firm)

To
Executive Engineer (Elect)
Construction Division
Southco, Jeypore

Dear Sirs,
I/We ............... (Name of Bidder) are submitting the bid as a single firm. In support of our meeting the Qualifying requirements (QR) for bidders, stipulated in this tender specification, we furnish herewith the details/documents etc. as follows.
Table – A: Previous Works Experience:

<table>
<thead>
<tr>
<th>Package Quoted for</th>
<th>Description of Proposed Works</th>
<th>Tender Qty</th>
<th>Sl. No.</th>
<th>FY</th>
<th>Name of Client</th>
<th>WO Ref</th>
<th>Qty Installed &amp; Commissioned</th>
<th>Documents provided in proof of having executed the works during the relevant FY.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table – B: Average Annual Turnover:

<table>
<thead>
<tr>
<th>Package Quoted for</th>
<th>Estimated Cost of the Package (Rs. in Lakh)</th>
<th>Annual Turnover Data (Rs. in Lakh)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Financial Year</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Last Three Year preceding to the year of tender</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total Estimated Cost of the packages quoted for Average Turnover

Table – C: Access to Credit Facility:

<table>
<thead>
<tr>
<th>Package Quoted for</th>
<th>Estimated Cost of the Package (Rs. in Lakh)</th>
<th>Liquid Assets as on 31.03.2013</th>
<th>Credit Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Description (Rs. in Lakh)</td>
<td>Description (Rs. in Lakh)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cash in Hand</td>
<td>Cash Credit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cash at Bank</td>
<td>LC</td>
</tr>
</tbody>
</table>

Total Estimated Cost of the packages quoted for

<table>
<thead>
<tr>
<th>Fixed Deposits</th>
<th>Others (Pl Specify)</th>
</tr>
</thead>
<tbody>
<tr>
<td>One fifth of the total Estimated Cost as above.</td>
<td>Total Liquid Assets</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>---------------------</td>
</tr>
</tbody>
</table>

Note: Continuation sheets, of like size and format, may be used as per Bidder’s requirements and annexed to this Schedule.

I/We declare that we are fulfilling the qualifying requirements as per clause no. 2.0 of Section – I, Invitation for Bids (IFB).

For & on behalf of ………… (Name of the Bidder).
LETTER OF COMPLIANCE OF QUALIFYING REQUIREMENT  
(In case of Bidder being a Joint Venture / Consortium Firm)

To  
Executive Engineer (Elect)  
Construction Division  
Southco, Jeypore  

Dear Sirs,

I/We ……………… (Name of Bidder) are submitting the bid as a Consortium/Joint Venture. In support of our meeting the Qualifying requirements (QR) for bidders, stipulated in this tender specification, we furnish herewith the details/documents etc. as follows.

Name of the members of the JV / Consortium

1.  
2.  
3.  

Table – A: Previous Works Experience: Name of the Member (any one member only)

<table>
<thead>
<tr>
<th>Package Quoted for</th>
<th>Description of Proposed Works</th>
<th>Tender Qty</th>
<th>Sl. No.</th>
<th>FY</th>
<th>Name of Client</th>
<th>WO Ref</th>
<th>Qty Installed &amp; Commissioned</th>
<th>Qty Installed</th>
<th>Documents provided in proof of having executed the works during the relevant FY.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table B: Average Annual Turnover: (All the members of JV/Consortium taken together)

<table>
<thead>
<tr>
<th>Package Quoted for</th>
<th>Estimated Cost of the Package (Rs. in Lakh)</th>
<th>Financial Year</th>
<th>Turnover (Rs. in Lakh)</th>
<th>Name of Member 1</th>
<th>Annual Turnover (Rs. in Lakh)</th>
<th>Name of Member 2</th>
<th>Annual Turnover (Rs. in Lakh)</th>
<th>Total Turnover (Rs. in Lakh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY 2010 -11</td>
<td>FY 2010 -11</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>FY 2011 - 12</td>
<td>FY 2011 - 12</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>FY 2012 - 13</td>
<td>FY 2012 - 13</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Total</td>
<td>Total</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Total Estimated Cost of the packages quoted for</td>
<td>Total Estimated Cost of the packages quoted for</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Average Turnover</td>
</tr>
</tbody>
</table>

### Table C: Access to Credit Facility: (All the members of JV/Consortium taken together)

<table>
<thead>
<tr>
<th>Package Quoted for</th>
<th>Estimated Cost of the Package (Rs. in Lakh)</th>
<th>Liquid Assets as on 31.03.2013</th>
<th>Credit Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Member 1 Description (Rs. in Lakh)</td>
<td>Member 1 Description (Rs. in Lakh)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cash in Hand</td>
<td>Cash Credit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cash at Bank</td>
<td>LC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fixed Deposits</td>
<td>Others (Pl Specify)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Liquid Assets</td>
<td>Total Credit Facility</td>
<td></td>
</tr>
</tbody>
</table>
### Liquid Assets as on 31.03.2013

<table>
<thead>
<tr>
<th>Description</th>
<th>(Rs. in Lakh)</th>
<th>Description</th>
<th>(Rs. in Lakh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash in Hand</td>
<td></td>
<td>Cash Credit</td>
<td></td>
</tr>
<tr>
<td>Cash at Bank</td>
<td></td>
<td>LC</td>
<td></td>
</tr>
<tr>
<td>Fixed Deposits</td>
<td></td>
<td>Others (Pl Specify)</td>
<td></td>
</tr>
<tr>
<td>Total Liquid Assets</td>
<td></td>
<td>Total Credit Facility</td>
<td></td>
</tr>
<tr>
<td><strong>Total Liquid Assets</strong></td>
<td><strong>Total Credit Facility</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Liquid Assets as on 31.03.2013

<table>
<thead>
<tr>
<th>Description</th>
<th>(Rs. in Lakh)</th>
<th>Description</th>
<th>(Rs. in Lakh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash in Hand</td>
<td></td>
<td>Cash Credit</td>
<td></td>
</tr>
<tr>
<td>Cash at Bank</td>
<td></td>
<td>LC</td>
<td></td>
</tr>
<tr>
<td>Fixed Deposits</td>
<td></td>
<td>Others (Pl Specify)</td>
<td></td>
</tr>
<tr>
<td><strong>Total Estimated Cost of the packages quoted for</strong></td>
<td></td>
<td><strong>Total Credit Facility</strong></td>
<td></td>
</tr>
<tr>
<td><strong>One fifth of the total Estimated Cost as above.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Continuation sheets, of like size and format, may be used as per Bidder’s requirements and annexed to this Schedule.

I/We declare that we are fulfilling the qualifying requirements as per clause no. 2.0 of Section – I, Invitation for Bids (IFB).

For & on behalf of ............ (Name of the Bidder).

(All members of JV / Consortium should sign).
Details of qualification and experience of key personnel proposed for carrying out the works

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Name of Personnel</th>
<th>Degree/Diploma</th>
<th>Branch</th>
<th>Year of Passing</th>
<th>Past Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>From To Name of Employer Position Held Responsibilities/ Relevant experience</td>
</tr>
</tbody>
</table>

Date: (Signature) …………………..

Place: (Printed Name) ……………….

(Designation) …………………..

(Common Seal) …………………

Note: 1. Continuation sheets, of like size and format, may be used as per Bidder’s requirements and annexed to this Schedule.
2. In case of Joint Venture, separate sheet for each partner of Joint Venture should be used.

Details for sub-contracting elements

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Item Description</th>
<th>Qty. proposed to be bought-out/Sub-contracted</th>
<th>Source of Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
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<tr>
<td>2.</td>
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<tr>
<td>3.</td>
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<tr>
<td>4.</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Date: (Signature) …………………..

Page 53 of 355
DETAILS OF COMMERCIAL DEVIATIONS

Bidder’s Name & Address

To

Executive Engineer (Elect)
Construction Division
Southco, Jeypore

Dear Sirs,

Sub: Commercial Deviation for Construction of Name of the project.

The following are the Commercial Deviations and variations from and exceptions to the specifications and documents for the subject Project. These deviations and variations are exhaustive. Except for these deviations, the entire work shall be performed as per your specifications and documents.

<table>
<thead>
<tr>
<th>Volume/Clause</th>
<th>Ref./Page No.</th>
<th>As specified in the Specification</th>
<th>Commercial deviation and variation to the specification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Date: (Signature) …………………..

Place: (Printed Name) ……………….

(Designation) …………………..
Office of the Executive Engineer (Elect)   Construction Division   Jeypore

(Common Seal) …………………

Note: 1. Continuation sheets, of like size and format, may be used as per Bidder’s requirements and annexed to this Schedule.
        2. This will be read out during opening of Part-I Bid.

ANNEXURE – VIII

DETAILS TECHNICAL DEVIATIONS

Bidder’s Name & Address

To

Executive Engineer (Elect)   Construction Division   Southco, Jeypore

Dear Sirs,

Sub: Technical Deviation for Construction of ………………. (Name of the Project)

The following are the Technical Deviations and variations from and exceptions to the specifications and documents for the subject package. These deviations and variations are exhaustive. Except for these deviations, the entire work shall be performed as per your specifications and documents.

<table>
<thead>
<tr>
<th>Volume/Clause</th>
<th>Ref./Page No.</th>
<th>As specified in the Specification / Relevant ISS</th>
<th>Technical deviation and variation to the specification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

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

Note: 1. Continuation sheets, of like size and format, may be used as per Bidder’s requirements and annexed to this Schedule.
2. The deviations and variations, if any, shall be brought out separately for each of the equipment.

---

**ANNEXURE – IX**

**ADDITIONAL INFORMATION**

Bidder’s Name & Address

To

Executive Engineer (Elect)
Construction Division
Southco, Jeypore

Dear Sirs,

We have enclosed with our proposal the following additional information for the subject, package.

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Brief description of Information</th>
<th>Ref. &amp; Page No.</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Date: (Signature) ....................

Place: (Printed Name) ................

(Designation) ....................

(Common Seal) ....................

Page 56 of 355
Note: Continuation sheets, of like size and format, may be used as per Bidder’s requirements and annexed to this Schedule.

ANNEXURE – X

BOUGHT OUT & SUB CONTRACTED ITEMS

Bidder’s Name & Address

To

Executive Engineer (Elect)
Construction Division
Southco, Jeypore

Dear Sirs,

We hereby furnish the details of the items/sub-assemblies; we propose to buy for the purpose of subject package

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Item description</th>
<th>Qty. Proposed</th>
<th>Source of Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Be bought/</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sub-contracted</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
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<td>5.</td>
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<td>6.</td>
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<td>7.</td>
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</tbody>
</table>
ANNEXURE – XI

WORK COMPLETION SCHEDULE

Bidder’s Name & Address

To

Executive Engineer (Elect)
Construction Division
Southco, Jeypore

Dear Sirs,
We hereby declare that the following Work Completion Schedule shall be followed by us for the purpose of subject package

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Description of Work</th>
<th>Period in Months (from the date of LOA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Completion of detailed engineering</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Procurement of raw materials</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Establishment of site office</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Erection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(a) Commencement</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(b) Completion</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Testing &amp; Pre-commissioning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(a) Commencement</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(b) Completion</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Commissioning</td>
<td></td>
</tr>
</tbody>
</table>

Date: ..................................................
Place: ..................................................
(Signature) ...........................................
(Printed Name) .................................
(Designation) .......................................
/Common Seal) .....................................
ANNEXURE – XII

CHECK LIST

Bidder’s Name & Address

To

Executive Engineer (Elect)
Construction Division
Southco, Jeypore

Dear Sirs,

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Item Description</th>
<th>Status of the Submission of data</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bid Guarantee</td>
<td>Yes /No</td>
<td>If yes please give details No, amount, validity &amp; date of issue.</td>
</tr>
<tr>
<td>2</td>
<td>Qualifying Data</td>
<td>Yes /No</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Commercial Deviation</td>
<td>Yes /No</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Technical Deviation</td>
<td>Yes /No</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Cost of withdrawn of deviations</td>
<td>Yes /No</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Bid validity</td>
<td>Yes /No</td>
<td>If yes state here the period.</td>
</tr>
<tr>
<td>7</td>
<td>Period of completion</td>
<td>Yes/No</td>
<td>If, yes please state here the period of completion.</td>
</tr>
<tr>
<td>8</td>
<td>Additional information offered by bidder</td>
<td></td>
<td>State here briefly</td>
</tr>
</tbody>
</table>

N.B.:- The contents of this schedule will be read out during opening of Part-I Bid.

…………………………

Signature of Bidder
N.B:-

1. The bid guarantee one original and one copy shall be furnished in two separate sealed envelope appropriately superscribed thereon.

2. All Schedules pertaining to prices (originals) shall be furnished in a sealed envelope duly superscribed with the name of Package thereon. Similarly one set of copies of such schedules shall be given in a separate sealed envelope (these are not to be opened during opening of Part –I).

3. All other schedules, one set original and another copy shall be submitted in two separate sealed envelope (these are to be opened during Part –I bid opening)

Date: 

(Signature) ..........................

Place: 

(Printed Name) ......................

(Designation) .......................  

(Common Seal) ......................
PROFORMA OF INDEMNITY BOND TO BE EXECUTED BY THE CONTRACTOR FOR THE EQUIPMENT/MATERIAL HANDED OVER BY SOUTHCO FOR PERFORMANCE OF ITS CONTRACT

(Entire Equipment consignment in one lot)
(On non-Judicial stamp paper of appropriate Value)

INDEMNITY BOND

THIS INDEMNITY BOND is made this ............ day of ............20............... by.................... a Company registered under the Companies Act, 1956/ Partnership Firm / Proprietary Concern having its Registered Office at ..................................(hereinafter called as ‘Contractor’ or “Obligor” which expression shall include its successors and permitted assigns ) in favour of Southern Electricity Supply Company of Odisha Ltd.(SOUTHCO) ,Corporate Office: Courtpeta, Berhampur, Ganjam – 760004 registered under the Company Act 1956 (here in after called “Owner”)”Which expression shall include its successors and assigns ) :

WHEREAS Owner has awarded to the Contractor a Contract for ............ vide its Letter of Award / Contract No.......................... dated.......................... and its Amendment No. ...................... and Amendment No...................... (applicable when amendments have been issued) hereinafter called the “Contract”) in terms of which Owner is required to handover various equipment to the Contractor for execution of the Contract.

And WHERAS by virtue of Clause No.......... of the said Contract, the Contractor is required to executive an Indemnity Bond in favour of Owner for the Equipment/Material handed over to it by Owner for the purpose of performance of the Contract / Erection portion of the Contract (hereinafter called the “Equipment”)

NOW THEREFORE, This Indemnity Bond witnessth as follows:

1. That in consideration of various equipment as mentioned in the Contract, valued at Rs... .............. (Rupees ...................) handed over to the Contractor for the purpose of performance of the Contract, the Contractor hereby undertakes to indemnify and shall keep Owner indemnified, for the full value of the Equipment. The Contractor hereby acknowledges receipt of the Equipment as per dispatch title documents handed over to the Contractor duly endorsed in their favour and detailed in the Schedule appended hereto. It is expressly understood by the Contractor that handing over of the
Office of the Executive Engineer (Elect)  Construction Division  Jeypore

dispatch title documents in respect of the said Equipment duly endorsed by Owner in favour of the Contractor shall be construed as handing over of the Equipment purported to be covered by such title documents and the Contractor shall hold such Equipment is trust as a Trustee for and on behalf of Owner.

2. That the Contractor is obliged and shall remain absolutely responsible for the safe transit / protection and custody of the Equipment at Owner project Site against all risks, whatsoever, till the Equipment are duly used / erected in accordance with the terms of the Contract and the Plant / Package duly erected and commissioned in accordance with the terms of the Contract, is taken over by Owner. The Contractor undertakes to keep Owner harmless against any loss or damage that may be caused to the Equipment.

3. The Contractor undertakes that the Equipment shall be used exclusively for the performance / execution of the Contract strictly in accordance with its terms and conditions and no part of the equipment shall be utilized for any other work or purpose whatsoever. It is clearly understood by the Contractor that non-observance of the obligations under this Indemnity Bond by the Contractor shall inter-alia constitute a criminal breach of trust on the part of the Contractor for all intents and purpose including legal / penal consequences.

4. That SOUTHCO (as the case may be) is and shall remain the exclusive Owner of the Equipment free from all encumbrances, charges or liens of any kind, whatsoever. The Equipment shall at all times be open to inspection and checking by Engineer in Charge / Engineer or other employees/agents authorized by him in this regard. Further, Owner shall always be free at all times to take possession of the Equipment in whatever form the Equipment may be, if in its opinion the Equipment are likely to be endangered, misutilised or converted to uses other than those specified in the Contract, by any acts of omission or commission on the part of the Contractor binds himself and undertakes to comply with the direction of demand of Owner to return the Equipment without any demur or reservation.

5. That this indemnity Bond is irrevocable. If at any time any loss or damage occurs to the Equipment or the same or any part thereof is misutilised in any manner whatsoever, then the Contractor hereby agrees that the decision of the Engineer-in-Charge/Engineer of Owner as to assessment of loss or damage to the Equipment shall be final and binding on the Contractor. The Contractor binds itself and undertakes to replace the lost and/or damaged Equipment at its own cost and/or shall pay the
amount of loss of Owner without demur, reservation or protest. This is without prejudice to any other right or remedy that may be available to Owner against the Contractor under the Contract and under this Indemnity Bond

6. NOW THE CONDITION of this Bond is that if the Contractor shall duly and punctually comply with terms and conditions of this Bond to the satisfaction of Owner, THEN, the above Bond shall be void, but otherwise, it shall remain in full force and virtue.

IN WITNESS WHEREOF, the Contractor has hereunto set its hand through its authorized representative under the common seal of the Company, the day, month and year first above mentioned.

SCHEDULE

<table>
<thead>
<tr>
<th>Particulars of the Equipment handed over</th>
<th>Quantity</th>
<th>Particulars of Dispatch Title Documents RR / GR / No. / Date of Bill of Lading</th>
<th>Value of the Equipment</th>
<th>Signature of Attorney (authorised representative as a token of receipt)</th>
</tr>
</thead>
</table>

For an on behalf of M/s.................................

WITNESS

1. 1. Signature ........................................ Signature ........................................

   2. Name .................................................. Name ........................................

   3. Address ................................................ Designation ................................

       Authorised representative *

2. 1. Signature ........................................

2. Name ..............................................(Common Seal in case of Company)

3. Address ...........................................

* Indemnity Bonds are to be executed by the authorised person and (i) in case of Contracting Company under common seal of the Company or (ii) having the Power of Attorney issued under common seal of the company with authority to execute Indemnity Bonds, (iii) in case of (ii), the
original Power of Attorney if it is specifically for this Contract or a Photostat copy of the Power of Attorney if it is General Power of Attorney and such documents should be attached to Indemnity Bond.

**ANNEXURE-XIV**

**SELF DECLARATION FORM**

Name of the Purchaser: -------------------------

Tender Notice No: -------------------------

Sir,

1. I / we, the undersigned do hereby declare that, I / we have never ever been blacklisted and / or there were no debarring actions against us for any default in supply of material / equipments or in the performance of the contract entrusted to us in any of the Electricity Utilities of India.

2. In the event of any such information pertaining to the aforesaid matter found at any given point of time either during the course of the contract or at the bidding stage, my bid/contract shall be liable for truncation / cancellation / termination without any notice at the sole discretion of the purchaser.

Yours faithfully,

Place-

Date-

Signature of the bidder
With seal

(This form shall be duly filled-up and signed by the bidder & submitted along with the original copy of the Bid.)
ANNEXURE – XV (A)

PROFORMA FOR BANK GUARANTEE FOR EARNEST MONEY DEPOSIT

(ON NON-JUDICIAL STAMP PAPER OF Rs.100/-)

Ref Date Bank Guarantee No:

In accordance with invitation to Tender Notice No.--------- Dated ------------ of Southern Electricity Supply Company of Odisha Ltd. [herein after referred to as the SOUTHCO] for the execution of ___________________________________________________________ (name of package)

M/s__________________________Address___________________________________________

_________________________wish/wished to participate in the said tender and as the Bank Guarantee for the sum of Rs.____________ [Rupees_________________________] Valid for a period of .......... days (in words) is required to be submitted by the Bidder.

1. We the________________________________________________[Indicate the Name of the Bank] [Hereinafter referred to as ‘the Bank’] at the request of M/S ___________________________________ [Herein after referred to as supplier (s)] do hereby unequivocally and unconditionally guarantee and undertake to pay during the above said period, on written request by SOUTHCO an amount not exceeding Rs._________________ to the SOUTHCO, without any reservation. The guarantee would remain valid up to 4.00 PM of _________________ [date] and if any further extension to this is required, the same will be extended on receiving instructions from M/s ___________________________________ on whose behalf this guarantee has been issued.

2. We the ______________________________________ [Indicate the name of the bank] do hereby further undertake to pay the amounts due and payable under this guarantee without any demur, merely on a demand from the SOUTHCO stating that the amount claimed is due by way of loss or damage caused to or would be caused to or suffered by the SOUTHCO by reason of any breach by the said supplier [s] of any of the terms or conditions or failure to perform the said Bid. Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs.______________________________ (in wards)
3. We, the _____________ Bank undertake to pay the SOUTHCO any money so demanded notwithstanding any dispute or disputes so raised by the supplier [s] in any suit or proceeding instituted/pending before any Court or Tribunal relating thereto, our liability under this agreement being absolute and unequivocal. The payment so made by us under this bond shall be a valid discharge of our liability for payment there under and the supplier(s) shall have no claim against us for making such payment.

4. We, the__________Bank [Indicate the name of the bank] or our local branch at Berhampur further agree that the guarantee herein contain shall remain in full force and effect during the aforesaid period of ------------ days and it shall continue to be so enforceable till all the dues of the SOUTHCO under by virtue of the said Bid have been fully paid and its claims satisfied or discharged or till SOUTHCO certifies that the terms and conditions of the said Bid have been fully and properly carried out by the said Supplier [s] and accordingly discharges this guarantee. Unless a demand or claim under this guarantee is made on us in writing on or before the _________________ (date) we shall be discharged from all liability under this guarantee thereafter.

5. We, the __________Bank [Indicate the name of the bank] or our local branch at Berhampur further agree that the SOUTHCO shall have the fullest liberty without our consent and without affecting in any manner our obligations here under to vary any of the terms and conditions of the said Bid or to extend time of performance by the said Supplier [s] from time to time or to postpone for any time or from time to time any of the powers exercisable by the SOUTHCO against the said supplier [s] and to forbear or enforce any of the terms and conditions relating to the said bid and we shall not be relieved from our liability by reason of any such variation, postponement or extension being granted to the said Supplier [s] or for any forbearance act or omission on the part of the SOUTHCO or any indulgence by the SOUTHCO to the said Supplier[s] or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision, have effect of so relieving us.

6. This guarantee will not be discharged due to the change in the name, style and constitution of the Bank or the supplier [s].

7. We, the ____________Bank or our local branch at Berhampur lastly undertake not revoke this Guarantee during its currency except with the previous consent of the SOUTHCO in writing.

8. We, the___________________________ Bank further agree that this guarantee shall also be invokable at our place of business at Berhampur [Indicate address & Branch code of local branch at Berhampur] in the State of Odisha.
Dated ______________________ Day of 2013.

Witness ((Signature, names & address) For_______ [Indicate the name of Bank]
1. Power of Attorney No._____
2. Date: __________
SEAL OF BANK

Note: The non-judicial stamp paper of worth Rs.100/- shall be purchased in the name of the bank, which has issued the bank guarantee.

ANNEXURE- XV (B)

FORM OF EXTENSION OF BANK GUARANTEE
(ON NON-JUDICIAL STAMP PAPER OF Rs.100/-)

Ref. No.________________
Dated: __________

SOUTHCO Ltd.,
Courtpata, Berhampur - 760004

Dear Sirs,

Sub: Extension of Bank Guarantee No.__________for Rs._____________favouring yourselves expiring ____________ on account of M/s. ______________ in respect of contract No.______________ dated ____________ (hereinafter called original bank guarantee).

At the request of M/s. ____________ we ____________ bank Branch office at ________ having its head office at ____________ do hereby extend our liability under the above mentioned guarantee No. ____________ Dated____________ for a further period of _______ Years/months from ________ to expire on __________ except as provided above, all other terms and conditions of the original bank guarantee No.__________dated __________ shall remain unaltered and binding.

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

Yours faithfully,
For ____________
Manager/Agent/Accountant

Page 68 of 355
Power of Attorney No.______
Date: _________

SEAL OF BANK
TECHNICAL SPECIFICATION
VOL-I

FOR
CONSTRUCTION OF
33 KV SC/DC SUB-TRANSMISSION
&
11 KV SC DISTRIBUTIONS
LINES

TECHNICAL SPECIFICATION FOR CONSTRUCTION OF
33 KV DISTRIBUTION LINES

1.0 NATURE OF WORK
The work covered by this Specification is for 33kV distribution lines as specified herein and in the attached Schedules. The overhead distribution lines will form part of the SOUTHCO’s distribution System.
1.1 GENERAL PARTICULARS OF THE SYSTEM

The following are the general particulars governing the design and working of the complete system of which the Works will form a part —

a) Electrical energy is transmitted from 132/33 KV or from 220/33 KV grid S/S of OPTCL to SOUTHCO’s Primary 33/11 KV sub-stations as three-phase supply at a frequency of 50 Hz, and transmitted there from by means of overhead lines.

b) The system will be in continuous operation during the varying atmospheric and climatic conditions occurring at all seasons.

1.2 SCOPE-

(A) Construction of 33 KV Lines under various packages

Important: The eligible Contractor has to obtain project license from the competent authority in respect of the mentioned works prior to commencement of the works. All the expenses towards the project license and inspection thereof have to be borne by the contractor.

The department will provide 100 mm2 AAA conductors which will be received from SOUTHCO’s store. All other items required for construction of New lines are to be supplied by contractor.

DISCLAIMER:

This Document includes statements, which reflect various assumptions, which may or may not be correct. Each Bidder/Bidding Consortium should conduct its own estimation and analysis and should check the accuracy, reliability and completeness of the information in this Document and obtain independent advice from appropriate sources in their own interest.
Neither Purchaser nor its employees will have any liability whatsoever to any Bidder or any other person under the law or contract, the principle of restitution or unjust enrichment or otherwise for any loss, expense or damage whatsoever which may arise from or be incurred or suffered in connection with anything contained in this Documents and mater deemed to form part of this documents, provision of services and any other information supplied by or on behalf of purchaser or its employees, or otherwise arising in any way from the selection process for the supply.

Though adequate care has been take while issuing the Bid document, the Bid document, the Bidder should satisfy itself that documents are complete in all respects. Intimation for any discrepancy shall be given to this office immediately.

2.0 SURVEY (detail & check, estimating of quantities & spotting of towers / Poles)

Walk over survey, Theodolite survey, profile survey (if required) shall have to be carried out to establish the Route alignment by the contractor for new 33 KV lines. If the line is passing in any Municipal/ NAC areas permission from local bodies has to be obtained prior to execution of work. Suitable distance from the side of the road has to be made towards placement of line poles.

2.0.1 CHECK SURVEY

The contractor shall undertake the check survey during execution on the basis of the alignment profile drawing and tower schedule approved by the employer. If during check survey necessity arises for minor change in route to eliminate way leave or other unavoidable constraints, the contractor may change the said alignment after obtaining prior approval from the employer

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

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

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

(a) The line is as near as possible to the available roads in the area.
(b) The route is straight and short as far as possible.
(c) Good farming areas, religious places, forest, civil and defense installations, aerodromes, public and private premises, ponds, tanks, lakes, gardens, and plantations are avoided as far as practicable.
(d) The line should be far away from telecommunication lines as reasonably possible. Parallelism with these lines shall be avoided as far as practicable.
(e) Crossing with permanent objects are minimum but where unavoidable preferably at right angles.
(f) Difficult and unsafe approaches are avoided.
(g) The survey shall be conducted along the approved alignment only.
(h) For river crossing/ Crossing of Nallas : Taking levels at 25 meter interval on bank of river and at 50 meter interval at bed of river so far as to show the true profile of the ground and river bed railway/road bridge, road The levels shall be taken at least 100 m. on either side of the crossing alignment. Both longitudinal and cross sectional shall be drawn preferably to a scale of 1:2000 at horizontal and 1:200 vertical.
After completing the detailed survey, the contractor shall submit the final profile and tower schedule/ pole schedule (with no. of stay or structure) for final approval of the employer. To facilitate checking of the alignment, suitable reference marks shall be provided. For this purpose, concrete pillars of suitable sizes shall be planted at all angle locations and suitable wooden/iron pegs shall be driven firmly at the intermediate points. The contractor shall quote his rate covering these involved jobs.

2.0.5 (a) Optimization of Pole Location

I. Pole Spotting

To optimize the line length, the contractor shall spot the poles in such a way so that the line is as close as possible to the straight line drawn between the start & end point of the line.

II. Crossings

Road Crossings: - At all road crossings, the double tension HW fittings should be used. There should absolutely no joints in the conductors in all roads, power line and all other major crossing. The ground clearance from the road surfaces under maximum sag condition shall be not less than 8.5mtr over roads. In National High way the minimum height of guarding at the maximum sagging point should be less than 8.5 mts.

Railway Crossings- The railway crossing overhead or underground shall be carried out in the manner as approved & prescribed by the railway authorities from time to time.

The crossing shall normally be at right angle to the railway track. In case crossing is required to be done through underground cable, cost of the cable including laying and other accessories shall be in the scope of the contractor. During detailed engineering, the contractor shall submit his proposed arrangement for each railway crossing to the owner. The approval for crossing railway track shall be obtained by the owner from the Railway Authority.

Power Line Crossings-
Where the line is to cross over another line of the same voltage or lower voltage, provisions to prevent the possibility of their coming into contact with each shall be made in accordance with the Indian Electricity Rules.

III. **Details En-route**

After survey and finalization of route, the contractor shall submit detailed route map for each line. This would be including following details:

All poles on both sides of all the crossings shall be tension poles i.e. disc type insulators shall be used on these poles. At all the crossing described above the contractor shall use protective guarding as per REC Construction Standard A-1 to fulfill statutory requirements for 11 kV & 33 KV trunks & main spur line. 11kV & 33 KV branch spur line, being in the village, protective guarding shall be used wherever it will be required.

Clearance from Ground, Building, Trees etc. – Clearance from ground, buildings, trees and telephone lines shall be provided in conformity with the Indian Electricity Rules, 1956 as amended up to date. The vendor shall select the height of the poles in order to achieve the prescribed electrical clearances.

IV. **Final Schedule**

The final schedule including Bill of quantity indicating location of poles specifically marking locations of failure containment pole/structure, DTs 11 KV line sectionalizes, line tapping points; angle of deviation at various tension pole locations, all type of crossings and other details shall be submitted for the approval of the owner. After approval, the contractor shall submit six more sets of the approved documents along with one set in reproducible form to purchaser for record purpose.

V. **Danger Boards**

The vendor shall provide & install danger plates on all 33KV DP structures, H pole structures and towers besides in all poles where DT is installed. The danger plates shall conform to REC specification No. 57/1993.
VI.  **Anti-climbing Devices**

The vendor shall provide and install anti-climbing device on all 33kv DP structures, towers and at all poles as per CEA guide line. This shall be done with G.I. Barbed wire or modified spikes as specified. The barbed wire shall conform to IS-278 (Grade A1). The barbed wires shall be given chromatin dip as per procedure laid down in IS: 1340.

VII. **Fittings Common to all Line**

Pin Insulator Binding: The contractor shall use AL. Binding wire for binding shall be as per REC Construction Standards No. C-5 or better thereof.

Mid Span Compression Joint & Repair Sleeves: The contractor shall supply & install the Mid Span Compression Joint and Repair Sleeves as per IS: 2121 (Part II).

Guy/Stay wire Clamp: The contractor shall supply & install Guy/Stay wire Clamp as per REC Construction Standard G-1 or better here of as specified..

VIII. **Stay/Guy Sets**

a) The Stay/Guys shall be used at the following pole locations;

   At all the tapping points & dead end poles
   At all the points where DT is to be installed
   At all the points as per REC construction dwg. No. A-10 (for the diversion angle of 10-60 degree)
   At every alternative pole for 11 KV line (two sets)
   Both side poles at all the crossing for road, nallah, railway crossings etc.

b) The arrangement and number of stay sets to be installed on different pole structures shall be as per REC Construction Standards no. A-23 to A-27, G-5 & G-8. However, this shall be decided finally during erection, as per the advice of Engineer.

c) The stay set to be installed complete in all respect and would broadly consist of following items:
7/10 SWG G.I. Stay wire for 11 kV lines and 7/12 SWG for LT line as per REC Specification No.46/1986Stay Insulator type A for LT line and type C for 11 kV line as per REC Specification No. 21/1981, Turn Buckle. Anchor rod and plate (Hot Dipped galvanized). Thimbles and Guy Grip Complete stay set shall be as per REC Construction Standards no. G-1. The stay clamp is envisaged as GS structure along with other clamps brackets etc.

IX. **Erection of stay sets**

The contractor shall install the stay set complete in all respect. This includes excavation of pit in all kinds of soil with PCC in the ratio 1:2:4 as specified which shall be placed in the bottom of the pit.

The rest (upper half) of the pit shall be filled with excavated soil duly compacted layer by layer. An angle between 30 to 45 degrees shall be maintained between stay wire and the pole. The stay wire shall be used with a stay insulator at a height of 5 mts. above ground level with F.I. turn buckle.

X. **Stringing and Installation of Line with Bare Conductors.**

**General**

The scope of erection work shall include the cost of all labour, tools and plants such as tension stringing equipment and all other incidental expenses in connection with erection and stringing work. The Bidders shall indicate in the offer the sets of stringing equipment he would deploy exclusively for work under each package.

The stringing equipments shall be of sufficient capacity to string AAA conductor.

The Contractor shall be responsible for transportation to site of all the materials to be provided by the Contractor as well as proper storage, insurance etc. at his own cost, till such time the erected line is taken over by the owner.

Contractor shall set up required number of stores along the line and the exact location of such stores shall be discussed and agreed upon with the owner.

**Insulator Fixing**

Pin insulators shall be used on all poles while strain insulators shall be used on all angle & dead end poles. The special type Pin Insulators should be used for conductors more than 100 mm². Damaged insulators and fittings, if any, shall not be used. Prior to fixing, all insulators
shall be cleaned in a manner that shall not spoil, injure or scratch the surface of the insulator, but in no case shall any oil be used for this purpose. Torque wrench shall be used for fixing various line materials and components, such as suspension clamp for conductor, whenever recommended by the manufacturer of the same.

**Running Out of the Conductors**

The contractor shall be entirely responsible for any damage to the pole or conductors during stringing. The conductors shall be run out of the drums from the top in order to avoid damage to conductor.

A suitable braking device shall be provided to avoid damaging, loose running out and kinking of the conductors. Care shall be taken to ensure that the conductor does not touch and rub against the ground or objects, which could scratch or damage the strands.

The sequence of running out shall be from the top to down i.e. the top conductor shall be run out first, followed in succession by the side conductors. Unbalanced loads on poles shall be avoided as far as possible.

Wherever applicable, inner phase off-line conductors shall be strung before the stringing of the outer phases is taken up.

When lines being erected run parallel to existing energized power lines, the Contractor shall take adequate safety precautions to protect personnel from the potentially dangerous voltage build up due to electromagnetic and electrostatic coupling in the pulling wire, conductors and earth wire during stringing operations.

The Contractor shall also take adequate safety precautions to protect personnel from potentially dangerous voltage build up due to distant electrical storms or any other reason.

**Repairs to Conductors**

The conductor shall be continuously observed for loose or broken strands or any other damage during the running out operations. Repair to conductors, if necessary, shall be carried out with repair sleeves and not more than one repair sleeve will be used in one span.

Repairing of the conductor surface shall be carried out free of cost only in case of minor damage, scuff marks, etc. The final conductor surface shall be clean, smooth and free from
projections, sharp points, cuts, abrasions etc. After compression the sharp edges must be smoothened by filing.

The Contractor shall be entirely responsible for any damage to the poles, insulators etc during stringing.

**Stringing of Conductor**

The stringing of the conductor shall be done by the standard stringing method.

The Bidder shall submit complete details of the stringing method for owner’s approval. Conductors shall not be allowed to hang in the stringing blocks for more than 96 hours before being pulled to the specified sag.

Derricks/ scaffoldings or other equivalent methods shall be used to ensure that normal services are not interrupted and any property is not damaged during stringing operations for roads, telecommunication lines, power lines and railway lines. However, shut-down shall be obtained when working at crossings of overhead power lines. The contractor shall make specific request for the same to the owner.

**Jointing**

When approaching the end of a drum length at least three coils shall be left in place when the stringing operations are stopped. These coils are to be removed carefully, and if another length is required to be run out, a joint shall be made as per the recommendations of the accessories manufacturer.

Conductor splices shall not crack or otherwise be susceptible to damage during stringing operation. The Contractor shall use only such equipment/methods during conductor stringing which ensures complete compliance in this regard.

All the joints on the conductor shall be of compression type, in accordance with the recommendations of the manufacturer, for which all necessary tools and equipment like compressors, dies etc., shall be arranged by the contractor. Each part of the joint shall be
cleaned by wire brush till it is free of rust or dirt, etc. This shall be properly greased with anti-
corrosive compound if recommended by the manufacturer, before the final compression is
carried out with the compressors.

All the joints or splices shall be made at least 30 meters away from the pole. No joints or
splices shall be made in spans crossing over main roads, railway line and Small River spans.
Not more than one joint per conductor per span shall be allowed. The compression type
fittings shall be of the self centering type or care shall be taken to mark the conductors to
indicate when the fitting is centered properly.

During compression or splicing operation, the conductor shall be handled in such a manner as
to prevent lateral or vertical bearing against the dies. After compressing the joint, the
Aluminium sleeve shall have all corners rounded; burrs and sharp edges removed and
smoothened.

To avoid any damage to the joint, the contractor shall use a suitable protector for mid span
compression joints in case they are to be passed over pulley blocks/aerial rollers. The pulley
groove size shall be such that the joint along with protection can be passed over it smoothly.

In case AAAC is used each press should over lap 25% of the previous press.

**Tensioning and Sagging Operations:**
The tensioning and sagging shall be done in accordance with the approved stringing charts or
sag tables.

The sag shall be checked in the first and the last section span for sections up to eight spans
and in one additional intermediate span for sections with more than eight spans Tensioning
and sagging operations shall be carried out in calm weather when rapid changes in
temperature are not likely to occur.

**Clipping In**
Clipping of the conductors into position shall be done in accordance with the manufacturer’s recommendations.

Jumpers at section and angle towers shall be formed to parabolic shape to ensure maximum clearance requirements. Pilot pin insulator shall be used, if found necessary, to restrict jumper swing & to ensure proper clearance to design values.

Fasteners in all fittings and accessories shall be secured in position. The security clip shall be properly opened and sprung into position.

**Fixing of Conductors and Earth wire Accessories**

Conductor and earth wire accessories supplied by the Contractor shall be installed by the Contractor as per the design requirements and manufacturer’s instructions. While installing the conductor and earth wire accessories, proper care shall be taken to ensure that the surfaces are clean and smooth and that no damage occurs to any part of the accessories or of the conductors.

**Replacement:**

If any replacements are to be effected after stringing and tensioning or during maintenance e.g. replacement of cross arms, the conductor shall be suitably tied to the pole at tension points or transferred to suitable roller pulleys at suspension points.

**HT/LT/Road Crossing Guarding**

The contractor shall provide & install protective guarding as per REC construction standard for both 33 and 11 kV line, The guarding shall be provided at all the crossing i.e. road, telecommunication & power lines, railway line, nullah etc.

The contractor is required to follow local statutory regulations stipulated in Electricity (Supply) Act 1948, Indian Electricity Rules 1956 as amended and other local rules and regulations referred in these specifications.

**Reference Standards**

The codes and/or standards referred to in the specifications shall govern, in all cases wherever such references are made. In case of a conflict between such codes and/or standards and the
specifications, latter shall govern. Such codes and/or standards, referred to shall mean the latest revisions, amendments/changes adopted and published by the relevant agencies unless otherwise indicated. Other internationally accepted standards which ensure equal or better performance than those specified shall also be accepted, subject to prior approval by the owner. In case no reference is given for any item in these specifications, latest REC specification & Construction Standards shall be referred to.

2.0.6 SPAN

1. The span should be as near as possible to the basic design span so that the minimum ground clearance should not less than 7.0 mts in cross country at maximum sag condition.(The span length should be applicable for both 33KV& 11 KV lines.)

2. In urban areas minimum in every Half KM one angle tower (Cut point) has to be provided.

3. In other areas in every 1.5 KM one angle tower (Cut point) may be provided.

2.0.7 WAY-LEAVE AND TREE CUTTING

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

The employer shall not be held responsible for any claim on account of damage done by the contractor or his personnel to trees, crops and other properties.

The contractor shall take necessary precaution to avoid damage to any ripe and partially grown crops and in the case of unavoidable damage, the employer shall be informed and necessary compensation shall be paid by the contractor.
All the documents required for application to the statutory authorities must be prepared by the contractor & submitted to the employer for submission of the application towards approval of Railway Crossing etc. However, the responsibilities lie with the contractor to get the clearance.

Trimming of tree branches or cutting of a few trees en-route during survey is within the scope of survey to be done by the contractor. Contractor shall arrange for necessary way-leave and compensation in this regard. During erection of the line, compensation for tree cutting, damage caused to crops, actual cutting and falling of the trees including way-leave permission for such route clearance shall be arranged by the contractor at his cost. The contractor will identify the number of trees and detail of obstructions to be removed for erection of the line and intimate the employer well in advance in case of any help. Other related works like construction of temporary approach roads, etc. as required, shall be done by the contractor and the same will lie within the scope of contractor’s work and such cost shall be considered to be included in the rates quoted by him.

3.0.1 POWER LINE CROSSINGS
Where the lines cross over another line of the same voltage or lower voltage, provisions to prevent the possibility of its coming into contact with other overhead lines shall be made in accordance with the Indian Electricity Rules, 1956 as amended from time to time. All the works related to the above proposal shall be deemed to be included in the scope of the Contractor.

3.0.2 TELECOMMUNICATION LINE CROSSINGS
   a) The angle of crossing shall be as near to 90 degree as possible. However, deviation to the extent of 20 degree may be permitted under exceptionally difficult situations. The existing line route may be changed where required.
   b) HT line shall be routed with requisite suppression with parallel telecom line to avoid inductance during faults.

3.0.3 DETAILS EN-ROUTE
All topographical details, permanent features, such as trees, telecommunication lines, building etc. 7.5 mtr (33 kV) on either side of the alignment shall be detailed on the route plan before execution of work. However, any problems arising out of Right of way, shall be taken care of by the Contractor. The owner shall extend all possible Co-operations.

3.0.4 CLEARANCE FROM GROUND, BUILDING, TREES ETC.

3.0.4.1 Clearance from ground, buildings, trees and telephone lines shall be provided in conformity with the Indian Electricity Rules, 1956 as amended up to date. The bidder shall select the height of the poles such that all electrical clearances are maintained.

3.0.4.2 Guarding mesh shall be used in all electric line / telecom line / road / drain / canal crossing and at all points as per statutory requirements. The bidder shall provide & install anti climbing devices and danger plates on all poles and DT stations. Where there is no such provision in the existing line.

3.0.4.3 Pole accessories like danger plates, and number plates shall be provided.

3.0.5. TOWERS/ POLES

Support Structures may be of lattice type or joist or PSC poles. Double Ckt. both suspension and tension poles in case of all 33 KV lines and if required in case of 11 KV lines to be specified individually in the packages. 2 to 3 mts. extension where ever necessary in case mini base tower is to be used. Any new design (approved and tested in any approved test bed) as per the required parameters is also acceptable. In case of 11KV and LT lines the conventional PSC poles may be used. For easy transportation two pieces of poles with single splice joint using sections of channels/angles/plates of adequate size along with required size MS bolt nuts & spring washers is to be adopted. Joist with minimum 150x150mm or 116x100 mm sections are to be considered for the supports (in accordance to scope). 2 nos 450 mm long cleats with 65 x 65 x 5mm angle to be welded or bolted by providing minimum 2 nos 16 mm B&N, sp. washer. Full length welding is to be done on either side in the base level.
The materials must conform to IS: 800. The entire test on materials and fabrication etc will be as per the relevant Indian standards.

In different crossings the contractor shall take into consideration the prevailing regulations of the respective authorities before finalizing type and location of the towers. While carrying out survey work, the contractor has to collect all relevant data, prepare and submit drawings in requisite number for obtaining clearance from road, aviation, railways, river and forest authorities.

4.0 **ERECTION WORK**

When the survey is approved, the contractor shall submit to the employer a complete detail schedule of all materials to be used in the line. Size and length of conductor etc. are also to be given in the list. This schedule is very essential for finalizing the quantities of all line materials. The contractor shall furnish the same.

4.1 **SCHEDULE OF ERECTION PROGRAMME**

After due approval of the detailed and check survey, the contractor shall submit to the employer a complete detailed schedule of erection programme with a Bar-Chart for construction of the lines indicating there in the target date of completion.

4.2 **DRAWINGS FOR TOWER AND FOUNDATIONS**

All indicative drawings of towers, structures etc with foundation will be provided by SOUTHCO. The final drawings which are actually to be used has to be submitted by contractor for approval by SOUTHCO.

(I) **Mini Base Towers**

In case of river crossing, self supported Mini-based Towers can be used, having the base width varying from 0.5 mts to 1.0 mts. Also it will be made double circuit which can carry 232 sq. mm. Conductor. No stay or strut will be allowed for towers. The entire tower parts are to be from welded Galvanised structure having three nos of section. The details of Mini Based
Towers is furnished below (This is indicative, the dimension, volume etc may vary according to soil data).

A’  Type Tower Details: Back To Back :- 500x500 mm Total Wt : 850 kg
    Normal          WBC
    Concrete Vol. : 1.75 cum   -     2.0 cum
    Reinforcement : 50 kgs     -     60 kg
    Excavation Vol : 6.97 cum  -     7.21 cum
    Lean Concrete : 0.15 cum   -     0.17 cum

B’  Type Tower Details : Back To Back :- 770x770 mm Total Wt : 1760 kg
    Concrete Vol. : 4.04 cum   -     5.14 cum
    Reinforcement : 175 kg     -     220 kgs
    Excavation Vol : 25.2 cum  -     36.35 cum
    Lean Concrete : 0.39 cum   -     0.58 cum

5.0  CONSTRUCTION OF FOUNDATION FOR TOWER, RS Joist POLES AND PSC POLES

5.0.1  ERECTION OF POLE, CONCRETING OF POLES AND COMPACTION OF SOIL

Drawing for the excavation of pits, Foundation of both wet and Black cotton soil is enclosed which are to be adopted. If better design with less volume approved or tested by any other distribution agencies will also be acceptable.

5.0.2  Following arrangement shall be adopted for proper erection of poles wherever necessary and properly compacting of the soil around the base / foot of the poles, under this package.

(a) Excavation has to be done as per the drawing to the required depth and size. After final excavation the pit should be dressed properly so that uneven portion and loose soil should be removed before PCC (M-7.5) of thickness 75 mm is laid. The base footing of the pole concreting RCC (M-15) has to be done by proper alignment and verticality.
(b) The verticality and leveling of pole/structure should be done by the help of plumbob or with theodolite and leveling instrument.

(c) In case of Joist pole Base clits and in case of PSC pole base plate (450x450x10) mm or RCC Pre–cast slab of size (500 x 500 x 100) mm has to be provided over the Lean concrete.

5.0.3 CEMENT CONCRETE (PLAIN OR REINFORCED), STUB SETTING GROUNDING AND BACK FILLING etc.

A) Materials
All materials whether to be consumed in the work or used temporarily shall conform to relevant IS specification, unless stated otherwise, and shall be of the best approved quality.

B) Cement
Cement to be used in the work under the contract shall generally conform to IS:269/455-1989. Cement bags shall be stored by the contractor in a water tight well ventilated store sheds on raised wooden platform (raised at least 150 mm above ground level) in such a manner as to prevent deterioration due to moisture or intrusion of foreign matter. Cements to be used within three months from the date of manufacture. Sub-standard or partly set cement shall not be used and shall be removed from the site by the contractor at his cost.

C) Coarse Aggregates i.e Stone chips or stone ballast. For M15 concrete (mix 1:2:4) the aggregate will be in the ranges from 12mm to 20mm.size and for M7.5 concrete (mix 1:4:8) these will be from 25mm to 40mm size.

D) Pole erection
1. After proper alignment, checking of verticality and leveling, the pole or structure should be properly tied before placing of base concrete of required height. Again the verticality and leveling should be checked.

2. The RCC pedestal concrete (M-15) is to be done by providing good quality of shutters, so that there will no leakage of cement slurry during concreting. The cooping height should be 450 mm/750 mm above the existing ground level in urban area and in cultivated lands respectively. The top portion of the cooping should be made tapered.
3. **Above** the cooping 450 mm of pole or structure should be painted with double layer of Black Bituminous paints.

4. **All the bolted joints** should be tightened properly by providing suitable size Bolt Nuts and Spring washers. After completion of erection works all the bolts should be spot welded in order to avoid theft of members.

5. **The back filling** of locations should be done by using the excavated soil only in layers (each layer should not be more than 500 mm) by putting water and ramming by using wooden rammers. In no case stone of size more than 75mm used for back filling. Back-filling has to be done 75mm above ground level or as specified

6. **Curing of concrete** should be done for 28 day continuously. Curing should not be done within 24 Hours of concreting.

7. **All the excess** excavated materials and other unused materials from the concreting site should be disposed of to a suitable site by the contractor.
   a) **Mixer** (Running time-2 min.)
   b) **In case of** hand mixing, 10% extra cement has to be provided. Hand mixing should be done on GI sheet platform only.
   c) **Poking rod** may be used for compacting in locations at PSC poles only
   d) **Use of vibrator** for compacting is mandatory.
   e) **Clean water** (free from saline and alkaline) should be used for concreting.
   f) **Aggregates** (both coarse and fine) used should be free from foreign materials.
   g) **Shutters** used should not be removed before 24hrs. of casting.
   h) **In case of** black cotton soil borrowed earth (morum soil mixed with sand is preferable) may be used for back filling.
   i) **Sufficient qty. of water** should be sprinkled over backfilled earth and chimney kept wet by using wet gunny bags.

5.0.4 **All the persons** working on tower shall wear safety helmet, safety belt and safety shoes, Similarly all the persons working on ground shall wear safety helmet and safety shoes.

5.0.4.1. **If there is any LT/HT** power line near the vicinity of tower erection, necessary shutdown of the power line shall be obtained in writing from the concerned Agency in order to avoid electrical hazards caused by accidental touching of stay/Guy ropes with power line.
5.0.4.2 Safety precaution Safety shall be given utmost importance during stringing. The following need to be ensured.

5.0.4.3 Safe working conditions shall be provided at the stringing site.

5.0.4.4 Full proof communication through walky-talkie / mobile phones shall be used in order to avoid any damage to workmen or public on ground.

5.0.5 (A) PSC Pole (9 Mtr. x 300 Kg, 10mtr. x 300 Kg)

TECHNICAL SPECIFICATIONS

I. Applicable Standard:

The Poles shall comply with latest standards as under:

II. Materials :

Cement
Cement to be used in the manufacture of pre-stressed concrete poles shall be ordinary for rapid hardening Portland cement confirming to IS: 269-1976 (Specification for ordinary and low heat Portland cement) or IS: 8041 E-1978 (Specification for rapid hardening Portland cement).

Aggregates
Aggregates to be used for the manufacture of pre-stressed concrete poles shall confirm to IS: 383 (Specification for coarse and fine aggregates from natural sources for concrete). The nominal maximum sizes of aggregates shall in no case exceed 12 mm.

Water
Water should be free from chlorides, sulphates, other salts and organic matter. Potable water will be generally suitable.

Admixture
Admixture should not contain Calcium Chloride or other chlorides and salts which are likely to promote corrosion of pre-stressing steel. The admixture shall conform to IS: 9103.

Pres-Stressing Steel
Pre-stressing steel wires including those used as un tensioned wires should conform to IS:1785 (Part-I) (Specification for plain hard-drawn steel wire for pre-stressed concrete, Part-I cold drawn stress relieved wire).IS:1785 (Part-II)(Specification for plain hard-drawn steel
wire) or IS:6003 (Specification for indented wire for pre-stressed concrete). The type design given in the annexure are for plain wires of 4 mm diameter with a guaranteed ultimate strength of 160 kg/mm². All pre-stressing steel shall be free from splits, harmful scratches, surface flaw, rough, aged and imperfect edges and other defects likely to impair its use in pre-stressed concrete.

**Concrete Mix**

Concrete mix shall be designed to the requirements laid down for controlled concrete (also called design mix concrete) in IS: 1343-1980 (Code of practice for pre-stressed concrete) and IS: 456 – 1978 (Code of practice for plain and reinforced concrete) subject to the following special conditions:

- Minimum works cube strength at 28 days should be at least 420 Kg/cm².
- The concrete strength at transfer should be at least 210 Kg/cm².
- The mix should contain at least 380 Kg of cement per cubic meter of concrete.
- The mix should contain as low water content as is consistent with adequate workability. It becomes necessary to add water to increase the workability the cement content also should be raised in such a way that the original value of water cement ratio is maintained.

**III. Design Requirements**

The poles shall be designed for the following requirements:

- The poles shall be planted directly in the ground with a planting depth as per IS: 1678. Wherever, planting depth is required to be increased beyond the specified limits or alternative arrangements are required to be made on account of ground conditions e.g, water logging etc., the same shall be in the scope of the bidder at no extra cost to owner. The bidder shall furnish necessary design calculations/details of alternative arrangements in this regard.

- The working load on the poles should correspond to those that are likely to come on the pole during their service life.

- The factor of safety for all poles above 9.0Mts. Shall not be less than 2.0.

- The average permanent load shall be 40% of the working load.

- The F.O.S. against first load shall be 1.0.

- At average permanent load, permissible tensile stress in concrete shall be 30 kg/cm².

- At the design value of first crack load, the modulus of rupture shall not exceed 53.0kg/cm² for M-40.

- The ultimate moment capacity in the longitudinal direction should be at least one fourth of that in the transverse direction.
The maximum compressive stress in concrete at the time of transfer of pre-stress should not exceed 0.8 times the cube strength.

The concrete strength at transfer shall not be less than half the 28 days strength ensured in the design, i.e. 420x0.5=210kg/cm². For model check calculations on the design of poles, referred to in the annexure, a reference may be made to the REC “Manual on Manufacturing of solid PCC poles, Part-I-Design Aspects”.

IV. Dimensions and Reinforcements
The cross-sectional dimensions and the details of pre-stressing wires should conform to the particulars given in the enclosed drawing. The provisions of holes for fixing cross-arms and other fixtures should conform to the REC specification No.15/1979.

All pre-stressing wires and reinforcements shall be accurately fixed as shown in drawings and maintained in position during manufacture. The un-tensioned reinforcement as indicated in the drawings should be held in position by the use of stirrups which should go round all the wires.

All wires shall be accurately stretched with uniform pre-stressed in each wire. Each wire or group of wires shall be anchored positively during casing. Care should be taken to see that the anchorages do not yield before the concrete attains the necessary strength.

V. Cover
The cover of concrete measured from the outside of pre-stressing tendon shall be normally 20 mm.

VI. Welding and Lapping of Steel
The high tensile steel wire shall be continuous over the entire length of the tendon. Welding shall not be allowed in any case. However, joining or coupling may be permitted provided the strength of the joint or coupling is not less than the strength of each individual wire.

VII. Compacting
Concrete shall be compacted by spinning, vibrating, shocking or other suitable mechanical means. Hand compacting shall not be permitted.

VIII. Curing
The concrete shall be covered with a layer of sacking, canvass, Hessian or similar absorbent material and kept constantly wet up to the time when the strength of concrete is at least equal to the minimum strength of concrete at transfer of pre-stress. Thereafter, the pole may be removed from the mould and watered at intervals to prevent surface cracking of the unit the interval should depend on the atmospheric humidity and temperature. The pre-stressing wires shall be de-tensioned only after the concrete has attained the specified strength at
transfer (i.e. 200 or 210 kg/cm² as applicable). The cubes cast for the purpose of determining
the strength at transfer should be coured, a ear as possible, under condition similar to those
under which the poles are cured. The transfer stage shall be determined based on the daily
tests carried out on concrete cubes till the specified strength indicated above is reached.
Thereafter the test on concrete shall be carried out as detailed in IS: 1343(code of practice for
pre-stressed concrete). The manufacture shall supply, when required by the
owner or his representative, result of compressive test conducted in accordance with IS: 456
(Code of practice for plain and reinforced concrete) on concrete cubes made from the concrete
used for the poles. If the manufacture so desired, the manufacture shall supply cubes for test
purpose and such cubes shall be tested in accordance with IS: 456 (Code of practice for plain
and reinforced concrete).

IX. Lifting Eye-Hooks or Holes
Separate eye-hooks or hoes shall be provided for handling the transport, one each at a distance
of 0.15 times the overall length, from either end of the pole. Eye-hooks, if provided, should be
properly anchored and should be on the face that has the shorter dimension of the cross-
section. Holes, if provided for lifting purpose, should be perpendicular to the broad face of the
pole.

X. Holes for Cross Arms etc
Sufficient number of holes shall be provided in the poles for attachment of cross arms and
other equipments.

XI. Stacking & Transportation
Stacking should be done in such a manner that the broad side of the pole is vertical. Each tier
in the stack should be supported on timber sleeper located as 0.15 times the overall length,
measured from the end. The timber supported in the stack should be aligned in vertical line.

XII. Earthing

(a) Earthing shall be provided by having length of 6 SWG GI wire embedded in Concrete
during manufacture and the ends of the wires left projecting from the pole to a length of
100mm at 250 mm from top and 1000 mm below ground level.

(b) Earth wire shall not be allowed to come in contract with the pre-stressing wires

B. PSC Pole (9 Mtr x 300 Kg, 10mtr x 300Kg)

GUARANTEED TECHNICAL PARTICULARS
(To be submitted along with offer)

<table>
<thead>
<tr>
<th>SL No.</th>
<th>Description</th>
<th>Unit</th>
<th>Bidder’s Offer</th>
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<td>10mtr X 300 Kg</td>
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<td>9 Mtr X300 Kg</td>
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5.0.5.1 All the poles shall be provided with a RCC block base or MS base plate having dimensions as mentioned at 5.0.2 © as per the site requirement to be decided by Engineer in Charge. The decision of Engineer in Charge will be Final.

5.0.5.2 The poles shall then be lifted to the pit with the help of wooden supports. The pole shall then be kept in the vertical position with the help of 25 mm (min.) manila ropes, which will act as the temporary anchor. The verticality of the pole shall be checked by spirit level in both longitudinal & transverse directions. The temporary anchor shall be removed only when poles set properly in the pit for foundation concreting & backfilling with proper compacting the soil. The backfilling should be done in layers (maxm. 0.5 mts at a time with sprinkling...
of water and by using wooden hammer. No stone more than 75 mm should be used during back filling.

5.0.5.3 Suspension type H/W fittings in all tangent locations and Four pair bolted type tension H/W fittings should be used in all new 33&11 Kv lines. 45 KN & 70 KN normal B&S insulators will be used in suspension & tension locations respectively.

5.0.5.4 Concreting of foundation up to a minimum height of 1.8 mtrs from the bottom of the pit with a circular cross-section of radius 0.25 mtrs. (volume of 0.3 cu.mtr. per pole) in the ratio of 1:2:4 shall be done at the following locations: The depth has to be increased to 2mtr or as required at site condition if poles more than 11 Mts. are to be used.

i) At all the tapping points and dead end poles.

ii) At all the points as per REC construction dwg. No. A-10 (for the diversion angle of 10-60 degree) or better there of as per the instruction of Engineer in charge. The decision of Engineer in charge will be final.

iii) Both side poles at all the crossing for road, Nallaha railway crossings etc.

iv) Where Rail poles, Joist poles, double pole and four pole structures are to be erected.

6.0. Earthing of Support

6.0.1 Each pole shall be earthed with coil type earthing as per REC Construction Standard J-1.

6.0.2 All DP & Four pole structures & the poles on both sides of railway crossing shall be earthed by providing two nos. pipe earthing as per Drawing provided by SOUTHCO.

6.0.3 Each tower/structures should be earthed by providing 2.5 mts. 50x6 GI flat and 40 x 3000 mm heavy gauge ISI mark earthing pipe. The top of the earthing pipe should remain 600 mm below ground level. All railway X-ing locations two nos. earthing should be provided. In case the required footing resistance is not achieved on measurement, counterpoise earthing has to be provided as per the standard.

6.0.3 (A) EARHTING COIL

TECHNICAL SPECIFICATION

I. Qualification Criteria of Manufacturer:-
The prospective bidder may source Earthing Coil from manufacturers who must qualify all the following requirements:

a) The manufacturer must have successfully carried out Type Test of similar item from any NABL Accredited Laboratory within the last 5 years, prior to the date of submission of the bid.

II. SCOPE

The specification covers design, manufacture, testing and dispatch to the owner’s stores of Earthing Coils for use in earthing of the HT & LT poles.

III. GENERAL REQUIREMENTS

Earthing coils shall be fabricated from soft GI Wire Hot Dip Galvanized. The Hot Dip galvanized wire shall have clean surface and shall be free from paint enamel or any other poor conducting material. The coil shall be made as per REC constructions standard.


IV. TESTS

Galvanizing Tests
Minimum Mass of Zinc
On GI Wire used 280 cm/m²
After Coiling-266 gm/m². The certificate from recognized laboratory shall be submitted towards mas of zinc.

Dip Test
Dip test shall stand 3 dips of 1 minute and one dip of ½ minute before coiling and 4 dips of 1 minute after coiling as per IS: 4826/1979

Adhesion Test
As per ISS 4826 – 1979.

V. DIMENSIONAL REQUIREMENT

Nominal dia of GI Wire -4 mm (Tolerance±2.5%)
Minimum no. of turns – 115 Nos.
External dia of Coil (Min) – 50 mm
Length of Coil (Min) – 460 mm
Free length of GI Wire at one end coil (Min.) – 2500 mm
The turns should be closely bound. Weight of one finished Earthing Coils (min.) – 1.850 Kg.

6.0.3(B) EARTHING COIL

GUARANTEED TECHNICAL PARTICULARS

(To be submitted along with Offer)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>GENERAL TECHNICAL PARTICULARS</th>
<th>Bidder’s Offer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nominal diameter of wire</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>No. of turns</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>External dia of Coil</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Length of Coil</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Mass of Zinc</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Total weight of Coil</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Whether drawing enclosed (yes)</td>
<td></td>
</tr>
</tbody>
</table>

6.0.4 EXTENSION POLE

Pole with pole extension arrangement up to two to three meters (in case of 33 KV new Mini base GI tower structure) shall be used at low ground level locations for maintaining ground clearance and for road crossings for HT Lines.

7.0 PROVISION OF GUYS/STRUT POLES TO SUPPORTS

7.0.1 The arrangement for guys shall be made wherever necessary. Strut poles/flying guys wherever required shall be installed on various pole locations as per REC construction standards. In order to avoid guys/ Strut self supported GI poles/ structures may be used.

7.0.2 In this work anchor type guy sets are to be used. These guys shall be provided at following locations where guys are damaged or not provided.

(i) Angle locations
(ii) Dead end locations
(iii) T-off points
(iv) Steep gradient locations.
(v) Double Pole, & four pole
The stay rod should be placed in a position so that the angle of rod with the vertical face of the pit is $30^0$ to $45^0$ as the case may be maximum movement for tightening or loosening.

7.0.3 If the guy wire proves to be hazardous, it should be protected with suitable asbestos pipe filled with concrete of about 2 m length above the ground level, painted with white and black strips so that, it may be visible at night.

7.0.4 The guy insulator should have a minimum vertical clearance of 3.5 mtr from the ground.

7.0.4 (A) 
HT STAY SETS

TECHNICAL SPECIFICATION

I. Qualification Criteria of Manufacturer:

The prospective bidder may source Stay Sets from manufacturers only must qualify all the following requirements:

a) Manufacturer must have successfully carried out Type Test of similar item from any NABL Accredited Laboratory within the last 5 years, prior to the date of submission of the bid.

II. SCOPE

This specification covers design, manufacture, testing and dispatch of HT stay sets 20 mm dia.

III. GENERAL REQUIREMENTS

20 mm Dia Stays Sets for 33 KV, 11 KV Lines (Galvanized) HT Stay Set

The Stay Set (Line Guy Set) will consist of the following components:

**Anchor Rod with one Washer and Nut**

Overall length of Rod should be 1800mm to be made out of 20 mm dia GI rod one end threaded up to 40 mm length with a pitch of threads per cm. And provided with one square G.I Washer of Size 50x50x1.6mm and one GI Hexagonal nut conforming to IS: 1363:1967 & IS:1367:1967. Both washer and nut to suit the threaded rod of 20mm. The other end of the rod to be made into a round eye having an inner dia of 40mm with best quality of welding. Dimensional and other details are indicated and submitted by bidders for owner’s approval before start of manufacturing.
Anchor Plate Size 300 x 300 x 8 mm

To be made out of G.S. Plate of 8 mm thickness. The anchor plate to have at its centre 22mm dia hole.

Turn Buckle, Eye Bolt with 2 Nuts.

To be made of 20 mm dia G.I Rod having an overall length of 450 mm. One end of the rod to be threaded up to 300 mm length with a pitch of 4 threads per cm. The 20 mm dia bolt so made shall be provided with two G.I Hexagonal nuts of suitable size conforming to IS: 1363:1967 & IS: 1367:1967. The other end of the rod shall be rounded into a circular eye of 40 mm inner dia with proper and good quality of welding. Welding details are to be indicated by the bidder separately for approval.

Bow with Welded Channel:

To be made out of 16mm dia G.I Rod. The finished bow shall have an overall length of 995 mm and height of 450 mm. The apex or top of the bow shall be bent at an angle of 10R. The other end shall be welded with proper and good quality welding to a G.I Channel 200 mm long having a dimension of 100x50x4.7 mm. The Channel shall have 2 holes of 18 mm dia and 22 dia hole at its centre as per drawing No.3 enclosed herewith.

Thimble 2 Nos.

To be made of 1.5 mm thick G.I sheet into a size of 75x22x40mm and shape as per standard.

Galvanizing

The complete assembly shall be hot dip galvanized.

Welding

The minimum strength of welding provided on various components of 16mm and 20 mm dia stay sets shall be 3100 kg & 4900 kg respectively. Minimum 6mm filet weld or its equivalent weld area should be deposited in all positions of the job i.e. at any point of the weld length. The welding shall be conforming to relevant IS: 823/1964 or its latest amendment.

Threading

The threads on the Anchor Rods, Eye Bolts and Nuts shall be as per specification IS: 4218:1967 (ISO Metric Screw Threads). The Nuts shall be conforming to the requirements of IS: 1367:1967 and have dimension as per IS 1363:1967. The mechanical property requirement
of fasteners shall confirm to the properly clause 4.6 each for anchor rods and Eye bolt and property clause 4 for nuts as per IS: 1367:1967.
Average weight of finished 20 mm Stays Set: 14.523 Kg.(Min) (Excluding Nuts Thimble & Washer) :15.569 Kg.(Max.)

IV. TESTS

The contractor shall be required to conduct testing of materials at Govt./Recognized testing laboratory during pre-dispatch inspection for Tensile Load of 3100 Kg/4900Kg. applied for one minute on the welding and maintained for one minute for 16 mm and 20mm dia stay sets respectively.

V. IDENTIFICATION MARK

All stay sets should carry the identification mark of the Purchaser (SOUTHCO) applicable. This should be engraved on the body of stay rods to ensure proper identification of the materials. The nuts should be of a size compatible with threaded portion of rods and there should not be play or slippage of nuts. Welding wherever required should be perfect and should not give way after erection.

VI. TOLERANCES

The tolerances for various components of the stay sets are indicated below subject to the condition that the average weight of finished stay sets of 16mm dia excluding nuts, thimbles and washers shall not be less than the weight specified above:

B) HT STAY SET
GURANTEED TECHNICAL PARTICULARS
(To be submitted along with Offer)

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Item Description</th>
<th>Specified Parameters</th>
<th>Bidder’s Offer</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Section Tolerances</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fabrication Tolerances</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Material</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Anchor Plate</td>
<td>8mm thick+2.5%-5%</td>
<td>GI Plate 8 mm thick</td>
</tr>
<tr>
<td></td>
<td></td>
<td>300x300mm+1%</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Anchor Rod</td>
<td>20mm dia +3%-2%</td>
<td>GI Round 20mm dia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Length 1800mm</td>
<td>GI Round</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+0.5% Round Eye</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>40mm inside dia +</td>
<td></td>
</tr>
</tbody>
</table>
### TECHNICAL SPECIFICATIONS

#### I. Qualification Criteria of Manufacturer:

The prospective bidder may source Stay Wire from manufacturers only who must qualify all the following requirements:

- **a)** The manufacturer must have successfully carried out Type Test of similar item from any NABL Accredited Laboratory within the last 5 years, prior to the date of submission of the bid.
II. Application Standards

Except when they conflict with the specific requirements of this specification, the G.I Stay Stranded Wires shall comply with the specific requirements of IS: 2141-1979, IS: 4826-1979 & IS: 6594-1974 or the latest versions thereof.

III. Application and Sizes

The G.I. stranded wires covered in this Specification are intended for use on the overhead power line poles, distribution transformer structures etc.

The G.I stranded wires shall be of 7/8SWG7/4 mm for 33 kv lines, 7/10SWG (7/3.15 mm for 11KV lines and 7/12 SWG 7/2.5 mm for LT lines standard sizes.

IV. Materials

The wires shall be drawn from steel made by the open hearth basic oxygen or electric furnace process and of such quality that when drawn to the size of wire specified and coated with zinc, the finished strand and the individual wires shall be of uniform quality and have the properties and characteristics as specified in this specification. The wires shall not contain sulphur and phosphorus exceeding 0.060% each.

Tensile Grade

The wires shall be of tensile grade 4, having minimum tensile strength of 700 N/mm² conforming to 1S:2141.

General Requirements

The outer wire of strands shall have a right-hand lay.
The lay length of wire strands shall be 12 to 18 times the strand diameter.

Minimum Breaking Load

The minimum breaking load of the wires before and after stranding shall be as follows:

<table>
<thead>
<tr>
<th>No. of Wires &amp; Const.</th>
<th>Wire Dia (mm)</th>
<th>Min. breaking load of the Single wire before stranding (KN)</th>
<th>Min. breaking load of the standard wire (KN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 (6/1)</td>
<td>2.5</td>
<td>3.44</td>
<td>21.40</td>
</tr>
<tr>
<td>7 (6/1)</td>
<td>3.15</td>
<td>5.46</td>
<td>34.00</td>
</tr>
<tr>
<td>7 (6/1)</td>
<td>4.0</td>
<td>8.80</td>
<td>54.9</td>
</tr>
</tbody>
</table>
V.  Construction

The galvanized stay wire shall be of 7-wire construction. The wires shall be so stranded together that when an evenly distributed pull is applied at the ends of completed strand, each wire shall take an equal share of the pull. Joints are permitted in the individual wires during stranding but such joints shall not be less than 15 meters apart in the finished strands. The wire shall be circular and free from scale, irregularities, imperfection, flaws, splits and other defects.

VI.  Tolerances

A tolerance of (+) 2.5% on the diameter of wires before stranding shall be permitted.

VII.  Sampling Criteria

The sampling criteria shall be in accordance with IS: 2141.

VIII. Tests on Wires before Manufacture

The wires shall be subjected to the following tests in accordance with IS: 2141. Ductility Test Tolerance on Wire Diameter

Tests on Completed Strand

The completed strand shall be tested for the following tests in accordance with IS:2141. Tensile and Elongation Test: The percentage elongation of the stranded wire shall not be less than 6%.

Chemical analysis Galvanizing Test

The Zinc Coating shall conform to "Heavy Coating" as laid down in IS:4826

IX.  Marking

Each coil shall carry a metallic tag, securely attached to the inner part of the coil bearing the following information:
   a)  Manufacturers name or trade mark
   b)  Size
   c)  Tensile Designation
   d)  Length
   e)  Mass
   f)  ISI certification mark, if any

X.  Packing
The wires shall be supplied in 75-100 Kg. coils. The packing should be done in accordance with the provisions of IS:6594

XI. Other Items:

For remaining items of stay sets mentioned in the enclosed drawing, relevant applicable Indian standards shall be applicable.

(D) STAY WIRE (7/10 SWG) (7/10 SWG) & (7/12 SWG)

GURANTEED TECHNICAL PARTICULARS
(To be submitted along with offer)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>GENERAL TECHNICAL PARTICULARS</th>
<th>7/08 SWG</th>
<th>7/10 SWG</th>
<th>7/12 SWG</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nominal diameter of wire</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Tolerance in diameter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Sectional Area (In Sq. mm.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Tensile strength</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Min. N/mm²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Max. N/mm²</td>
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<td></td>
<td></td>
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<tr>
<td>5</td>
<td>Minimum breaking load (KN)</td>
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<tr>
<td>6</td>
<td>Type of coating Heavy/Medium/Light</td>
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<tr>
<td>7</td>
<td>Variety Hard/Soft</td>
<td></td>
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<tr>
<td>8</td>
<td>Weight of Zinc coating (Gms/Sq. Mtr.) Min.</td>
<td></td>
<td></td>
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<tr>
<td>9</td>
<td>No. of dips the coating is able to withstand as 18 ± 20°C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Adhesion Test (Wrap Test at 1 turn per second coiling while stress not exceeding % nominal tensile strength)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Min. complete turn of wrap</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Dia of mandrel on which wrapped</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Bend Test</td>
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</tr>
<tr>
<td>A</td>
<td>Angle</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>B</td>
<td>Dia round a format to be bent</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Freedom from defect</td>
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<tr>
<td>13</td>
<td>Chemical composition the MS Wire used shall not exceed</td>
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</tr>
<tr>
<td>A</td>
<td>Sulphur 0.060%</td>
<td></td>
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</tr>
<tr>
<td>B</td>
<td>Phosphorous 0.065%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
GI WIRE 6 SWG & GI WIRE 8 SWG

TECHNICAL SPECIFICATIONS

I. Qualification Criteria of Manufacturer:-

The prospective bidder may source GI Wire from manufacturers only who must qualify all the following requirements:
a) The manufacturer must have successfully carried out Type Test of similar item from any NABL Accredited Laboratory within the last 5 years, prior to the date of submission of the bid.

II. SCOPE

This specification covers manufacture, testing and supply of hot dip galvanized MS solid wire of sizes 6 SWG (5 MM) & 8 SWG (4 MM) diameters.

III. APPLICABLE STANDARDS

ZINC
Zinc shall conform to grade Zen 98 specified in IS 209 & IS: 4826-1979 with up to date amendments.

ZINC COATING
Zinc coating shall be in accordance with IS: 4826-1979 for heavily coated hard quality.

GALVANISING
Galvanizing shall be as per IS: 2629-1966, IS 4826-1979 with up to date amendments

UNIFORMITY OF ZINC COATING
Uniformity of zinc coating shall be as per IS: 2633-1972 with up to date amendments

TENSILE PROPERTIES
The tensile strength of the wire after galvanizing shall be between 55-95 Kg/sq.mm ensuring MS wire mechanical properties as per IS-28:1972 8.1 to 8.3.

FREEDOM FROM DEFECTS
As per IS: 2629-1966 & 4826-1979 & with up to date amendments be ensured

IV. MATERIAL

The mild steel wire shall have chemical composition maximum sulphur- 0.055%, phosphorous -0.055%, Carbon 0.25%.
V. TESTS

During the process of manufacturer/fabrication and all tests for chemical, mechanical, galvanizing as per IS- 280-1979, IS1521-1972, IS-1755-1961, IS: 6745-1972 & 4826-1979 shall be carried out. The certificate towards, chemical composition shall be submitted for each lot offered for inspection.

The following tests shall be conducted in presence of the representative of the purchaser:

- Visual physical inspection and measurement of specified dimension
- Tensile strength and breaking load and elongation determined as per IS: 1521-1972 with up to date amendments

VI. PACKING & MARKING

Packing shall be as per IS: 280-1979 and each coil shall be between 50-100 kg. marking shall be as per IS:280-1972.

(F) GI WIRE 6 SWG & GI WIRE 8 SWG

GUARANTEED TECHNICAL PARTICULARS
(To be submitted along with offer)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>GENERAL TECHNICAL PARTICULARS</th>
<th>6 SWG</th>
<th>8 SWG</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td></td>
</tr>
<tr>
<td>2</td>
<td>Tolerance in diameter</td>
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<td></td>
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<tr>
<td>3</td>
<td>Sectional Area (In Sq. mm.)</td>
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<tr>
<td>4</td>
<td>Tensile strength</td>
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<td>A</td>
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<tr>
<td>B</td>
<td>Max. N/mm²</td>
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<td></td>
</tr>
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<td>5</td>
<td>Minimum breaking load (KN)</td>
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<td>6</td>
<td>Type of coating Heavy/Medium/Light</td>
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<td>Adhesion Test (Wrap Test at 1 turn per second coiling while stress not exceeding % nominal tensile strength)</td>
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<td>B</td>
<td>Dia of mandrel on which wrapped</td>
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</tr>
<tr>
<td>11</td>
<td>Bend Test</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
EYE BOLT FOR GUARDING

TECHNICAL SPECIFICATIONS

GENERAL REQUIREMENTS:

M20 eye bolts (120 mm long) shall preferably be of drop forged manufacture and shall be supplied complete with full thread and two full nuts.

Eye bolt shall be manufactured from steel to ISO 272, 885, 888, 4759/1 and shall meet the requirements for mechanical properties detailed in ISO 272, 885, 888, 4759/1.

Where a welding process is used in manufacture, each eye bolt shall be individually proof tested by the manufacture in accordance with ISO 272, 885, 888, 4759/1 to 125% of its safe working tensile load that is to 48kN. The safe working tensile load shall be the ultimate axial tensile strength divided by the factor of safety of 2.5.

The eye shall be permanently and legibly stamped with the letter METRIC in letters not less than 3mm high. The safe working load of any eye bolt is that load which may be safely carried in an axial direction. If loaded in any other direction the safe working load is reduced and reference shall be made to the following table for safe working load of M20 eye bolts and eye nuts.

ALUMINIUM BINDING WIRE

TECHNICAL SPECIFICATION

SCOPE:

Scope covers manufacture, testing and supply of 3.53 mm dia Aluminium Binding Wire as per IS 398.

MATERIALS:

The material comprising the wire shall have the following chemical composition:
Aluminium 99.5% minimum Copper, silicon and iron 0.5% maximum

The surface of the wire shall be smooth and free from all irregularities and imperfections. Its cross sections shall closely approximate that of true circle.

**Characteristics of Aluminium Binding wire**

<table>
<thead>
<tr>
<th>Diameter of wire</th>
<th>Cross sectional area of nominal dia. Wires (mm)</th>
<th>Weight of wire kg/km</th>
<th>Breaking Load (kN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>Nominal</td>
<td>Maximum</td>
<td></td>
</tr>
<tr>
<td>3.15</td>
<td>3.53</td>
<td>3.55</td>
<td>9.787</td>
</tr>
</tbody>
</table>

**Inspection and Tests**

The following routine checks and tests shall be carried out on 10% of the coils of aluminium binding wire. If anyone sample fails to pass any one of the test nominated for that wire, then samples shall be taken from every coil in the consignment and any coil from which a sample proves defective shall be rejected. On no account shall any rejected material be presented for test again unless with the written approval of, and under conditions determined by the Purchaser.

**Physical properties**

The surface of the finished wires shall be checked to ensure that it is smooth, free from all irregularities, imperfections and inclusions and that its cross section approximates closely that of true circle.

The wire shall be checked to ensure that its diameter and weight are within the values given in the table above characteristic of a aluminium binding wire.

**Ultimate tensile strength**

When tested on a standard tensile testing machine, the value obtained for the ultimate tensile stress shall not be less than 1.57kN

**Wrapping test**

The wire shall withstand one cycle of a wrapping test as follows:

The wire shall be closely wrapped round a wire of its own diameter form a close helix of eight turns. Six turns shall then be unwrapped and again closely rewrapped in the same direction as the first wrapping. The wire shall not break or crack when subjected to this test.

**Packing & Delivery**
The aluminium binding wire shall be delivered in 30m coils, with a permitted tolerance of +5%. Random or non standard lengths shall not be permitted.

Each coil shall be adequately guarded against damage due to transportation and handling and shall have an outer layer of tightly wound polythene tape or be contained in a suitable, transparent plastic bag.

The internal diameter of the wound coil shall not be such as to result in a permanent set in the conductor.

The coils shall be contained in non returnable wooden cases, with a gross weight not in excess of 300 kg. The number of coils contained shall be marked on the outside of each case.

(I)

ALUMINIUM BINDING WIRE
GUARANTEED TECHNICAL PARTICULARS

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Bidder’s Offer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Manufacturer Address</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Indian Standard No. IS 398 (Part-4) 1994</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Material of Binding Wire</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Dia. Of Wire</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Maximum D.C. resistance at 20 degree centigrade</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Individual Aluminium Alloy Strands</td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>Tensile breaking stress</td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td>Elongation on 200 mm length in breaking</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Particulars of Raw Materials</td>
<td></td>
</tr>
<tr>
<td>7.1</td>
<td>Aluminium</td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>Minimum Purity of aluminium</td>
<td></td>
</tr>
<tr>
<td>7.2</td>
<td>Aluminium Alloy</td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>Aluminium redraw rod conforming to Elements</td>
<td></td>
</tr>
<tr>
<td>(a) Si</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b) Cu</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(c) Other Element (If any)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Linear mass of Wire</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Modulus of Elasticity</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Coefficient of Linear Expansion (per deg. Cent.)</td>
<td></td>
</tr>
</tbody>
</table>

J. 33 KV, 11 KV “V” CROSS ARM, BACK CLAMP FOR “V” CROSS ARM & POLE TOP BRACKET (F CLAMP)
TECHNICAL SPECIFICATIONS

8.0 CROSS ARMS

Cross Arms should be made by using 100x50x6 mm MS channel for both 33 KV & 11 KV systems. In tower type poles (GI) all the X-arms are part of the structure.

8.0.1 MATERIALS:

a) MS Cross arms and Pole Top Brackets for both 33 KV & 11kV construction at intermediate and light angle pole shall be fabricated from grade 43A mild steel of channel section and for heavy angle poles, end poles and section poles fabricated from grade 43A mild steel of angle section. The grades of structural steel shall conform to IS – 226: 1975.

b) The 33 KV & 11 KV ‘V’ Cross arm shall be made out of 100x 50x5.6. mm MS Channel of (9.56 kg/mtr weight).

The Back Clamp for both 33 KV & 11 KV shall be made out of 75 x 10 MS Flat and shall be suitably designed to fit PSC Pole 9 Mtr x 300 Kg, 8 Mtr x 200 Kg and 9 mtrx415kg

c) The Pole Top Bracket (F Clamp) shall be made out of 75 x 10 MS Flat suitably designed to fit PSC Pole 9 Mtr x 300 Kg, 10X Mtr x 425 Kg, & 9 mtrx415 kg for both 33 KV & 11 KV.

Except where otherwise indicated all dimensions are subject to the following tolerances:

Dimensions up to and including 50mm: +1mm: and dimensions greater than 50mm: +2%

All steel members and other parts of fabricated material as delivered shall be free of warps, local deformation, unauthorized splices, or unauthorized bends. Bending of flat strap shall be carried out cold. Straightening shall be carried out by pressure and not by hammering.

Straightness is of particular importance if the alignment of bolt holes along a member is referred to its edges.

Holes and other provisions for field assembly shall be properly marked and cross referenced. Where required, either by notations on the drawing or by the necessity of proper identification and fittings for field assembly, the connection shall be match marked. A tolerance of not more than 1mm shall be permitted in the distance between the center lines of bolt holes.

The holes may be either drilled or punched and, unless otherwise stated, shall be not more than 2mm greater in diameter than the bolts. When assembling the components force may be used to bring the bolt holes together (provided neither members nor holes are thereby distorted) but all force must be removed before the bolt is inserted. Otherwise strain shall be
deemed to be present and the structure may be rejected even though it may be, in all other respects, in conformity with the specification.

The back of the inner angle irons of lap joints shall be chamfered and the ends of the members cut where necessary and such other measures taken as will ensure that all members can be bolted together without strain or distortion. Similar parts shall be interchangeable.

Shapes and plates shall be fabricated and assembled in the shop to the greatest extent practicable. Shearing, flame cutting and chipping shall be done carefully, neatly and accurately. Holes shall be cut, drilled or punched at right angles to the surface and shall not be made or enlarged by burning. Holes shall be clean-cut without torn or ragged edges, and burrs resulting from drilling or reaming operations shall be removed with the proper tool.

Shapes and plates shall be fabricated to the tolerance that will permit field erection within tolerance, except as otherwise specified. All fabrication shall be carried out in a neat and workmanlike manner so as to facilitate cleaning, painting and inspection and to avoid areas in which water and other matter can lodge.

Contact surfaces at all connections shall be free of loose scale, dirt, burrs, oil and other foreign materials that might prevent solid seating of the parts.

8.0.2 Fabrication has to be made as per drg. of ‘V’ X-arm, Back clamp & ‘F’ clamp.

8.0.3 33 KV & 11 KV V CROSS ARM

GURANTEED TECHNICAL PARTICULARS
(To be submitted along with offer)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Unit</th>
<th>Bidder’s offer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>33 Kv   11 Kv</td>
</tr>
<tr>
<td>1</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Grade of steel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Steel standard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Fabrication Standard</td>
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</tr>
<tr>
<td>5</td>
<td>Dimensions</td>
<td>Mm</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Steel section utilized</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Steel tensile strength</td>
<td>N/cm²</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Working load</td>
<td>Kg</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Weight of cross arm</td>
<td>kg</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Whether drawing has been submitted with the bid</td>
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<td></td>
</tr>
</tbody>
</table>
8.0.4 POLE TOP BRACKETS (F CLAMP)
GURANTEED TECHNICAL PARTICULARS
(To be submitted along with offer)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description Unit</th>
<th>Bidder’s offer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Type of crossarm</td>
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<tr>
<td>2</td>
<td>Grade of steel</td>
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<td>3</td>
<td>Steel standard</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Fabrication Standard</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Dimensions</td>
<td>Mm</td>
</tr>
<tr>
<td>6</td>
<td>Steel section utilized</td>
<td></td>
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<tr>
<td>7</td>
<td>Steel tensile strength</td>
<td>N/cm²</td>
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<tr>
<td>8</td>
<td>Working load</td>
<td>Kg</td>
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<tr>
<td>9</td>
<td>Weight of cross arm</td>
<td>kg</td>
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<tr>
<td>10</td>
<td>Whether drawing has been submitted with the bid</td>
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</tbody>
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8.0.5 BACK CLAMP FOR “V” CROSS ARM
GURANTEED TECHNICAL PARTICULARS
(To be submitted along with offer)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description Unit</th>
<th>Bidder’s offer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Type of Clamp</td>
<td>33 Kv, 11 Kv</td>
</tr>
<tr>
<td>2</td>
<td>Grade of steel</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Steel standard</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Fabrication Standard</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Dimensions</td>
<td>Mm</td>
</tr>
<tr>
<td>6</td>
<td>Steel section utilized</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Steel tensile strength</td>
<td>N/cm²</td>
</tr>
<tr>
<td>8</td>
<td>Working load</td>
<td>Kg</td>
</tr>
<tr>
<td>9</td>
<td>Weight of back clamp</td>
<td>kg</td>
</tr>
<tr>
<td>10</td>
<td>Whether drawing has been submitted with the bid</td>
<td></td>
</tr>
</tbody>
</table>

8.0.6 Fixing of Cross Arms
After the erection of supports and providing guys, the cross-arms are to be mounted on the support with necessary clamps, bolts and nuts. The practice of fixing the cross arms before the pole erection should be followed.

9.0 INSTALLATION OF LINE MATERIALS

9.0.1 Insulator and Bindings - These materials are to be procured from the approved vendors only after design approval of SOUTHCO

1. Suspension type H/W fittings (Single suspension normally to be used and in important X-ings double suspension fittings to be used) in all tangent locations. In S/S fittings 3 nos. 45 KN normal disc insulators, D/S fittings 6 nos. 45 KN normal disc insulators to be used in 33 KV line. In case of 11 KV line 2 nos & 4 nos 45 KN B&S normal insulators are to be used.

2. In angle locations single tension fittings to be used with 4 nos. 70 KN disc insulators. In all road X-ings and other important X-ings Double Tension H/W fittings 8 nos. 70 KN disc insulators to be used in case of 33 KV line & in 11 KV line it should be 45 KN insulators 2 nos. & 4 nos. are to be used.

3. Suitable pre formed armoured rods should be used in all suspension fittings in case of higher size Conductors.

4. Guarding / pilot insulators at the sharp angle points has to be provided.

5. Four pair bolted type (suitable for M-16 bolts) tension fittings for AAA conductors and compression type tension fittings for ACSR conductors has to be used.

6. The “distribution tie “ meant for pin insulator binding should be of no. 6 size and that of soft annealed wire having a minimum length of 3 mtr.

7. Compression type jointing sleeves should be used for jointing of conductors only.

9.0.2 Checking of Suspension Fitting

a) It shall be checked that there is no damage to any component of hardware fittings.

b) It shall be verified that all nuts and bolts are tightened properly.

c) It shall be made sure that all the necessary security pins (split pins) are fixed properly as per approved drawings.

9.0.3 Insulator hoisting
Insulators shall be completely cleaned with soft and clean cloth.

It shall be verified that there is no crack or any other damage to insulators.

It is very important to ensure that ‘R’ clips in insulator caps are fixed properly. This is a security measure to avoid disconnection of insulator discs.

Both Arcing horns (both at top & bottom) of each insulators string has to be provided.

Where change of insulators required, prior to fixing, all insulators shall be cleaned in a manner that will not spoil, injure or scratch surface of the insulator, but in no case shall any oil be used for that purpose.

Pin insulators shall be used on all poles in straight line and disc insulators on angle and dead end poles. Damaged insulators and fittings, if any, shall not be used. The insulator and its pin should be mechanically strong enough to withstand the resultant force due to combined effect of wind pressure and weight of the conductor in the span.

The pins for insulators shall be fixed in the holes provided in the cross-arms and the pole top brackets. The insulators shall be mounted in their places over the pins and tightened. In the case of strain or angle supports, where strain fittings are provided for this purpose, one strap of the strain fittings is placed over the cross-arm before placing the bolt in the hole of cross-arms. The nut of the straps shall be so tightened that the strap can move freely in horizontal direction.

All materials, which are to be supplied by the contractor should be procured from the approved Manufactures of SOUTHCO’s only. Procurement from any suppliers will not be permitted. All the related drawings of materials have to be approved by Project Manager. All the materials has to be tested in presence of authorized representative of Project Manager as well as officers of third party engaged by SOUTHCO if any also.

14.0.6 PIN INSULATORS

14.0.6.1 33 Kv Pin Insulators.-IS-731/77 (Porcelain Insulator for O/H power lines with nominal voltage greater than 1000 volts.

14.0.6.3 11 Kv Pin Insulators: - IS-731/77 (Porcelain Insulator for O/H power lines with nominal voltage greater than 1000 volts.


14.0.7 DISC –INSULATORS:

14.0.7.1 Insulator Strings

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Particulars</th>
<th>Single Suspension string</th>
<th>Double suspension string</th>
<th>Single Tension string</th>
<th>Double Tension string</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>No. of standard Discs (nos)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1)</td>
<td>33 KV</td>
<td>1X3</td>
<td>2X3</td>
<td>1X4</td>
<td>2X4</td>
</tr>
<tr>
<td>2)</td>
<td>11 kV</td>
<td>1X2</td>
<td>2X2</td>
<td>1X3</td>
<td>2X3</td>
</tr>
<tr>
<td>2.</td>
<td>Size of Disc (33 Kv/11 Kv)</td>
<td>255X145</td>
<td>255X145</td>
<td>280X170</td>
<td>280X170</td>
</tr>
</tbody>
</table>

All the above materials must conform to the schedules at C2 and C3

14.0.7.2 PORCELAIN GLAZE:

Surfaces to come in contact with cement shall be made rough by stand glazing. All other exposed surfaces shall be glazed with ceramic materials having the same temperature coefficient of expansion as that of the insulator shell. The thickness of the glaze shall be uniform throughout and the colour of the glaze shall be brown. The glaze shall have a visible luster and smooth on surface and be capable of satisfactory performance under extreme tropical climatic weather conditions and prevent ageing of the porcelain. The glaze shall remain under compression on the porcelain body throughout the working temperature range.

14.0.7.3 METAL PARTS:

Cap and Ball pins:

Twin Ball pins shall be made with drop forged steel and caps with malleable cast iron. They shall be in one single piece and duly hot dip g galvanized. They shall not contain parts or pieces joined together, welded, shrink fitted or by any other process from more than one piece.
of material. The pins shall be of high tensile steel, drop forged and heat malleable cast iron and annealed. Galvanizing shall be by the hot dip process with a heavy coating of zinc of very high purity with minimum of 6 dips. The bidder shall specify the grade, composition and mechanical properties of steel used for caps and pins.

14.0.7.4 SECURITY CLIPS:

The security clips shall be made of phosphor bronze or of stainless steel.

14.0.7.5 FILLER MATERIAL:

Cement to be used as a filler material shall be quick setting, for curing Portland cement. It shall not cause fracture by expansion or loosening by contraction. Cement shall not react chemically with metal parts in contact with it and its thickness shall be as small and as uniform as possible.

14.0.7.6 MATERIAL DESIGN AND WORKMANSHIP:

i) All raw materials to be used in the manufacture of these insulators shall be subject to strict raw materials quality control and to stage testing quality control during manufacturing stage to ensure the quality of the final end product. Manufacturing shall conform to the best engineering practices adopted in the field of extra high voltage transmission. Bidders shall therefore offer insulators as are guaranteed by them for satisfactory performance on Transmission lines.

ii) The design, manufacturing process and material control at various stages be such as to give maximum working load, highest mobility, best resistance to corrosion, good finish, elimination of sharp edges and corners to limit corona and radio interference voltage

14.0.7.7 INSULATOR SHELL:

The design of the insulator shell shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration. Shells with cracks shall be eliminated
by temperature cycle test followed by temperature cycle test followed by mallet test. Shells shall be dried under controlled conditions of humidity and temperature.

14.0.7.8 METAL PARTS:

a) The twin ball pin and cap shall be designed to transmit the mechanical stresses to the shell by compression and develop uniform mechanical strength in the insulator. The cap shall be circular with the inner and outer surfaces concentric and of such design that it will not yield or distort under loaded conditions. The head portion of the insulator or is under tension the stresses are uniformly distributed over the pinhole portion of the shell. The pinball shall move freely in the cap socket either during assembly of a string or during erection of a string or when a string is placed in position.

b) Metal caps shall be free from cracks, seams, shrinks, air holes, blowholes and rough edges. All metal surfaces shall be perfectly smooth with no projecting parts or irregularities which may cause corona. All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly. Pins shall not show any macroscopically visible cracks, insulations and voids.

14.0.7.9 GALVANIZING:

All ferrous parts shall be hot dip galvanized six times in accordance with IS: 2629. The zinc to be used for galvanizing shall conform to grade Zn 99.5 as per IS: 209. The zinc coating shall be uniform, smoothly adherent, reasonably light, continuous and free from impurities such as flux ash, rust stains, bulky white deposits and blisters. Before ball fittings are galvanized, all die flashing on the shank and on the bearing surface of the ball shall be carefully removed without reducing the designed dimensional requirements.

14.0.7.10 CEMENTING:

The insulator design shall be such that the insulating medium shall not directly engage with hard metal. The surfaces of porcelain and coated with resilient paint to offset the effect of difference in thermal expansions of these materials.

14.0.7.10 (a) Specific Requirement for Insulators
The insulators shall confirm in the following specific conditions of respective IS given in the table below.

<table>
<thead>
<tr>
<th>Insulator</th>
<th>Designation</th>
<th>Minimum mechanical failing load</th>
<th>Minimum Creepage distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 KV Pin</td>
<td>Type-B of IS731</td>
<td>10 KN</td>
<td>320 mm</td>
</tr>
<tr>
<td>33 KV Pin</td>
<td>Type-B of IS731</td>
<td>10 KN</td>
<td>580 mm</td>
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<tr>
<td>33KV/11KV Stay</td>
<td>Type-C of IS 1445</td>
<td>88 KN</td>
<td>57 mm</td>
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<tr>
<td>LT Stay</td>
<td>Type-C of IS 1445</td>
<td>44 KN</td>
<td>41 mm</td>
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</tbody>
</table>

14.0.7.11 SECURITY CLIPS (LOCKING DEVICES)

The security clips to be used as locking device for ball and socket coupling shall be ‘R’ shaped hump type to provide for positive locking of the coupling as per IS: 2486 (Part-IV). The legs of the security clips shall allow for sore adding after installation to prevent complete withdrawal from the socket. The locking device shall be resilient corrosion resistant and of sufficient mechanical strength. There shall be no possibility of the locking device to be displaced or be capable of rotation when placed in position and under no circumstances shall it allow separation of insulator units and fitting ‘W’ type security clips are also acceptable. The hole for the security clip shall be countersunk and the clip shall be of such design that the eye of the clip may be engaged by a hot line clip puller to provide for disengagement under energized conditions. The force required for pulling the clip into its unlocked position shall not be less than 50 N (5 Kgs.) or more than 500N (50 Kgs.)

DISC INSULATORS (B & S Type)
GURANTEED TECHNICAL PARTICULARS
(To be submitted along with offer)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>SOUTHCO’s Approved Standard</th>
<th>Bidder’s Offer</th>
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<td>1</td>
<td>Manufacturer’s name</td>
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</tr>
<tr>
<td>2</td>
<td>Address of manufacturer</td>
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</tr>
<tr>
<td>3</td>
<td>Location of type testing</td>
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</tr>
<tr>
<td>4</td>
<td>Applicable standard</td>
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</tr>
<tr>
<td>5</td>
<td>Type of insulator (Porcelain or toughened glass)</td>
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</tr>
<tr>
<td>No.</td>
<td>Description</td>
<td>SOUTHCO’s Approved Standard</td>
<td>Bidder’s Offer</td>
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<td>-----</td>
<td>-----------------------------------------------------------------------------</td>
<td>----------------------------</td>
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</tr>
<tr>
<td>6</td>
<td>Dry impulse withstand voltage</td>
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<td>7</td>
<td>Wet power frequency, 1 minute, withstand voltage</td>
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<td>8</td>
<td>Dry, Critical Impulse Flashover Voltage</td>
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</tr>
<tr>
<td>9</td>
<td>Dry, power frequency, Critical Flashover Voltage</td>
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<td></td>
</tr>
<tr>
<td>10</td>
<td>Wet, power frequency, Critical Flashover Voltage</td>
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<tr>
<td>11</td>
<td>Power frequency Puncture Voltage</td>
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<td>12</td>
<td>Mechanical Routine Test Load</td>
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<td>13</td>
<td>Mechanical Impact Strength</td>
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<td>14</td>
<td>Shattered Strength (Glass)</td>
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<td>15</td>
<td>Electromechanical Failing Load</td>
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<td>Safe Working Load</td>
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<td>17</td>
<td>Minimum Failing Load</td>
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<td>Protected Creepage Distance</td>
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<td>Type and Grade of Materials : Cap</td>
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<tr>
<td>22</td>
<td>Type and Grade of Materials : Pin</td>
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</tr>
<tr>
<td>23</td>
<td>Type and Grade of Materials : Locking Pin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Type and Grade of Materials : Cement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Type of semi conducting Glaze</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Colour of Insulator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Weight of Insulator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Number of Insulators per Crate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Gross Weight of Loaded Crate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Whether drawing showing dimensional details have been furnished along with Bid</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**33 KV, 11 KV PIN INSULATORS**

**GURANTEED TECHNICAL PARTICULARS**

*(To be submitted along with offer)*

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>SOUTHCO’s Approved Standard</th>
<th>Bidder’s Offer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Manufacturer’s name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Address of manufacturer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Location of type testing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Applicable standard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Type of insulator (Porcelain or toughened glass)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sl. No.</td>
<td>Description</td>
<td></td>
<td></td>
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<tr>
<td>--------</td>
<td>--------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Dry impulse withstand voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Wet power frequency, 1 minute, withstand voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Dry, Critical Impulse Flashover Voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Dry, power frequency, Critical Flashover Voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Wet, power frequency, Critical Flashover Voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Power frequency Puncture Voltage</td>
<td></td>
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<tr>
<td>12</td>
<td>Safe Working Load</td>
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<td></td>
</tr>
<tr>
<td>13</td>
<td>Minimum Failing Load</td>
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<td></td>
</tr>
<tr>
<td>14</td>
<td>Creepage Distance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Protected Creepage Distance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Type and Grade of Materials : Insulator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Type and Grade of Materials : Thimble</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Type and Grade of Materials : Cement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Type of semi conducting Glaze</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Radius of conductor Groove</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Colour of Insulator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Weight of Insulator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Number of Insulators per Crate</td>
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<tr>
<td>24</td>
<td>Gross Weight of Loaded Crate</td>
<td></td>
<td></td>
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<tr>
<td>25</td>
<td>Whether drawing showing dimensional details have been furnished along with Bid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Whether Type Test Certificate have been furnished</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Other particulars (if any)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**HT STAY INSULATOR & LT STAY INSULATORS**

**GUARANTEED TECHNICAL PARTICULARS**
(To be submitted along with offer)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>SOUTHCO’s Approved Standard</th>
<th>Bidder’s Offer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Manufacturer’s name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Address of manufacturer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Location of type testing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Applicable standard &amp; Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Type of insulator (Porcelain or toughened glass)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Dry impulse withstand voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Wet power frequency, 1 minute, withstand voltage</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### GURANTEED TECHNICAL PARTICULARS
(To be submitted along with offer)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Bidder’s Offer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>33 KV GI PIN</td>
</tr>
<tr>
<td>1</td>
<td>Manufacturer’s name Manufacturer’s name &amp; Address</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Standard applicable specification</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Minimum failing load</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Dimensions (mm)</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Total length</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Shank length</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Stalk length</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Type of threads</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Threads per Inch</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Type of galvanization of pin &amp; nuts</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Mass of zinc (minimum)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Applicable specification</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>No. of Nuts with each pin &amp; its size</td>
<td></td>
</tr>
</tbody>
</table>
Office of the Executive Engineer (Elect)  Construction Division  Jeypore

<table>
<thead>
<tr>
<th></th>
<th>11. No. of spring washer with each pin &amp; its size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12. Packing details</td>
</tr>
<tr>
<td>A</td>
<td>Type of packing</td>
</tr>
<tr>
<td>B</td>
<td>Weight of each pin approx. (with nut &amp; washers)</td>
</tr>
<tr>
<td>C</td>
<td>No. of Pins in each packing (Kg)</td>
</tr>
<tr>
<td></td>
<td>13. Tolerance in weight / dimensions, if any</td>
</tr>
<tr>
<td></td>
<td>14. I.S.I. Certificate License number</td>
</tr>
<tr>
<td></td>
<td>15. Any other relevant information the bidder would like to indicate</td>
</tr>
<tr>
<td></td>
<td>16. Manufacturer’s Trade mark with each GS Pins</td>
</tr>
<tr>
<td></td>
<td>17. Whether drawing has been submitted by the bidder</td>
</tr>
</tbody>
</table>

14.0.8 LONG ROD INSULATOR

33KV Long Rod Insulator in conformity to IS: 2486 , IEC:433 & IS:731 can be used preferably in Saline affected area. The technical requirements are as under:

- a. minimum nominal creapage distance: 850 mm
- b. Lightning impulse withstand voltage: 170KVp
- c. Wet Power Frequency withstand voltage: 75 KV
- d. Tensile load: 70KN

MILD STEEL CHANNEL & ANGLE

Clause No.

1.00.00 SCOPE

This specification covers design, manufacture, testing and dispatch to owner’s stores of M.S. Channel & Angle for use in structures in distribution system.

2.00.00 APPLICABLE STANDARD

Materials shall conform to the latest applicable Indian standards. In case bidders offer steel section and supports conforming to any other international specifications which shall be equivalent or better than IS, the same is also acceptable.

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Standard No.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IS: 2062 Grade ‘A’</td>
<td>Quality Specification for M.S.Angles, M.S.Channel</td>
</tr>
</tbody>
</table>
3.00.00 **GENERAL REQUIREMENTS**

3.01.00 **Raw material**

The Steel Sections shall be re-rolled from the BILLETS/INGOTS of tested quality as per latest version of IS: 2830 or to any equivalent International Standard and shall be arranged by the bidder from their own sources.

The Chemical composition and Physical properties of the finished material shall be as per the equivalent standards.

Chemical Composition and Physical Properties of M.S. Angles, M.S. Channels, and M.S. Flat conforming to IS: Conforming to IS: 2062/84

3.02.00 **Chemical Composition**

3.02.01 **Chemical composition For Fe 410 WA Grade**

1. C - 0.23% MAX  
2. Mn - 1.5% MAX  
3. S - 0.050% MAX  
4. P - 0.050% MAX  
5. SI - 0.40% MAX  

(Carbon Equivalent) - 0.42% MAX

3.04.00 **Mechanical Properties**

1. Tensile strength Kgf/mm² - 410  
2. Yield stress Min. for thickness/diameter  
   < 20 mm - 26 Kgf/mm² OR 250 N/ mm²  
   20-40 mm - 24 Kgf/mm² OR 240 N/ mm²  
   > 40 mm - 23 Kgf/mm² OR 230 N/ mm²  
3. Elongation % - 23%  
4. Bend Test (Internal Dia) - Min-3t  

(t—is the thickness of the material).
3.05.00 **Tolerance**

Variation in ordered quantity for any destination and overall ordered quantity be only to the extent of ±2%.

Rolling and weight tolerances shall be as per version of IS: 1852 or to any equivalent International Standard.

4.00.00 **TEST**

Steel Section shall be tested in IS approved Laboratory or Standard Laboratory the Bidder country having all facilities available for conducting all the test prescribed in relevant IS or IEC or to any equivalent International Standard or any recognized and reputable International Laboratory or Institutions.

The bidders are required to specifically indicate that;

- They hold valid IS (or equivalent IEC) License.
- Steel Section offered are bearing requisite IS certification or equivalent marks.

The bidders are required to submit a copy of the valid IS (or equivalent IEC) License clearly indicating size and range of product against respective ISS or any equivalent International Standards along with their offer.

5.00.00 **MARKING**

It is desirable that the bidder should put his identification marks on the finished material. The mark shall be in “legible English letter” given with marking dies of minimum 18 mm size.

6.00.00 **INSPECTION AND TEST CERTIFICATES**

The material to be supplied will be subject to inspection and approval by the purchaser’s representative before dispatch and/or on arrival at the destination. Inspection before dispatch shall not however, relieve the bidder of his responsibility to supply the Steel Sections strictly in accordance with the specification.

The purchaser’s representative shall be entitled at all reasonable time during manufacture to inspect, examine and test at the bidder’s premises the materials and workmanship of the steel section to be supplied.
As soon as the steel Section are ready for testing, the bidder shall intimate the purchaser well in advance, so that action may be taken for getting the material inspected. The material shall not be dispatched unless waiver of inspection is obtained or inspected by the purchaser’s authorized representative.

Test certificates shall be in accordance with latest version of the relevant Indian Standards or any equivalent International Standard.

The acceptance of any batch/lot shall in no way relieve the bidder of any of his responsibilities for meeting all the requirements of the specification and shall not prevent subsequent rejection of any item if the same is later found defective.

15.0 **FLEXIBLE COPPER BOND**

At suspension and tension towers, the earth wire suspension and tension clamps shall be securely bonded to the tower steelwork by means of a multi-strand flexible copper bond wire. The copper bond shall be sufficiently flexible to allow movement of the suspension clamp under all operating conditions and terminated with compression lugs.

The flexible copper bond shall be of nominal 34 sq.mm equivalent copper area and not less than 500 mm in length. It shall consist of 259 wires of 0.417 mm dia. tinned copper conductor. It shall be laid up as seven stranded ropes, each of 37 bunched wires. The tinning shall be as per IS 9567. Two tinned copper connecting lugs shall be press jointed to either ends of the flexible copper cable. One lug shall be suitable for 12 mm dia. bolt and the other for 16 mm dia. bolt. The complete assembly shall also include one 16 mm dia., 40 mm long mild steel bolt hot dip galvanized with nut and lock washers.

16.0 **TRANSMISSION TOWERS**

16.0.1 Types of Towers

The towers shall normally be of the following standard types, and as stated in Schedule C-1.

<table>
<thead>
<tr>
<th>Type of Tower</th>
<th>Deviation Limit</th>
<th>Typical Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>OA/PA</td>
<td>0deg- 2deg</td>
<td>To be used as tangent tower with suspension strings</td>
</tr>
</tbody>
</table>
Note: The above towers can also be used for longer span with smaller angle of deviations. (To be decided as per the tower spotting data to be submitted by the Contractor and approved by Project Manager.)

16.0.2 The towers shall be of the self-supporting type, built up of lattice steel sections or members and designed to carry the power conductors with necessary insulators. Outline diagrams of the towers required are to be furnished by the Bidder.

16.0.3 The towers shall be fully galvanized structures built up of structural mild steel sections. All members shall be connected with bolts, nuts and spring washers.

16.0.4 TOWER HEIGHT
However, for calculating the tower height, an allowance of 150mm shall be provided, over and above the specified ground clearances, at still air and maximum conductor temperature, to account for any stringing error.

<table>
<thead>
<tr>
<th>Situation</th>
<th>Minimum clearance (metres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>System voltage (kV):</td>
<td>33</td>
</tr>
<tr>
<td>Normal ground (open country) 85 deg.</td>
<td>6.10</td>
</tr>
<tr>
<td>*Road crossings, road level 85 deg</td>
<td>8.50</td>
</tr>
<tr>
<td>(Also in Urban Areas)</td>
<td></td>
</tr>
</tbody>
</table>

*Any road which is normally maintained by Government and/or other recognized public authority.

16.0.5 STUBS AND SUPERSTRUCTURES:

(i) The stub shall mean a set of four stub angles forming the foundation level steel section fully galvanized and shall include cleats, gussets, bolts and nuts, etc. The stub being cast in foundation footings. Stub length shall correspond to foundation depth of 3-0 metres from ground level.
(ii) Superstructure shall mean the galvanized tower assembly above the stubs which includes structural members like angle sections, cross arms, ground wire peaks, accessories and fittings such as gusset plates, pack washers, spring washers, ladders, step bolts, anti climbing devices and such other items which are required for completing the towers in all respect. Steel and zinc required for manufacturing these items will be arranged by the supplier.

(iii) Supply of GI bolts and nuts and spring washers **3.5 mm thickness**, hangers/D-shackles for attaching suspension strings and ‘U’ bolts for attaching ground wire suspension assemblies are included in the supply of tower.

(iv) The following provisions shall apply in connection with the procurement of steel and zinc by the supplier.

(a) The steel used for fabrication of tower parts extensions, templates etc. shall be of mild steel of tested quality as per IS: 2062 GRA.

(b) The Bidder shall take into account the fabrication wastage while quoting the rates. The employer will not accept any liability in connection with the wastage of steel during fabrication or otherwise.

(c) The Bidder shall indicate in his offer the sizes of steel sections which are proposed to be used by him in the design of towers.

(d) Substitutions, if any, of steel sections of the tower parts by higher sizes, due to non-availability or otherwise shall be to the supplier’s account. The employer will not accept any liability on this account.

(e) The steel shall be procured exclusively from the main steel producers. However, sections not rolled by main producers, can be procured from re-rollers provided.

- Re-rolling of structural steel sections is done from billets/ingots of tested quality.
- Re-rolled sections are duly tested as per relevant standard.

(f) The zinc used for galvanizing fabricated material shall be of High Grade Electrolytic zinc.

**16.0.6 EXTENSIONS:**
The towers shall be designed so as to be suitable for adding 3 meters, 6 meters, 2 meters or 3 meters extensions (in case of Mini based towers) for maintaining adequate ground clearances without reducing the specified factor of safety in any manner.

16.0.7 STUB SETTING TEMPLATES:

Stub templates if required shall be designed and supplied by the supplier free of cost as per requirement for all types of towers with or without extensions. Stub templates for standard towers and towers with extension shall be fined type. The stub templates shall be painted and members marked clearly with anti-corrosive paints.

16.0.8 FASTENERS: BOLTS, NUTS & WASHERS

16.0.8.1.1 All bolts shall be of property class 5.6 and nuts of property class 5.0 IS: 1367 (Part – 3) 1991 and IS: 6639-1972 shall conform to IS: 12427, they shall be galvanized and shall have hexagonal heads and nuts, the heads being forged out of solid steel rods and shall be truly concentric and square with the shank. The shank shall be perfectly straight.

16.0.8.1.2 Usually threaded bolts shall not be used, the length of bolts should be such that the threaded portion shall not extend into the place of contact of the members.

16.0.8.1.3 All bolts shall be threaded to take the full depth of the nut and threaded far enough to permit firm gripping of the members, but not any further. It shall be ensured that the threaded portion of each bolt protrudes not less than 3 mm and not more than 8 mm when fully tightened. All nuts shall fit hand tight to the point where the shank of the bolt connects to the head.

16.0.8.1.4 Spring washers shall be provided for insertion under all nuts. These washers shall be of electro-galvanized steel and of the positive lock type. Their thickness shall be 2.5 mm for 12 mm dia bolts, 3.5 mm for 16 mm dia bolts and 4.5 mm for 20 mm dia bolts.

16.0.8.1.5 The Bidder shall furnish bolt schedules giving thickness of members connected, size of bolts and nuts, the length of the shank, the length of the threaded portion of bolts, sizes of bolt holes, thickness of washers and any other special details of this nature.
16.0.8.1.6 To obviate bending stress in bolts or to reduce it to a minimum, no bolt shall connect aggregate thickness of more than three (3) times its dia.

16.0.8.1.7 Bolts at the joints shall be so staggered that nuts may be tightened with spanners without fouling.

16.0.8.2 Step Bolt Ladders: These bolts shall be of property class 4.6 conform to IS: 6639-1972.

16.0.8.2.1 Each tower shall be provided with step bolts on one of the main legs, of not less than 16 mm diameter and 175 mm long, spaced not more than 400 mm apart and extending from about 2.5 metres above the ground level to the top of the tower. Each step bolt shall be provided with two nuts on one end to fasten the bolt security to the tower and button head at the other end to prevent the feet from slipping away. The step bolts shall be capable of withstanding a vertical load not less than 1.5 KN and shall be used as a ladder for climbing.

17.0 TOWER DESIGNS SUPERSTRUCTURE (Mini base)

17.0.1 Wind Pressure
The wind pressure on towers, power conductors and earth wire shall be as per IS: 802 (Part-I/Sec-I) – 1995.

17.0.2 Design Temperatures
The following temperature range for the power conductor and ground wires shall be adopted for the line design confirming to IS: 802 (Part –I/Sec – I) – 1995.

i) Minimum temperature: 50°C
ii) Every day temperature: 32°C
iii) Maximum temperature of:
   a) Conductor: 75°C for ACSR
      90°C for AAAC
   b) Ground wire exposed to Sun 53°C
17.0.3 Factors of Safety & Span details

a) **Factor of safety.**

The factor of safety based on crippling strength of struts and elastic limit of tension members shall not be less than 2(two) under normal condition and 1.5 (one and a half) under broken wire conditions for all the members of the towers and their cross arms.

b) **Broken Wire condition**

i) **Suspension Tower**

Breaking of any one power conductor in one phase only, resulting in instantaneous unbalance tension of 50% of conductor tension at 32°C without wind. or breaking of one earth wire resulting in an unbalance tension equal to the maximum tension of the ground wire whichever is more stringent is to be considered for design along with appropriate impact factor.

ii) **Tension Tower**

Breakage of all the three phases on the same side and on the same span or breakage of two phases and any one ground wire on the same span, whichever combination is more stringent along with appropriate impact factor for a particular member. Cross arms for angle tower shall be of equal length for both sides.

17.0.4 Design Load

(i) Employer’s requirement for design longitudinal and transverse loads shall confirm to IS: 802(Part-I/Sec-I)-1995.

The Bidder shall furnish the details of design loads proposed to be adopted in the tower design in accordance with this specification.

The design criteria and other special requirements as stipulated for special towers shall be applicable for river crossing/special towers.

ii) **Thickness of Members**

The minimum thickness of angle sections used in the design of towers, shall be kept not less than the following values:

a) Main corner leg members excluding the ground wire peak and main cross arm 6 mm.
b) For all other main members 5 mm.

c) Redundant members 4 mm.

iii) Bolt Arrangement

The minimum bolt spacing and rolled edge distance and sheared edge distances of sections from the centers of the bolt holes shall be provided as furnished in Table-1.

**TABLE-1**

<table>
<thead>
<tr>
<th>Dia of Bolts (mm)</th>
<th>Hole Dia (mm)</th>
<th>Min. bolt Spacing (mm)</th>
<th>Min. rolled Distance (mm)</th>
<th>Min. Sheared Edge distance (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>13.5</td>
<td>30</td>
<td>16</td>
<td>19</td>
</tr>
<tr>
<td>16</td>
<td>17.5</td>
<td>40</td>
<td>20</td>
<td>23</td>
</tr>
<tr>
<td>20</td>
<td>21.5</td>
<td>50</td>
<td>25</td>
<td>27</td>
</tr>
</tbody>
</table>

Bolts sizes mentioned above shall only be used. The minimum width of flanges without bolt holes shall be 30 mm.

For the purpose of calculating stress and bearing stress for bolts refer clause 14.4 and 14.5 of IS: 802 (Part-I/Sec-2)-1992.

iv) Erection Stress

Where erection stresses combined with other permissible co-existent stresses could produce a working stress in any member appreciably above the specified working stress, then additional materials shall be added to the member or such other provision made so as to bring the working stress within the specified limit. For the purpose of this clause the specified working stress shall be the ultimate stress divided by the factor of safety of 2.0.

a) Detailed structural drawings indicating section size, length of member. Sizes of plate along with hole to hole distances, joint details etc.

b) Bill of materials indicating cutting and bending details against each member.
c) Shop floor drawings showing all details relevant to fabrication.

17.0.5 Packing

Angle sections shall be wire bundled, cleat angles, gusset plates, blackets, filler plates, hanger and similar other loose items shall be netted and bolted together in multiples or securely wired together through holes.

Bolts, nuts, washers and other attachments shall be packed in double gunny bags, accurately tagged, in accordance with the contents.

The packings shall be properly done to avoid losses/damages during transit. Each bundle or package shall be appropriately marked.

17.0.6 Test for Galvanization

Galvanization of the members of the tower shall withstand tests as per IS:2633.

18.0 TOWER ACCESSORIES

18.0.1 Anti-climbing devices: This shall conform to IS: 5613 (Part-I/Sec –I), 19085.

Fully galvanized barbed wire type anti-climbing device shall be provided at a height of approximately 3 meters as an anti-climbing measure. Four layers of barbed wires will be provided each inside and outside the tower in horizontal plane, spacing between the layers being 140 to 150 mm. The towers to be designed by the supplier shall have provision to fix the barbed wire as indicated above. Thus the angle pieces with notches for accommodating barbed wire shall be designed and supplied with the towers along with provision for suitable bolt holes on leg members for fitting bolt holes on leg member for fitting the angles. The scheme of the anti-climbing device shall be submitted along with the tower drawing. Barbed wire shall be included in the scope of bidder. For Mini base towers the anti-climbing device shall be as per SOUTHCO’s design which shall be provided to the contractor along with the design drawings of the tower.
18.0.2 INSULATOR STRINGS AND GROUND WIRE CLAMP ATTACHMENTS

For the attachment of suspension insulator strings a suitable swinging hanger on the tower shall be provided so as to obtain requisite clearance under extreme swinging conditions and free swinging of the string. For Mini base towers ground wire stringing is not necessary.

18.0.3 (a) For ground wires at suspension towers suitable ‘U’ Bolts strong enough to withstand the full designed loads shall be provided to accommodate the hook of the ground wire suspension clamps.

(b) At tension towers, horizontal strain plates of suitable dimensions on the underside of each power cross-arm tip and at the top ground wire peak shall be provided for taking the ‘D’ Shackles of the tension insulator strings or ground wire tension clamps, as the case may be. Full details of the attachments shall be submitted by the supplier for the employer’s approval before commencing with mass fabrication.

18.0.4 PHASE PLATE

Phase plate shall be of mild steel of 16 gauge vitreous enameled at back and front, circular in shape and diameter 75 mm. One set of phase plate shall be consisting of 3 plate red, yellow and blue colour accordingly to indicate the phase of the conductor. There shall be one fixing bolt on the plate. This shall conform to IS: 5613 (Part-II/Section01) of latest edition.

18.0.5 NUMBER PLATE

The number plate shall be mild steel vitreous enameled at back and front, 200 mm x 150 mm, 2 mm thick, rectangular shape and inscribed thereon shall be the number of the tower location preceded by letter corresponding to the short name of the line and the type of towers. There shall be two fixing bolts on both end of the plates. The dimension and details of the number plate shall be as per IS: 5613 (Part-II/Section1 & Section-2), 1985.

18.0.6 DANGER PLATE
These shall be of mild steel vitreous enameled at back and front 250 x 200 mm, 2mm thick, rectangular shape and inscribed thereon shall be in signal red the work ‘DANGER’ with its Odia and Hindi translation and also with the inscription of Bone and Scull and voltage of the line. There shall be two holes on the plates for fixing. This shall conform to IS: 2551 (latest edition). The fixing of the plate should be above 3 (three) meters from ground level.

18.0.7 ERECTION MARK:

Each individual member shall have an erection mark conforming to the component number given to it in the fabrication drawings. This mark shall be done with marking dies of 16 mm size before galvanizing and shall be legible after galvanizing.

18.0.8 GALVANIZING

The super structure shall be galvanized. Galvanizing of tower members and stub shall be in conformity with IS: 4759-1984 and shall be done after all fabrication work has been completed except that the nuts may be tapped or return after galvanizing. Threads of bolts and nuts after galvanizing shall have a neat fit and shall be such that they can be turned with fingers throughout the length of the threads of bolts and they shall be capable of developing the full strength of the bolts. Spring washers shall be electro-galvanized as per Grade – 4 of IS: 1573 – 1986. Galvanizing for fasteners shall conform to IS: 1367 (Part-XIII) – 1978.

19.0 QUANTITIES AND WEIGHTS

19.0.1 The quantities stated in Annexure – I are only provisional. Final quantities will be informed by the employer to the supplier on completion of detailed survey. However, bids will be evaluated based on quantities indicated.

19.0.2 The employer reserves the right to increase or decrease quantities at the rates quoted in the bid.

19.0.3 The unit weight of each type of tower stubs, super structure and extension be furnished by the Bidder.
20.0 INSPECTION

20.0.1 The supplier shall keep the employer informed well in advance of the commencement of manufacture, progress of manufacture thereof and fabrication of various tower parts at various stages. So that arrangements could be made for inspection by the employer.

20.0.2 The acceptance of any batch of items shall in no way relieve the supplier of any his responsibilities for meeting all the requirements and intent of this specification and shall not prevent subsequent rejection if any item of that batch is later found defective.

20.0.3 The employer or his authorized representatives shall have free access at all reasonable time to all parts of the supplier’s works connected with the fabrication of the material covered under the contract for satisfying themselves that the fabrication is being done in accordance with the provisions of this specification.

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

20.0.5 Should any member of the structure be found not to comply with the approved design, it shall be liable for rejection. No member once rejected shall be resubmitted for inspection except in cases where the employer or his authorized representative considers that the defects can be rectified.

20.0.6 Defects which occur during fabrication shall be made good with the consent of and according to the procedure to be laid down by the employer.

20.0.7 All gauges and templates necessary to satisfy the employer for conducting tests shall be made available at the test site by the supplier.

The correct grade and quality of steel shall be used by the supplier. To ascertain the quality of steel the employer may at his discretion get the material tested at an approved laboratory.

21.0 GENERAL TECHNICAL REQUIREMENTS FOR CIVIL WORKS
Design details - foundation
Line voltage - 33kV / 11kV
No. of circuits - Double/Single

a) Properties of soil for bidding purpose only

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Details</th>
<th>Soft Loose (normal dry)</th>
<th>Mud (Submerged)</th>
<th>Hard Rock</th>
<th>Soft Rock</th>
<th>WBC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Angle of repose of soil (in degree)</td>
<td>30</td>
<td>15</td>
<td>45</td>
<td>20-30</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>Ultimate bearing strength of earth</td>
<td>11</td>
<td>5.5</td>
<td>87.0</td>
<td>50.0</td>
<td></td>
</tr>
</tbody>
</table>

b) Properties of concrete

Weight of foundation concrete 1:2:4 mix for design purpose shall be taken as 2400 kg/cum in dry location.

c) Factor of safety for foundation against overturning due to up-lift and thrust.

i) Normal condition 2.2

ii) Broken wire condition 1.65

22.0 FOUNDATION GENERAL DESCRIPTION

Design, construction and other relevant drawings shall be furnished by the tower designer for all types of towers for Normal soil WBC soil.

23.0 TAKING OVER

Tower and tower accessories received at site stores are to be stored item-wise and mark-wise to facilitate joint inspection of the materials (with reference to packing list and detailed order). If the materials/equipment or any part thereof is damaged or lost during the transit, the replacement of such materials shall be effected by the contractor timely so as to maintain programme of work. However, the line under erection shall be taken over by the purchaser.
only when the entire line is completed in all respect and made ready for commissioning at rated voltage. Partly erected line will not be taken over.

Taking over of the line shall be in no way relieving the contractor from his responsibility for satisfactory operation of the erected line in terms of the guarantee clause of the specification.

24.0 MATERIALS HANDLING AND INSURANCE

The contractor shall deliver all equipment/materials against this contract to his site stores under cover of Transit Insurance to be taken in his name. Cost of such insurance is to be borne by the contractor.

Cost of transportation of all materials from contractor’s store to the site of work as well as department supply items like Conductors, Power Transformer, Distribution Transformers, 11 KV & 33 KV VCBs shall be borne by the contractor irrespective of mode of transportation and site condition.

The contractor has to bear the cost of premiums on insurance for all materials, tower accessories and total erection cost of the line including cement, rods for foundation.

It will be the responsibility of the contractor to report to the concerned Police Station about all incidents of thefts and lodge, pursue and settle all claims with Insurance Company in case of damage/loss due to theft, pilferage, flood and fire etc. and the employer of the work shall be kept informed promptly in writing about all such incidents. The loss, if any, on this account shall be recoverable from the contractor if the claims are not lodged and properly pursued in time or if the claims are not settled by the insurance company due to lapses on the part of the contractor. The contractor shall have to replenish promptly damaged, stolen tower members and accessories conductors, earth wire, hardware’s etc. and repair/re-erect the damaged lines, free of cost to the employer so as to maintain the programme of work. The employer will not be responsible in any way for such loss of materials.
1 GENERAL

1.1 Scope of work

A. Supply

In the package materials have been classified as under

i. Owner’s supply materials (OSM)

33/11 KV Power Transformers, Station 33/0.4 KV Transformers & 11/.4 KV distribution transformers), VCB, CT, PT, CR panels, , AAA conductors .

ii. Contractor’s scope
All other material except the items shown above such as Structures including bolts and nuts, Insulators with Hardware, reinforcements bars, cements, different type of aggregates, bricks, isolators, AB Switches (for 33 and 11 kV), HG fuses (for 33 and 11 kV), Control cables, Heat shrink type end connector (for all level), Lightning Arresters, earthing materials, building materials and other consumable required to complete the job.

B. Construction of 33 / 11 KV Sub-Stations

<table>
<thead>
<tr>
<th>Package No.</th>
<th>Name of the Sub Station</th>
<th>New Linking Lines</th>
<th>Location (Name of the division)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Prior to the commencement of the supply / work all relevant drawings, designs must be got approved by SOUTHCO.

C. The scope of the proposal for the balance materials to be supplied by the bidder to complete the job shall be on the basis of a single Bidder’s responsibility, completely covering supply and erection of all the equipment specified under the accompanying Technical Specifications including other services. It will include the following

(i) Detailed investigation of substation and preparation of BOQ to be done by the bidder.
(ii) Complete manufacture, including shops testing & supply of materials from the approved vendor(materials which are to be supplied by the bidder)
(iii) Providing Engineering drawings related to foundation details, structural details of both line & Sub-station work, equipments data, operational manual, etc for the Project Manager’s approval;
(iv) Packing and transportation from the manufacturer’s works to the site.
(v) Receipt, storage, preservation and conservation of equipment at the site.
(vi) Pre-assembly, if any, erection testing and commissioning of all the equipments;
(vii) Reliability tests and performance and guarantee tests on completion of commissioning’
(viii) Loading, unloading and transportation as required,
(ix) Erection of installations of specified voltages,
(x) Testing, Commissioning of installations of of the Sub-Station inclusive of all related Civil works.

(xi) Storing before erection

(xii) Getting the Sub-Stations (both new & Up-gradation of S/S) / lines inspected and certified by Electrical Inspection after completion of work.

Transportation of all above required materials from Purchaser’s nearest store to site and all other required materials (to be supplied by bidder) from supplier’s premises to work site, construction of new electrical/civil structures, dismantling of existing electrical structures and return of these dismantled items at the purchaser’s stores, safe custody of the items and return of unused purchaser supplied materials to the purchaser’s stores.

1.1.1 GENERAL CONDITIONS OF CONTRACT

- **Responsibility of the Contractor**
  
The Contractor shall be responsible for the complete design and engineering, overall co-ordination with internal and external agencies, project management, loading, unloading, storage at site, inventory management including OSM materials at site during construction, dismantling, re-erection of installations as per Engineer. in charge’s advice, handling, moving to final destination, obtaining statutory clearances for successful erection, testing and commissioning of the substation.

- **Specific exclusions:**
  
The following items of work are specifically excluded from the Contractors scope of work unless otherwise specifically brought out.

  a) Substation site selection

  b) Land acquisition

- **Limit of contract**

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

- **Quantity variation**

  The Employer reserves the right to order and delete such works which may be necessary for him within the quantity variation option laid down in the conditions of the contract. This shall include but not limited to the manufacture, supply, testing, and delivery to site, erection and commissioning as may be required in accordance with the Conditions of Contract at the prices stated in the Schedules.

  The Employer shall also be at liberty to delete Any Items from the Contractor’s scope of supply at any time before commencement of supply of works under the detailed scope of work.

### 1.1.2 GENERAL PARTICULARS OF SYSTEM

**System description**

The following are the general particulars governing the design and working of the complete system of which the Contract Works will eventually form a part:

The system is three phase, 50 Hz and power is to be distributed to consumers under SOUTHCO at appropriate voltage level via distribution sub-stations, which operate at 33/11kV, 33/0.4 KV or 11/0.4 KV.

### 1.2 SYSTEM DATA

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Description of Technical Parameter</th>
<th>Unit</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nominal system voltage</td>
<td>kV&lt;sub&gt;rms&lt;/sub&gt;</td>
<td>33kV</td>
</tr>
<tr>
<td>2</td>
<td>Maximum system voltage</td>
<td>kV&lt;sub&gt;rms&lt;/sub&gt;</td>
<td>36.6kV</td>
</tr>
<tr>
<td>3</td>
<td>Power frequency with stand voltage</td>
<td>kV&lt;sub&gt;rms&lt;/sub&gt;</td>
<td>70kV</td>
</tr>
<tr>
<td>4</td>
<td>Lightning impulse withstand voltage</td>
<td>KV&lt;sub&gt;p&lt;/sub&gt;s (for 1.2 / 50)</td>
<td>170kVp</td>
</tr>
<tr>
<td></td>
<td>Line to earth</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Across isolating gap</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>One minute power frequency withstand value</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dry</td>
<td>Wet</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>-----</td>
<td>------</td>
</tr>
<tr>
<td>6</td>
<td>System frequency</td>
<td>Hz</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>Variation in frequency</td>
<td>%</td>
<td>2.5</td>
</tr>
<tr>
<td>8</td>
<td>Continuous current rating</td>
<td></td>
<td>800A</td>
</tr>
<tr>
<td>9</td>
<td>Symmetrical short circuit current</td>
<td>kA</td>
<td>25</td>
</tr>
<tr>
<td>10</td>
<td>Duration of short circuit fault current</td>
<td>Second</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>Dynamic short circuit current rating</td>
<td>kAp</td>
<td>62.5kA</td>
</tr>
<tr>
<td>12</td>
<td>Air clearances</td>
<td>meters</td>
<td>0.480</td>
</tr>
<tr>
<td></td>
<td>Phase to ground</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Phase to phase</td>
<td></td>
<td>0.530</td>
</tr>
<tr>
<td>13</td>
<td>Conductor spacing for AIS layouts</td>
<td>meters</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>Phase to ground</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Phase to phase</td>
<td></td>
<td>1.5</td>
</tr>
<tr>
<td>14</td>
<td>Design ambient temperatures</td>
<td>ºC</td>
<td>50</td>
</tr>
<tr>
<td>15</td>
<td>Pollution level as per IEC-815 and 71</td>
<td>III</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Creepage distance</td>
<td>mm</td>
<td>900</td>
</tr>
<tr>
<td>17</td>
<td>Maximum fault clearing time</td>
<td>ms</td>
<td>not exceeding 150ms</td>
</tr>
<tr>
<td>18</td>
<td>Safety clearances</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Section clearance</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(a) Ground clearances (between ground and bottom most part of energised object)</td>
<td>metres</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>(b) Horizontal clearance between the fence and energised object</td>
<td>metres</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>(c) Horizontal clearance between the road centre line and energised part of the nearby equipment</td>
<td>metres</td>
<td>As per I.E. Rules</td>
</tr>
<tr>
<td>19</td>
<td>Bay width</td>
<td>metres</td>
<td>5.5</td>
</tr>
<tr>
<td>20</td>
<td>Height of bus equipment interconnection from ground</td>
<td>metres</td>
<td>4</td>
</tr>
<tr>
<td>21</td>
<td>Height of strung busbar</td>
<td>metres</td>
<td>5.5</td>
</tr>
</tbody>
</table>

### 1.3 DATA

#### 1.3.1 METEOROLOGICAL

<table>
<thead>
<tr>
<th>Description</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual mean of maximum monthly average temperature.</td>
<td>50</td>
</tr>
</tbody>
</table>
### 1.3.2 Sub station Philosophy

SOUTHCO has adopted the philosophy of installing open terminal air insulated substations. The bus bars may be of either rigid type or flexible strain type depending upon the choice of the designer considering the overall suitability and economy of the substation to be installed.

**a) Layout arrangement**

The Contractor shall study the details of layout arrangements already indicated in the schedules details for the existing substations. The bay width and height of the conductors for these substations shall be achieved by the Contractor in case of extension substations. However the Contractor shall finalize the layout arrangements in case of new substations in line with this Specification with the approval of the Engg- In-charge (Divisional Engr.) which shall be meeting at least the basic minimum electrical clearances as specified in the schedules.

**b) Location and site description**

The details of the sub-substation locations, their approach, geography and topography etc are to be collected from the respective divisions to the extent possible. The Bidder shall make necessary visit to the substation sites and fully appraise himself before bidding. Deviations on account of inadequate data for substation works shall not be acceptable and the Bid shall not be considered for evaluation in such cases.
c) **Soil data**

Detailed soil investigations in respect of various substations have not been made. However the general characteristics of the soil are of laterite, Sandy, Hard soil WBC soil. The Contractor shall investigate the properties of the soil of the substations and measure the soil resistivity as part of the scope of work.

d) **Completeness and accuracy of information**

The Contractor shall note that the information provided above and in the relevant schedules may not be complete or fully accurate at the time of bidding. For his own interest the Contractor is advised to make site visits and fully satisfy himself regarding site conditions in all respects, and shall be fully responsible for the complete design and engineering of the substations.

1.4 **GUARANTEED TECHNICAL PARTICULARS**

The Contract Works shall comply with the guaranteed technical particulars specified or quoted in the bid. All plant and apparatus supplied under this Contract shall be to the approval of the Engg In-charge.

The Contractor shall be responsible for any discrepancies, errors or omissions in the particulars and guarantees.

The Bidder for his own interest, shall establish the technical responsiveness of his bid, shall provide all data in appropriate technical data sheets, general/technical information, literature, and leaflets etc. along with the bid.

1.5 **Compliance with Specification**

All apparatus should comply with this Specification. Any departures from the requirements of this Specification shall be stated with reasons in the relevant Bid Proposal Schedules. Bid will be considered for evaluation if reasons shown are apparently justified. Unless brought out clearly in the technical schedules, it will be presumed that the equipment is deemed to comply with the technical specification.
In the event of there being any inconsistency between the provisions of the conditions of contract and the provisions of this Specification, in respect of commercial requirements, the provisions of the conditions of contract shall take precedence for commercial matters and the provisions of this Specification shall take precedence in respect of technical matters.

In case of inconsistency between technical specification (TS) & bid proposal sheet, (BPS) quantities of various items as specified in the bid proposal sheet shall be considered for quoting. However the work shall be executed as specified in the technical specification. Only brief description is given in the BPS & the work shall be executed in line with the requirement given in the TS.

The manufacturer and places of manufacture, testing and inspection of the various portions of the Contract Works shall be stated in the relevant Bid Proposal Schedules.

1.8.3 Erection at Site and accommodation

The Contractor shall provide, at his own cost and expense, all labors, plant and material necessary for unloading and erection at the Site and shall be entirely responsible for its efficient and correct operation.

The Contractor shall be responsible for arranging and providing all living accommodation services and amenities required by his employees.

Use of electrical energy

The Contractor shall arrange at his own cost and expense, any site supplies of electrical energy which he may require for supplying power for heavy erection plant, welding plant or other tools, lighting and testing purposes.

All wiring for such tackle and for lighting from the point of supply shall be provided by the Contractor and all such installations shall comply with all appropriate statutory regulations.

Wiring shall be of the best quality double insulated flexible cable, suitably fixed, protected and maintained. All necessary precautions shall be taken to ensure the safety of every person
employed or working on the Site and this shall include routine inspection of all temporary installations and portable equipment.

The Engg In-charge or his authorized representative may require the disconnection or alteration of any parts which he may consider dangerous.

As soon as any part or the whole of the Contractor’s installation is no longer required for the carrying out of the works, the Contractor shall disconnect and remove the same to the satisfaction of the Engg In-charge or his authorized representative.

The contractor shall be responsible for arranging construction water at his own cost besides drinking water at site

1.9 SUPERVISION AND CHECKING OF WORK ON SITE

All work on site included in the contractor’s scope of works shall be supervised by sufficient number of qualified representatives of the Contractor.

Before putting any plant or apparatus into operation the Contractor shall satisfy himself as to the correctness of all connections between the plant and apparatus supplied under this and other contracts. The Contractor shall advise the Engg In-charge in writing, giving the period of notice as specified in the General Conditions of Contract, when the plant or apparatus is ready for inspection or energisation.

1.10 RESPONSIBILITY FOR THE RUNNING OF PLANT BY CONTRACTOR

Until each Section of the Contract Works has been taken over or deemed to have been taken over under the Conditions of Contract, the Contractor shall be entirely responsible for the Contract Works, whether under construction, during tests, or in use for the Employer’s service.

Any work which may be necessary for the Contractor to carry out in pursuance of his obligations under the Conditions of Contract shall be carried out with the minimum of
interference to the normal operation of the substation. Work on the Site shall be carried out at such time and during such hours as the Engg In-charge may require.

1.11 COMPLIANCE WITH REGULATIONS

All apparatus and material supplied, and all work carried out shall comply in all respects with such of the requirements of all Regulations and Acts in force in the country and state in particular of the Employer as are applicable to the Contract Works and with any other applicable regulations to which the Employer is subjected to oblige.

The Contractor shall fully inform himself of the requirements of the local Laws, Regulations and rules in-force in the State of Odisha, especially with respect to local employment laws, licensing requirements, electrical safety rules and regulations, building regulations and planning procedures.

The Contractor shall be responsible for applying for all necessary licenses; including Electrical Contractors License, Workman’s Permits and Certificates of Competency for Supervisors, and local government approvals required for the contract works and for the payment of all necessary fees associated with such licenses and approvals.

Correspondence with the Electrical Inspector shall be conducted through the Engg In-charge, but the Contractor shall provide all necessary information, regarding the contract works, as may be required by the Electrical Inspector.

Additionally the Contractor shall also follow the adequate regulations on safety, environment, employee’s welfare etc. as stipulated under the relevant Clause of this section.

1.12 MAINTENANCE AND CLEARING OF SITE

The placing of materials and plant near the erection site prior to their being erected and installed shall be done in a neat, tidy and safe manner. The Contractor shall at his own expense keep the site area allocated to him and also the erection area of the Contract Works reasonably clean and shall remove all waste material as it accumulates and as directed by the Engg In-charge from time to time.
1.13 Insurance

1.13.1 General

In addition to the conditions covered under the Clause titled insurance in the Special Conditions of Contract, the following provisions will also apply to the portion of works to be done beyond the Suppliers own or his sub-Contractors manufacturing Works.

1.13.2 Workmen's Compensation Insurance

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

a. Workmen’s’ Compensation
   As per statutory provisions

b. Employee's liability
   As per statutory provisions According to the Govt. rules.

c. Comprehensive automobile insurance

This insurance shall be in a such a form to protect the Contractor against all claims for injuries, disability, disease and death to members of public including the Employer's men and damage to the property of others arising from the use of motor vehicles during on or off the Site operations, irrespective of the ownership of such vehicles. The minimum liability covered shall be as herein indicated:

1) Fatal Injury : Rs. 100,000/- each person
2) Property : Rs. 200,000/- each occurrence
3) Damage : Rs. 100,000/- each occurrence

As per latest prevailing Govt. rules.
d. Comprehensive General Liability Insurance

This insurance shall protect the Contractor against all claims arising from injuries, disabilities, disease or death of members or public or damage to property of others, due to any act or omission on the part of the Contractor, its agents, its employees, its representatives and subcontractors or from riots, strikes and civil commotion.

The hazards to be covered will pertain to all works and areas where the Contractor, its subcontractors, agents and employees have to perform work pursuant to the Contracts.

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

1.15 Work and Safety Regulations

The Contractor shall ensure safety of all the workmen, plant and equipment belonging to him or to others, working at the Site. The Contractor shall also provide for all safety notices and safety equipment required by the relevant legislation and deemed necessary by the Engg In-charge.

No claim due to such prohibition or towards additional safety provisions called for by him shall be entertained by the Employer.

All equipment used in construction and erection by Contractor shall meet Indian or International Standards and where such standards do not exist, the Contractor shall ensure these to be absolutely safe. All equipment shall be strictly operated and maintained by the Contractor in accordance with manufacturers operation manual and safety instructions and as per any existing Guidelines/Rules in this regard.

Periodical examinations and all tests for all lifting and hoisting equipment and tackle shall be carried out in accordance with the relevant provisions of Factories Act 1948, Indian Electricity (Supply) Act and associated Laws/Rules in force, from time to time. A register of
such examinations and tests shall be properly maintained by the Contractor and will be promptly produced as and when desired by Engg In-charge.

The Contractor shall provide suitable safety equipment of prescribed standard to all employees and workmen according to the need, as may be directed by the Engg In-charge who will also have the right to examine such safety equipment to determine it’s suitability, reliability, acceptability and adaptability.

Where explosives are to be used, the same shall be used under the direct control and supervision of an expert, experienced and qualified competent person, strictly in accordance with the Code of Practices/Rules framed under Indian Explosives Act pertaining to handling, storage and use of explosive.

In case any accident occurs during the construction, erection or other associated activities undertaken by the Contractor, thereby causing any minor or major or fatal injury to his employees due to any reason whatsoever, it shall be the responsibility of the Contractor to promptly inform the same to the Engg In-charge/ Project Manager and also to all the authorities envisaged under the applicable laws.

The Engg In-charge/ Project Manager /Owner shall have the right at his sole discretion to stop the work, if in his opinion the work is being carried out in such a way as may cause accidents or endanger the safety of the persons and/or equipment. In such cases, the Contractor shall be informed in writing about the nature of hazards and possible injury/accident and he shall remove shortcomings immediately. The Contractor, after stopping the specific work, can if felt necessary appeal against the order of stoppage of work to the owner within three days of such stoppage of work and the decision of the owner in this respect shall be conclusive.

The Contractor shall not be entitled for any damages or compensation for stoppage of work due to safety reasons and the period of such stoppage of work will not be taken as an extension of time for completion of work, nor will it be the grounds for waiver of any part of suppliers liability for timely completion of the works.
The Contractor shall follow and comply with all Safety Rules, relevant provisions of applicable laws pertaining to the safety of workmen, employees, plant and equipment as may be prescribed from time to time without any demur, protest or contest or reservation. In case of any conflict between statutory requirement and Safety Rules referred above, the most stringent clause shall be applicable.

If the Contractor does not take all safety precautions and comply with Safety Rules as prescribed by the Engg In-charge or as prescribed under the applicable law, to safeguard equipment, plant and personnel the Contractor shall be responsible for payment of compensation to the Employer as per the schedule given below.

If the Contractor does not prevent hazardous conditions which may cause injury to his own employees, employees of other Contractors, or the Employer or any other person at Site or adjacent thereto, the Contractor shall be responsible for payment of compensation to the Employer as per the following Schedule:

- **Fatal injury or accident causing death.**
  - Rs. 100,000/- per person
  - Applicable for injury or death to any person whomsoever.

- **Major injuries or accident causing 25% or more permanent disability.**
  - Rs. 20,000/- per person
  - Applicable for injury or death to any person whomsoever.

- As per prevailing Govt. rules.

Permanent disability shall have the same meaning as indicated in Workmen's Compensation Act. The compensation mentioned above shall be in addition to the compensation payable to the workmen/employees under the relevant provisions of the Workmen's Compensation Act.
and rules framed there under or any other applicable law as applicable from time to time. In case the Employer is made to pay such compensation, the Contractor will reimburse the Employer such amount(s) in addition to the compensation indicated above.

1.17 **Project Manager**- DGM/SE of concerned Electrical Circle is the designated Project Manager for the project. All the correspondence / communication will be addressed to him in his office address.

1.18 **SUBMITTALS**

1.18.1 **Submittals required with the bid**

The following shall be required in duplicate:

- completed technical data schedule;
- Descriptive literature giving full technical details of equipment offered;
- type test certificates, where available, and sample routine test reports;
- Deviations from this specification. Only deviations approved in writing before award of contract shall be accepted;

1.18.2 **Submittals required after contract award**

1.18.2.1 Five copies of the programme for production and testing.

1.18.2.2 Technical particulars

Within 15 days of contract award five bound folders with records of the technical particulars relating to the equipment. Each folder shall contain the following information

- General description of the equipment and all components, including brochures;
- Technical data schedule, with approved revisions;
- Calculations to substantiate choice of electrical and mechanical component size/ratings;
- statement drawing attention to all exposed points in the equipment at which copper, aluminium or aluminium alloy parts are in contact with or in close proximity to other metals and stating clearly what protection is employed to prevent corrosion at each point;
• Detailed installation and commissioning instructions;
  At the final hold point for Project Manager Approval prior to delivery of the equipment the
  following shall be submitted:
• Inspection and test reports carried out in the manufacturer's works;
• Installation and maintenance instructions.

1.18.2.4 Drawings

Within 15 days of contract commencement the Contractor shall submit, for approval by the
Project Manager, a schedule of the drawings to be produced detailing which are to be
submitted for "Approval" and which are to be submitted "For Information Only". The
schedule shall also provide a programme of drawing submission, for approval by the Project
Manager that ensures that all drawings and calculations are submitted within the period
specified above.

All detail drawings submitted for approval shall be to scale not less than 1:20.

Lettering sizes and thickness of lettering and lines shall be selected so that if reduced by two
stages to one quarter of their size, the alphanumeric characters and lines are still perfectly
legible so as to enable them to be microfilmed.

For presentation of design drawings and circuit documents IEC Publication 617 or equivalent
standards for graphical symbols are to be followed.

1.18.2.5 APPROVAL PROCEDURE

The Contractor shall submit all drawings, documents and type test reports for approval in
sufficient time to permit modifications to be made if such are deemed necessary and re-submit
them for approval without delaying the initial deliveries or completion of the contract work.
The Project Manager's representative shall endeavor to return them within a period of 7 days
from the date of receipt.
Three copies of all drawings shall be submitted for approval and three copies for any subsequent revision. The Project Manager reserves the right to request any further additional information that may be considered necessary in order to fully review the drawings. If the Project Manager is satisfied with the drawing, one copy will be returned to the Contractor marked with "Approved" stamp. If the Project Manager is not totally satisfied with the drawing, then "Approved Subject to Comment" status will be given to it and a comment sheet will be sent to the Contractor. If the drawing submitted does not comply with the requirements of the specification then it will be given "Not Approved" status and a comment sheet will be sent to the Contractor. In both these cases the Contractor will have to modify the drawing, update the revision column and resubmit for final Approval. Following approval, twenty copies of the final drawings will be required by the Project Manager.

The Contractor shall be responsible for any discrepancies or errors in or omissions from the drawings, whether such drawings have been approved or not by the Project Manager. Approval given by the Project Manager to any drawing shall not relieve the Contractor from his liability to complete contract works in accordance with this specification and the condition of contract nor exonerate him from any of his guarantees.

1.19 ELECTRICAL WORKS

1.19.1 General

The following provisions shall supplement all the detailed technical specifications and requirements brought out in accompanying Technical Specifications. The Contractor’s proposal shall be based upon the use of equipment and materials complying fully with the requirements specified herein. It is recognized that the Contractor may have standardized on the use of certain components, materials, processes or procedures different to those specified herein. Alternate proposals offering similar equipment based on the manufacturers standard practice will also be considered, provided such proposals meet the specified design standard and performance requirement and are acceptable to the Project Manager.
1.19.2 DESIGN AND STANDARDISATION

The Works covered by the specification shall be designed, manufactured, built, tested and commissioned in accordance with the Act, Rules, Laws and Regulations of India. The Equipment(s) shall also conform to the requirements detailed in the referred standards, which shall form an integral part of the Specification, in addition to meeting the specific requirements called for elsewhere in the Specification.

The Contract works shall be designed to facilitate inspection, cleaning and repairs, and for operation where continuity of supply is the first consideration. Apparatus shall be designed to ensure satisfactory operation in all atmospheric conditions prevailing at the Site(s) and during such sudden variation of load and voltage as may be met with under working conditions on the system.

The design shall incorporate all reasonable precautions and provisions for the safety of those concerned in the operation and maintenance of the Contract Works and of associated works supplied under other contracts.

Where the Specification does not contain characteristics with reference to workmanship, equipment, materials and components of the covered equipment, it is understood that the same must be new, of highest grade of the best quality of their kind, conforming to best engineering practice and suitable for the purpose for which they are intended.

The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expense. Each component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements and shall be used throughout the design. All joints and fastenings shall be so devised, constructed and documented that the component parts shall be accurately positioned and restrained to fulfill their required function.
All outdoor apparatus and fittings shall be designed so that water cannot accumulate at any point. Grease lubricators shall be fitted with nipples and where necessary for accessibility, the nipples shall be placed at the end of extension piping.

All water and oil pipe flanges shall be to IS 6392/BS 4504 or other equivalent standard, as regards both dimensions and drilling, unless otherwise approved.

Cast iron shall not be used for chambers of oil filled apparatus or for any part of the equipment which is in tension or subject to impact stresses.

Kiosks, cubicles and similar enclosed compartments shall be adequately ventilated to restrict condensation. All contactor or relay coils and other parts shall be suitably protected against corrosion.

All apparatus shall be designed to obviate the risk of accidental short circuit due to animals, birds, insects, mites, rodents or micro-organisms.

Corresponding parts shall be interchangeable. Where required by the Engg. Incharge (Divisional Engr.) the Contractor shall demonstrate this quality.

1.20 Sub-contractors

Prior approval should be taken from Owner/ Project Manager regarding engagement of any Sub-contractor by giving detail Bio-data, past experience in handling such type of works, Financial capability, Quality of work done etc of the proposed Sub-Contractor.

The Contractor shall ensure that the Quality Assurance requirements of this Specification are followed by any sub-contractor appointed by him under the Contract.

The Contractor shall assess the sub-contractor’s Quality Assurance arrangements prior to his appointment to ensure its compliance with the appropriate ISO 9000 standard and the Specification.
1.21 Method statement

Prior to commencing work, the Contractor shall submit a method statement setting out full details of his method of working. This is a Hold Point.

Details of the Contractor’s method of working shall also be submitted at the time of Bidding.

1.25 Health, Safety and Environment (HSE) Plan

1.25.1 General

Within one month of award of contract the Contractor shall produce a HSE Plan for the contract and submit for the approval of the Project Manager. The HSE Plan is described in the following sections.

The primary objective of the HSE Plan is for the contractor to demonstrate that he has the capability to carry out the contract work in a cost effective manner, giving due consideration to the Health, Safety and Environmental management of both his own employees, those of the Employer and anyone who may be affected by his activities.

1.25.2 Content of HSE Plan

The HSE Plan will comprise two parts i.e.:

**Part : I :** general HSE management and controls.

The following would be attached as appendices, where appropriate:

1) Organization chart showing the proposed Contractors HSE organizational structure

2) The CV’s, duties and responsibilities of the following personnel:

   3) Contract Manager

   4) Contractors Site Representatives

   5) Safety Officer

   6) Site Safety Officers
Part : II : Summary of hazards and controls.

1.25.3 General structure of HSE Plan

The HSE Plan shall conform to the following general structure:

1. Contractors Policy Statement
2. Health
   2.1 First Aid
   2.2 Primary health care
   2.3 Occupational health
3. Safety
   3.1 Objectives and targets
   3.2 Organization and responsibilities
   3.3 HSE meetings
   3.4 Motivation and communication
   3.5 HSE training
   3.6 Audits and inspections
   3.7 Emergency response
   3.8 Safety function
   3.9 Accident investigating and reporting
   3.10 Standards
   3.11 Personal protective equipment
4. Environment
   4.1 Waste management
   4.2 Chemicals management
   4.3 Environmental impact
5. Critical areas
   5.1 Subcontractors
6. Summary of hazards and controls
1.25.4 Section 6 of HSE Plan

In addition to general hazards and their controls, the following hazards have been identified as specific to this contract and therefore the contractor should demonstrate that he is capable of providing the necessary controls for the work:

1) Working within a Permit to Work system
2) Working adjacent to live high voltage equipment
3) Working adjacent to, and in the vicinity of, live high voltage overhead lines.
4) Working at elevation
5) Lifting operations
6) Use of explosives
7) Use of heavy machinery including carnage, pile rigs and concrete mixers
8) Excavation works
9) Work in confined spaces
10) Working with insulating oil
11) Working with compressed gas
12) Rotating machinery

The Contractor should demonstrate his understanding of these hazards by either proposing specific controls for each of them or by giving supporting documentation which demonstrates that such controls already exist.

1.25.5 Standards, Procedures and Guidelines

The HSE Plan shall identify the Standards, Procedures and Guidelines that will be applicable to the project. This will include the Indian Electricity Rules and will be subject to the approval of the Project Manager.

1.25.6 Supervision strategy
The Contractor will provide supervisors with a minimum of five years experience of this type of work such that they are able to supervise the quality and standards of the work without intervention by the Employer. The role of the Employer will be to monitor and audit the quality of the work to ensure that it is of adequate standard and that it is being safely and successfully managed.

1.26 Standards

Except where otherwise specified or implied, the Contract Works shall comply with the latest edition of the relevant Indian Standards, International Electro technical Commission (IEC) standards and any other standards mentioned in this Specification. The Contractor may submit for approval, equipment or materials conforming to technically equivalent National Standards. In such cases copies of the relevant Standards or part thereof, in the English language shall be submitted with the Tender. In case of conflict the order of precedence shall be (1) IEC, (2) IS and (3) other alternative standard.

Reference to a particular standard or recommendation in this Specification does not relieve the Contractor of the necessity of providing the Contract Works complying with other relevant standards or recommendations.

The list of standards provided in the schedules of this Specification is not to be considered exhaustive and the Contractor shall ensure that equipment supplied under this contract meets the requirements of the relevant standard whether or not it is mentioned therein.

1.27 Language and system of units

The English language shall be used in all written communications between the Employers, the Engg. In charge and the Contractor with respect to the services to be rendered and with respect to all documents and drawings procured or prepared by the Contractor pertaining to the work, unless otherwise agreed by the Employer.
It is required that danger plates, equipment designation labels or plates, instruction notices on plant and general substation notices be written in English, Hindi and Oriya. Control switch and lamp labels, indicator lamp and enunciator inscriptions shall be in English only.

The Contractor must furnish a schedule giving the English, Hindi and Oriya version of all labels, notices, etc., for approval.

1.28 General Requirements

1.31 Construction Management

1.31.1 General

Time is the essence of the Contract and the Contractor shall be responsible for performance of his Works in accordance with the specified construction schedule. If at any time the Contractor is falling behind the schedule, he shall take necessary action to make good for such delays by increasing his work force or by working overtime to accelerate the progress of the work and to comply with schedule and shall communicate such actions in writing to the Project Manager / Engg. In charge, providing evidence that his action will compensate for the delay. The Contractor shall not be allowed any extra compensation for such action.

1.31.2 Field office records

The Contractor shall maintain at his Site office up-to-date copies of all drawings, specifications and other supplementary data complete with all the latest revisions thereto. The Contractor shall also maintain in addition the continuous record of all changes to the above contract documents, drawings, specifications, supplementary data, etc. effected at the field. On completion of his total assignment under the Contract, such drawings and engineering data shall be submitted to the Project Manager in the required number of copies.

1.31.3 Protection of property and Contractor's liability

The Contractor will ensure provision of necessary safety equipment such as barriers, signboards, warning light and alarms, personal protective equipment etc. to provide adequate protection to persons and property. The Contractor shall be responsible for giving reasonable
notice to the Engg. In charge and the owners of public or private property and utilities when such property and utilities are likely to be damaged or injured during the performance of his works, and shall make all necessary arrangements with such owners, related to removal and/or replacement or protection of such property and utilities.

1.32 **Employer's Supervision**

To eliminate delays and avoid disputes and litigation, it is agreed between the Parties to the Contracts that all matters and questions shall be referred to the Employer and without prejudice the Contractor shall proceed to comply with the Employer's decision.

The work shall be performed under the direction and supervision of the Engg. In charge. The scope of the duties of the Engg. In charge pursuant to the contract, will include but not be limited to the following:

a) Interpretation of all the terms and conditions of these documents and specifications.

b) Review and interpretation of all the Contractors drawing, engineering data etc.

c) Inspect, accept or reject any equipment, material and work under Contract.

d) Issue certificate of acceptance and/or progressive payment and final payment certificates.

e) Review and suggest modification and improvements in completion schedules from time to time.

1.33 **Testing and inspection**

The Contractor shall carry out the tests stated in accordance with the conditions of this Specification, without extra charge for such additional tests as in the opinion of the Project Manager are necessary to determine that the Contract Works comply with this Specification. The tests shall be carried out generally in accordance with the relevant IEC’s or IS or equivalent standards. The specific details of testing and inspection are given in the appropriate section of this Specification.

The Contractor shall submit Type Test Reports for all equipment being supplied by him for the Project Manager’s approval.
All materials used shall be subjected to such routine tests as are customary in the manufacture of the types of plant included in the Contract Works. These materials shall withstand satisfactorily all such tests.

All tests shall be carried out to the satisfaction of the Project Manager in his presence, at such reasonable times as he may require, unless agreed otherwise. Not less than three weeks notice of all tests shall be given to the Project Manager in order that he may be represented if he so desires. As many tests as possible shall be arranged together. Six copies of the Contractor’s test reports and test sheets shall be supplied to the Project Manager for approval.

Measuring apparatus shall be approved by the Project Manager and if required shall be recalibrated at the expense of the Contractor at an approved laboratory.

The Contractor shall be responsible for the proper testing of the work completed or plant or materials supplied by a sub-contractor to the same extent as if the work, plant or materials were completed or supplied by the Contractor himself.

All apparatus, instruments and connections required for the above tests shall be provided by the Contractor, but the Project Manager may permit the use for the tests on site, any instruments and apparatus which may be provided permanently on site as part of the contract works conditional upon the Contractor accepting liability for any damage which may be sustained by such equipment during the test.

Any costs incurred by the Employer in connection with inspection and re-testing as a result of a failure of the subject under test, or damage during transport, or erection on site before take-over by the Employer, shall be to the account of the Contractor.

No inspection or lack of inspection or passing by the Project Manager of work, plant or materials, whether carried out or supplied by the Contractor or sub-contractor, shall relieve the Contractor from his liability to complete the Contract Works in accordance with the Contract or exonerate him from any of his guarantees.

1.34 Fire Precautions
All apparatus, connections and cabling shall be designed and arranged to minimize the risk of fire and any damage which might be caused in the event of fire. When cabling is carried out as part of this Contract the Contractor shall be responsible for sealing all holes in floors, walls, roofs etc. through which the cabling may pass.

The work procedures that are to be used during the erection shall be those which minimize fire hazards to the maximum extent practicable. Combustible materials, combustible waste and rubbish shall be collected and removed from the site at least once each day. Fuels, oils and volatile or flammable materials shall be stored away from the construction site and equipment and material stores in appropriate safe containers.

All Contractors’ supervisory personnel and at least ten percent all of workers shall be trained for fire-fighting and shall be assigned specific fire protection duties. At least ten percent of all personnel assigned to site at any one time shall be trained for fire fighting.

The contractor shall provide sufficient fire protection equipment of the types and sizes for the ware-houses, office temporary structures, labour colony area etc. Access to such fire protection equipment shall be easy and kept open at all time.

1.35 Packing, shipping and transport

The Contractor shall be responsible for the packing, loading and transport of the plant and equipment from the place of manufacture, whether this is at his own works or those of any Contractor, to Site, and for off-loading at site.

All apparatus and equipment shall be carefully packed for transport by air, sea, rail and road as necessary and in such a manner that it is protected against tropical climate conditions and transport in rough terrain and cross country road conditions. The method of packing shall provide complete protection to all apparatus and equipment during transport and storage at site in heavy rain. The method of packing shall provide adequate protection to main items of plant and those parts contained within and attached without, for transportation.

Precautions shall be taken to protect parts containing electrical insulation against the ingress of moisture.
All bright parts liable to rust shall receive a coat of anti-rusting composition and shall be suitably protected. The machined face of all flanges shall be protected by means of a blank disc bolted to each face.

Where appropriate all parts shall be boxed in substantial crates or containers to facilitate handling in a safe and secure manner. Each crate or container shall be marked clearly on the outside of the case to show “TOP” and “BOTTOM” positions with appropriate signs, and where the mass is bearing and the correct position for slings. Each crate or container shall also be marked with the notation of the part or parts contained therein, contract number and port of destination. It shall be the Contractor’s responsibility to dispose of all such packing.

Any damage due to defective or insufficient packing shall be made good by the Contractor at his own expense and within reasonable time when called upon by the Engg. In charge to do so. Four (4) copies of complete packing lists showing the number, size, marks, mass and contents of each package shall be delivered to the Engg. In charge immediately the material is dispatched.

The Contractor shall inform himself fully as to all relevant transport facilities and requirements and loading gauges and ensure that the equipment as packed for transport shall conform to these limitations. The Contractor shall also be responsible for verifying the access facilities specified.

The Contractor shall be responsible for all costs of repair or replacement of the equipment, including those incurred by the Employer, arising from damage during transport, off-loading or erection on site, until take-over by the Employer.

The Contractor shall be responsible for the transportation of all loads associated with the contract works and shall take all reasonable steps to prevent any highways or bridges from being damaged by his traffic and shall select routes, choose and use vehicles and restrict and distribute loads so that the risk of damage shall be avoided. The Contractor shall immediately report to the Engg. In charge any claims made against the Contractor arising out of alleged damage to a highway or bridge.
1.36 **Erection marks**

Before leaving the Contractor’s Works all apparatus and fittings shall be painted or stamped in two places with a distinguishing number and/or letter corresponding to the distinguishing number and/or letter on an approved drawing and material list. All markings shall be legible; weatherproof tags, where used, shall be durable, securely attached and duplicated.

The erection marks on galvanized material shall be stamped before galvanizing and shall be clearly legible after galvanizing.

1.37 **Spanners and special tools**

A complete set of each of Box, DE and Ring spanners shall be supplied for each station to fit every nut and bolt head on the apparatus supplied under this Contract, together with all special tools required for the adjustment and maintenance of the equipment. These tools shall be mounted in a lockable cabinet at each substation, also to be provided under this Contract. Eye bolts which have to be removed after use shall be accommodated in the cabinets.

Spanners and other maintenance equipment provided under the Contract shall not be used for the purpose of erection of the contract Works.

Any special devices, slings or tackle necessary for the complete overhaul of the plant shall be handed over to the Engg. In charge in working order on completion of the Contract.

On delivering any or all of these tools to the Engg. In charge, a signature shall be obtained from the Engg. In charge’s representative. Any tools not signed for shall be deemed not to have been delivered.

1.38 **Eye bolts and lifting tackle**

All slings, eye bolts and other lifting tackle provided shall be proof tested to twice the safe working load and suitably marked with embossed labels to show clearly the safe working loads.

**Substation Structures**

2.0 **Scope :**
This specification covers the supply of substation structures, as per the drawings. The scope also includes the testing of the steel sections before dispatch at the steel manufacturer’s works.

150X76x6.5 MM MS CHANNEL
125X65x5.3 MM MS CHANNEL
5.7 MM & 12 MM thick MS Plates

2.1 Standards:

The steel materials shall comply with the requirements of latest issue of I.S:808 & I.S: 2062 for Gr – A except where specified otherwise.

2.2 Climatic Conditions:

The climatic conditions at site under which the store shall operate satisfactory, are as follows

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum temperature of air in shade</td>
<td>45°C</td>
</tr>
<tr>
<td>Maximum temperature of air in shade</td>
<td>0°C</td>
</tr>
<tr>
<td>Maximum temperature of air in shade</td>
<td>50°C</td>
</tr>
<tr>
<td>Maximum rain fall per annum</td>
<td>2000mm</td>
</tr>
<tr>
<td>Maximum temperature of air in shade</td>
<td>45°C</td>
</tr>
<tr>
<td>Maximum ambient temperature</td>
<td>45°C</td>
</tr>
<tr>
<td>Maximum humidity</td>
<td>100%</td>
</tr>
<tr>
<td>Av. No. of thunder storm days per annum</td>
<td>70%</td>
</tr>
<tr>
<td>Av. No. of dust storm per annum</td>
<td>20</td>
</tr>
</tbody>
</table>

2.3 Column Structure

The T₁, T₂, T₃, T₄, T₅ & T₅ₓ type H Pole structures are constructed with two parallel run 7.5 Meter/ 6.0 mts / 5.5 meter long 150 x 76 x 6.5 mm G.I. Channels. Both the channels are separated by 150 mm distance (run through the entire length). The channels are further connected with 22 No. stiffeners (11 on each side) of size 100 x 270 x 5.7mm G.I. Flats welded to both the channels along 75 mm side (separated by 150 mm).

At the bottom the column is fixed with a BASE Plate (i) 620 x 620 x 12 mm galvanized & 6 Nos. of 33.5 mm dia holes for taking foundation bolts of size 32 mm dia 1400 mm long. On both sides of the channels (300 mm side) two nos. of stiffeners (ii) are welded with base plate and on 150 mm side two stiffeners (iii) are welded with base plate.
2.4 Beams / Girders:

The girders / beams shall be fabricated from galvanized 125 x 65 x 5.3mm channels as per the drawings / field requirements.

2.5 Dimensions and Properties

<table>
<thead>
<tr>
<th>MC DESIGNATION</th>
<th>150 x 76 mm MC</th>
<th>125 x 65 mm MC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight kg/m “M”</td>
<td>17.7</td>
<td>13.1</td>
</tr>
<tr>
<td>Sectional Area (cm$^2$) “a”</td>
<td>22.6</td>
<td>16.7</td>
</tr>
<tr>
<td>Depth of Section (mm) “D”</td>
<td>150</td>
<td>125</td>
</tr>
<tr>
<td>Width of Flange (mm) “B”</td>
<td>76</td>
<td>65</td>
</tr>
<tr>
<td>Thickness of Flange (mm) “t”</td>
<td>6.5</td>
<td>5.3</td>
</tr>
<tr>
<td>Thickness of Web (mm) ”T”</td>
<td>9.00</td>
<td>8.2</td>
</tr>
<tr>
<td>Corner Radius (mm) “R₁”</td>
<td>10.00</td>
<td>9.5</td>
</tr>
<tr>
<td>Moment of Inertia (cm$^4$)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I$_{xx}$</td>
<td>813.00</td>
<td>425</td>
</tr>
<tr>
<td>I$_{yy}$</td>
<td>110</td>
<td>61.1</td>
</tr>
<tr>
<td>Radius of Gyration (cm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R$_{xx}$</td>
<td>6.00</td>
<td>5.05</td>
</tr>
<tr>
<td>R$_{yy}$</td>
<td>2.20</td>
<td>1.91</td>
</tr>
<tr>
<td>Length in Meter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>“T₁” &amp; “T₃”</td>
<td>7500 mm</td>
<td>5000 (33Kv)</td>
</tr>
<tr>
<td>“T₂” &amp; “T₄”</td>
<td>6000 mm</td>
<td></td>
</tr>
<tr>
<td>“T₅” &amp; T₅X”</td>
<td>5500 mm</td>
<td>4000 (11Kv)</td>
</tr>
</tbody>
</table>

* where MC refers to the classification of the channels as Indian Standard Medium Weight Channels.

♦ Holes should be provided for fixing the foundation bolts as specified above and as per the drawings for the above column structures.

2.6 Tests
2.6.1 Mild steel channels and other steel sections used in the manufacture of structures shall be type tested with respect to their calculated working and ultimate tensile failure loads utilizing the mechanical properties as tabulated in this specification and IS –808 1964. This shall be achieved as per the procedure in the Transverse Strength Test.

2.6.2 Transverse Strength Test for Steel Sections

The steel sections may be tested in either a horizontal or vertical position. If tested in the horizontal position, provisions shall be made to compensate for the overhanging weight of the column.

For this purpose the overhanging portion of the column shall be supported on a moveable trolley or similar device.

The pole shall be rigidly supported at the butt end for a distance equal to the designed depth of planting.

The working load on the column should correspond to those that are likely to come onto the column during its working life. The offered designs shall meet system requirements with the point of application of the working loads as per the Bidder’s design but not more than 600 mm from the top of the column.

The steel column shall be deemed to have passed the test if no permanent deformation is visible at the rigidly supported end and the permanent set at the point of load application does not exceed 13 mm.

The load shall then be reduced to zero and increased gradually to a load equal to the design working load plus 10% of the minimum ultimate transverse load, and held for 2 minutes. The procedure shall be repeated until the load reaches a value of 80% of the minimum ultimate transverse load and thereafter increased in increments of 5%
until failure occurs.

Each time the load is applied, it shall be held from two minutes.
The column shall be deemed not to have passed the test if the observed ultimate transverse load is less than the design ultimate transverse load.

The factor of safety (FOS) for steel section is 2.

2.6.3 Anti-Corrosion Treatment

All steel sections support structures shall be treated to prevent corrosion. Where the thickness of the steel section is less than 6 mm then it shall be galvanized as per the section on surface treatment in this specification.

For steel sections of thickness greater than or equal to 6 mm then alternative means of corrosion protection may be offered, but they shall not be less than the requirements for painting in the section on surface treatment of this specification.

The corrosion prevention proposals offered by the Contractor shall be subject to the approval of the owner.

2.7.1 Bolts and nuts

All bolts, studs, screw threads, bolt heads and nuts shall comply with the appropriate national standards for metric threads, or the technical equivalent.

All nuts and pins shall be adequately locked.

Head of the bolt in bolt and nut assembly in the horizontal plane must remain in the top. All bolts, nuts shall be treated to prevent corrosion, by hot dip galvanizing and washers are to be electro galvanized.
Each bolt or stud shall project minimum three threads through its nut, except when otherwise approved for terminal board studs or relay stems.

2.8 Labels and plates

All columns shall be clearly labelled indicating, where necessary, its purpose and service positions. The material of all labels and the dimensions, legend, and method of printing / embossing shall be as per approval.

All labels and plates for outdoor use shall be of non-corroding material. Where the use of enameled iron plates is approved, the whole surface including the back and edges, shall be properly covered and resistant to corrosion. Protective washers of suitable material shall be provided front and back on the securing screws. Labels shall be engraved in English and Oriya. Name plates shall be white with black engraved lettering and shall carry all the applicable information specified in the applicable items of the Standards.

Any other relevant information which may be required for groups of smaller items for which this is not possible e.g. switch bays etc. a common name plate in Oriya or English with the title and special instructions on it shall be provided.

No scratching, corrections or changes will be allowed on name plates.

DISC INSULATORS

3.1 SCOPE.

This specification provides for design, manufacture, engineering, inspection and testing before dispatch packing and delivery FOR (destination) for Indian manufacturers of disc Insulators & Post Insulators as per technical requirements furnished in this specification.

These insulators are to be used in suspension and tension insulators strings for the suspension and anchoring of the bus-bar conductors.

Following is the list of documents constituting this package.

(i) Technical specification.
(ii) Technical data sheet.
(iii) Drawings of insulators

All the above volumes along with amendments there of shall be read and interpreted together. However, in case of a contradiction between the “Technical Specification” and any other volume, the provisions of this volume will prevail.

The insulators shall conform in all respects to high standards of engineering, design workmanship and latest revisions of relevant standards at the time of offer and purchaser shall have the power to reject any work or material which in his judgment, is not in full accordance therewith.

3.2 **STANDARDS:**

3.2.1 Except as modified in this specification, the disc insulators shall conform to the following Indian Standards, which shall mean latest revisions and amendments. Equivalent International and Internally recognized standards to which some of these standards generally correspond are also listed below.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Indian Standard</th>
<th>Title.</th>
<th>International Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>IS: 206</td>
<td>Method for Chemical Analysis of Slab Zinc.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>IS: 209</td>
<td>Specification for Zinc.</td>
<td>BS: 3436</td>
</tr>
<tr>
<td>3.</td>
<td>IS: 731</td>
<td>Porcelain insulators for overhead power lines with a normal voltage greater than 1000V</td>
<td>BS: 137(I&amp;II); IEC 274 IEC 383</td>
</tr>
<tr>
<td>6.</td>
<td>IS: 2486</td>
<td>Specification for Insulator fittings for overhead power lines with a nominal voltage greater than 1000V.</td>
<td>BS: 3288</td>
</tr>
<tr>
<td></td>
<td>Part – II</td>
<td>Dimensional Requirements.</td>
<td>IEC: 120</td>
</tr>
<tr>
<td></td>
<td>Part – III</td>
<td>Locking devices.</td>
<td>IEC: 372</td>
</tr>
<tr>
<td>7.</td>
<td>IS: 2629</td>
<td>Recommended practice for Hot Dip Galvanisation for iron and steel.</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>IS: 2633</td>
<td>Testing for Uniformity of Coating</td>
<td></td>
</tr>
</tbody>
</table>
### 3.2.2 The standards mentioned above are available from:

<table>
<thead>
<tr>
<th>Reference</th>
<th>Abbreviation</th>
<th>Name &amp; Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS</td>
<td></td>
<td>British Standards, British Standards Institution, 101, Pentonvile Road, N-19 ND,U</td>
</tr>
<tr>
<td>IEC / CISPR</td>
<td></td>
<td>International Electro technical commission Electro Technique International, 1, Rue de verembe Geneva SWITZERLAND.</td>
</tr>
<tr>
<td>IS</td>
<td></td>
<td>Bureau of Indian Standards, Manak Bhavan, 9 Bahadurshah Zafar Marg, New Delhi-110001</td>
</tr>
<tr>
<td>ISO</td>
<td></td>
<td>International Organisation for Standardization. Danish Board of Standardization Dansk Standardizing Sraat Aurehoegvej-12 DK-2900 Helleprup DENMARK.</td>
</tr>
<tr>
<td>NEMA</td>
<td></td>
<td>National Electric Manufacturers Association 1`55, East 44th. Street New York, NY 10017 USA</td>
</tr>
</tbody>
</table>

### 3.3 (A) **PRINCIPAL PARAMETERS.**

### 3.3.1 **DETAILS OF DISC INSULATORS:**
The Insulator strings shall consist of standard discs for use in three phases, 50 Hz 33/11KV S/s of SOUTHCO in a moderately polluted atmosphere. The discs shall be cap and pin, ball and socket type, radio interference and have characteristics as shown in Table-I and all ferrous parts shall be hot dip galvanized as per the latest edition of IS 2629. The zinc to be used for making sleeves shall be 99.95 % pure.

The size of disc insulator, minimum creepage distance the number to be used in different type of strings, their electromechanical strength and mechanical strength of insulator string along with hardware shall be as follows:

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Type of String.</th>
<th>Size of disc. Insulator (mm)</th>
<th>Minimum creepage distance of each disc(mm)</th>
<th>No. of standard discs 33KV</th>
<th>Electromechanical strength of insulator string fittings (KN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Single suspension</td>
<td>255x145</td>
<td>430</td>
<td>1x3</td>
<td>45</td>
</tr>
<tr>
<td>2.</td>
<td>Double suspension</td>
<td>-do-</td>
<td>-do-</td>
<td>2x3</td>
<td>2x45</td>
</tr>
<tr>
<td>3.</td>
<td>Single Tension</td>
<td>280x170</td>
<td>-do-</td>
<td>1x4</td>
<td>70</td>
</tr>
<tr>
<td>4.</td>
<td>Double Tension</td>
<td>-do-</td>
<td>-do-</td>
<td>2x4</td>
<td>2x70</td>
</tr>
</tbody>
</table>

3.3.2 SPECIFICATION DRAWINGS:

The specification in respect of the disc insulators are described. These specification for information and guidance of the Bidder only. The drawings to be furnished by the supplier shall be as per his own design and manufacture and in line with the specification.

3.3 (B) GENERAL TECHNICAL REQUIREMENTS:

3.3.1 Porcelain:

The porcelain used in the manufacture of the shells shall be ivory white nonporous of high dielectric, mechanical and thermal strength, free from internal stresses blisters, laminations, voids, forgone matter imperfections or other defects which might render it in any way unusable for insulator shells. Porcelain shall remain unaffected by climatic conditions ozone, acid, alkalis, zinc or dust. The manufacturing shall be by the wet process and impervious character obtained by through verification.

The insulator shall be made of highest grade, dense, homogeneous, wet-process porcelain, completely and uniformly vitrified throughout to produce uniform mechanical and electrical strength and long life service. The porcelain shall be free from warping, roughness, cracks, blisters, laminations, projecting points foreign particles and other defects, except those within
the limits of standard accepted practice. Surfaces and grooves shall be shaped for easy cleaning. Shells shall be substantially symmetrical.

3.3.2 Porcelain glaze:
Surface to come in contact with cement shall be made rough by stand glazing. All other exposed surfaces shall be glazed with ceramic materials having the same temperature coefficient of expansion as that of the insulator shell. The thickness of the glaze shall be uniform throughout and the colour of the glaze shall be down. The Glaze shall have a visible luster and smooth on surface and be capable of satisfactory performance under extreme tropical climatic weather conditions and prevent ageing of the porcelain. The glaze shall remain under compression on the porcelain body throughout the working temperature range.

3.4 METAL PARTS:

(i) Cap and Ball Pins:

Ball pins shall be made with drop forged steel caps with malleable cast iron. They shall be in one single piece and duly hot dip galvanized. They shall not contain parts or pieces joined together welded, shrink fitted or by any other process from more than one piece of materials. The pins shall be of high tensile steel, drop forged and heat-treated. The caps shall be cast with good quality black heart malleable cast iron and annealed. Galvanizing shall be by the hot dip process with a heavy coating of zinc of very high purity. The bidder shall specify the grade composition and mechanical properties of steel used for caps and pins. The cap and pin shall be of such design that it will not yield or distort under the specified mechanical load in such a manner as to change the relative spacing of the insulators or add other stresses to the shells. The insulator caps shall be of the socket type provided with nonferrous metal or stainless steel cotter pins and shall provide positive locking of the coupling.

(ii) Security Clips:

The security clips shall be made of phosphor bronze or of stainless steel.

3.5 FILLER MATERIAL:

Cement to be used, as a filler material be quick setting, fast curing Portland cement. It shall not cause fracture by expansion or loosening by contraction. Cement shall not react chemically with metal parts in contact with it and its thickness shall be as small and as uniform as possible.

3.6 MATERIALS DESIGN AND WORKMANSHIP:

3.6.1 GENERAL:

All raw materials to be used in the manufacture of these insulators shall be subject to strict raw material quality control and to stage testing/quality control during manufacturing stage to ensure the quality of the final end product. Manufacturing shall conform to the best engineering practices adopted in the field of extra high voltage transmission. Bidders shall
therefore offer insulators as are guaranteed by them for satisfactory performance on Transmission lines.

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

3.6.2 INSULATOR SHELL:
The design of the insulator shells shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration. Shells with cracks shall be eliminated by temperature cycle test followed by mallet test. Shells shall be dried under controlled conditions of humidity and temperature.

3.6.3 METAL PARTS:
1) The pin and cap shall be designed to transmit the mechanical stress to the shell by compression and develop uniform mechanical strength in the insulator. The cap shall be circular with the inner and outer surfaces concentric and of such design that it will not yield or distort under loaded conditions. The head portion of the pinball shall be suitably designed so that when the insulator is under tension the stresses are uniformly distributed over the pinhole portion of the shell. The pinball shall move freely in the cap socket either during assembly of a string or during erection of a string or when a string is placed in position.

ii) Metal caps shall be free from cracks, seams, shrinks, air holes, blowholes and rough edges. All metal surfaces shall be perfectly smooth with no projecting part or irregularities, which may cause corona. All load bearing surfaces shall be smooth and uniform so as to distribute the loading stress uniformly. Pins shall not show any microscopically visible cracks, inclusions and voids.

3.6.4 GALVANIZING:
All ferrous parts, shall be hot dip galvanized in accordance with IS: 2629. The zinc to be used for galvanizing shall conform to grade Zn 99.5 as per IS: 209. The zinc coating shall be uniform, smoothly adherent, reasonably light, continuous and free from impurities such as flux, ash, rust stains, bulky white deposits and blisters. Before ball fittings are galvanized, all die flashing on the shank and on the bearing surface of the ball shall be carefully removed without reducing the designed dimensional requirements.

3.6.5 CEMENTING:
The insulator design shall. Be such that the insulating medium shall not directly engaged with hard metal. The surface of porcelain and coated with resilient paint to offset the effect of difference in thermal expansions of these materials. High quality Portland cement shall be used for cementing the porcelain to the cap & pin.

3.6.6 SECURITY CLIPS (LOCKING DEVICES)
The security clips to be used as locking device for ball and socket coupling shall be ‘R’ shaped hump type to provide for positive locking of the coupling as per IS: 2486 (Part-IV). The legs of the security clips shall allow for spreading after installation to prevent complete withdrawal from the socket. The locking device shall resilient corrosion resistant and of sufficient mechanical strength. There shall be no possibility of the locking device to be displaced or be capable of rotation, which placed in position, and under no circumstances shall it allow separation of insulator units and fittings. ‘W’ type security clips are also acceptable. The hole for the security clip shall be counter sunk and the clip shall be of such design that the eye of the clip may be engaged by a hot line clip puller to provide for disengagement under energized conditions. The force required for pulling the clip into its unlocked positions shall not be less than 50 N (5 kg.) or more than 500 N (50 kgs.).

3.6.7 MARKING:

Each insulator shall have the rated combined mechanical and electrical strength marked clearly on the porcelain surface. Each insulator shall also bear symbols identifying the manufacturer, month, and year of manufacture. Marking on porcelain shall be printed, not impressed, and shall be applied before firing.

3.6.8 BALL AND SOCKET DESIGNATION:

The dimensions of the ball and sockets for 70 and 90 KN discs shall be of 16 mm and for 120 KN and 160 KN discs shall be of 20 mm designation in accordance with the standard dimensions stated in IS: 2486 (Part-II).

3.6.9 DIMENSIONAL TOLERANCE OF INSULATOR DISCS:

It shall be ensured that the dimensions of the disc insulators are within the limits specified below:

a) Diameter of Disc (mm)

<table>
<thead>
<tr>
<th>Disc Type</th>
<th>Standard</th>
<th>Maximum</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 KN Disc</td>
<td>255</td>
<td>266</td>
<td>244</td>
</tr>
<tr>
<td>70 KN Disc</td>
<td>280</td>
<td>293</td>
<td>267</td>
</tr>
</tbody>
</table>

b) Ball to Ball spacing Between Discs (mm)

<table>
<thead>
<tr>
<th>Disc Type</th>
<th>Standard</th>
<th>Maximum</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 KN Disc</td>
<td>145</td>
<td>149</td>
<td>141</td>
</tr>
<tr>
<td>70 KN Disc</td>
<td>170</td>
<td>175</td>
<td>165</td>
</tr>
</tbody>
</table>

3.6.10 INTERCHANGEABILITY:

The insulators inclusive of the ball and socket fittings shall be of standard design suitable for use with hardware fittings of any make conforming to relevant Indian Standards.

3.6.11 FREEDOM FROM DEFECTS:

Insulators shall have none of the following defects:

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1) Ball pin shake.
2) Cementing defects near the pin like small blow holes, small hair cracks lumps etc.
3) Sand fall defects on the surface of the insulator.

3.7. INSULATOR STRINGS:

3.7.1 TYPE AND RATING:
The insulator strings shall be formed with standard discs described in this specification for use on 3 phases 33 KV 50 Hz effectively earthed systems in an atmosphere with pollution level as indicated in project synopsis. Suspension insulator strings for use with suspension/tangent supports are to be fitted with discs 45 KN EMS rating while tension insulator strings for use with Anchor / Tension towers are to be fitted with discs of 70 KN KN EMS level rating.

3.7.2 STRING SIZE:
The sizes of the disc insulator, the number to be used in different types of strings, their electro-mechanical strength and minimum nominal creep age distance shall be as given in this specification.

3.7.3 Insulator units after assembly shall be concentric and coaxial within limits as permitted by Indian Standards.

3.7.4 The strings design shall be such that when units are coupled together there shall be contact between the shell of one unit and metal of the adjacent unit.

3.8 DIMENSIONAL TOLERANCE OF INSULATORS DISCS
It shall be ensured that the dimensions of the long rod insulators are within the limits as per relevant IEC/ISS.

3.9 TESTS (FOR DISC INSULATORS):

The following tests shall be carried out on the insulator string and disc insulators.

3.9.1 TYPE TEST:
This shall mean those tests, which are to be carried out to prove the design, process of manufacture and general conformity of the material and product with the intents of this specification. These tests shall be conducted on a representative number of samples prior to commencement of commercial production. The Bidder shall indicate his schedule for carrying out these tests.

3.9.2 ACCEPTANCE TESTS:
This shall mean these tests, which are to be carried out on samples taken from each lot offered for pre-dispatch inspection for the purpose of acceptance of the lot.

3.9.3 ROUTINE TESTS:
This shall mean those tests, which are to be carried out on each insulator to check the requirements, which are likely to vary during production.

3.9.4 TESTS DURING MANUFACTURE:

Stage tests during manufacture shall mean those tests, which are to be carried out during the process of manufacture to ensure quality control such that the end product is of the designed quality conforming to the intent of this specification.

3.9.5 TEST VALUE:

For all type and acceptance tests the acceptance values shall be the value guaranteed by the bidder in the guaranteed technical particulars of the acceptance value specified in this specification of the relevant standard whichever is more stringent for that particular test.

3.9.6 TEST PROCEDURE AND SAMPLING NORMS:

The norms and procedure of sampling for the above tests shall be as per the relevant Indian Standard or the internationally accepted standards. This will be discussed and mutually agreed to between the supplier and purchaser before placement of order. The standards and normal according to which these tests are to be carried out are listed against each test. Where a particular test is a specific requirement of this specification, the norms land procedure for the same shall be as mutually agreed to between the supplier and the purchaser in the quality assurance programme.

3.9.7 TYPE, ROUTINE & ACCEPTANCE TESTS:

The following type test shall be conducted on a suitable number of individual unit components, materials or complete strings.

1. **On complete insulator string with hardware fittings**
   
   a) Power frequency voltage withstand test with corona control rings and under wet condition. Standards: BS:137(Part-I)
   
   b) Impulse voltage withstand test under dry condition. Standards: IEC: 383
   
   c) Mechanical strength test. Standards: As per this specification.

2. **On Insulators:**
   
   a) Verification of dimensions. Standards: IS: 731
   
   b) Thermal mechanical performance test: Standards: IEC:575
   
   c) Power frequency voltage withstand and flashover (I) dry (ii) wet. Standards: BS: 173
   
   d) Impulse voltage withstand flashover test (dry) Standards: IEC: 383
   
   e) Visible discharge test (dry) Standards: IS:731

   All the type tests given under clause No.5.14 above shall be conducted on single suspension
and Double Tension insulator string along with hardware fittings.

3. ACCEPTANCE TESTS:
   For insulator:
   a) Visual examination : IS:731
   b) Verification of dimensions. : IS:731
   c) Temperature cycle test. : IS:731
   d) Galvanizing test. : IS:731
   e) Mechanical performance test. : IEC:575
   f) Test on locking device for ball and socket coupling. : IEC:372
   g) Eccentricity test. As per this specification.
   h) Electro-mechanical strength test. :
   i) Puncture test. : IS:731
   j) Porosity test. : IS:731

4. ROUTINE TESTS:
   For insulators:
   a) Visual inspection. : IS:731
   b) Mechanical routine test. :
   c) Electrical routine test. : IEC:383

5. TEST DURING MANUFACTURE:
   Chemical analysis, hardness test and magnetic particle inspection for forgings.
   As per this specification.

3.9.8 ADDITIONAL TESTS:

The purchaser reserves the right for carrying out any other tests of a reasonable nature at the works of the supplier/ laboratory or at any other recognized laboratory/ research institute in addition to the above mentioned type, acceptance and routine tests at the cost of the purchaser to satisfy that the material complies with the intent of this specification.

3.9.9 CO-ORDINATION FOR TESTING:

For insulator strings, the supplier shall arrange to conduct testing of their disc insulators with the hardware fittings to be supplied to the purchaser by other suppliers. The supplier is also required to guarantee overall satisfactory performance of the disc insulator with the hardware fittings.

3.10 TEST CHARGES AND TEST SCHEDULE:

3.10.1 TYPE TEST:
The insulator offered shall be fully type tested as per this specification. In case the equipment of the type and design offered, has already been type tested in an independent test laboratory. The bidder shall furnish four sets of type test reports along with the offer. These tests must not have been conducted earlier than five years. The purchaser reserves the right to demand repetition of some or all type tests in the presence of purchasers’ carrying representative. For this purpose the bidder may quote unit rates for carrying out each type test. These prices shall be taken into consideration for bid evaluation. For any change in the design/type already type tested and the design/type offered against this specification, purchaser reserves the right to demand repetition of tests without any extra cost.

3.10.2 ACCEPTANCE AND ROUTINE TEST:

All acceptance and routine tests as stipulated herein shall be carried out by the supplier in the presence of purchaser’s representative.

3.10.3 Immediately after finalization of the programme of type/acceptance/routine testing, the supplier shall give sufficient advance intimation to the purchaser to enable him to depute his representative for witnessing the tests.

3.10.4 For type tests involving tests on a complete insulator string with hardware fittings, the purchaser will advice the supplier of the hardware fittings to provide the necessary fittings to the place of the test.

3.10.5 In case of failure of the complete string in any type tests, the supplier whose product has failed in the tests shall get the tests repeated at his cost. In case of any dispute, assessment of the purchaser as to the items that has caused the failure in any of the type tests shall be final and binding.

3.10.6 VOLTAGE DISTRIBUTION TEST:

a) The voltage across each insulator unit shall be measured by sphere gap method. The result obtained shall be converted into percentage and proportionate correction be applied as to give a total of 100% distribution.

b) The complete insulator string along with its hardware fitting excluding arcing horn corona controlling/grading ring and suspension assembly/dead end assembly shall be subject to a load equal to 50% of the specified minimum ultimate tensile strength (UTS) which shall be increased already rate to 68% of the minimum UTS specified. The load shall be held for five minutes and then removed. After removal of the load, the string components shall not show any visual deformation and it shall be possible to disassemble them by hand,. Hand tools may be used to remove cotter pins and loosen the nuts initially. The string shall then be reassembled and loaded to 50% of UTS and the load shall be further increased at a steady rate till the specified minimum UTS and held for one minute. No fracture should occur during this period. The applied load shall then be increased until the failing loads reached and the value recorded.
3.10.7 VIBRATION TEST:
The suspension string shall be tested in suspension mode, and tension string in tension mode itself in laboratory span of minimum 30 meters. In the case of suspensions string a load equal to 600 Kg. shall be applied along with the axis of the suspensions string by means of turn buckle. The insulators string along with hardware fittings and two sub conductors throughout the duration of the test vibration dampers shall not be used on the test span. Both the sub-conductors shall be vertically vibrated simultaneously at one of the resonance frequencies of the insulator string (more than 10Hz) by means of vibration inducing equipment. The amplitude of vibration at the antipode point nearest to the string shall be measured and the same shall not be less than 120.4 being the frequency of vibration. The insulator strings shall be vibrated for five million cycles then rotated by 90 deg and again vibrated for 5 million cycles without any failure, after the test, the disc insulators shall be examined for looseness of pins and cap or any crack in the cement. The hardware fittings shall be examined to fatigue fatter and mechanical strength test. There shall be no deterioration of properties of hardware components and disc insulators after the vibration test. The disc insulators shall be subjected to the following tests as per relevant standards.

<table>
<thead>
<tr>
<th>Test</th>
<th>Percentage of disc to be tested</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Temperature cycle test followed by</td>
<td>60</td>
</tr>
<tr>
<td>Mechanical performance test.</td>
<td>40</td>
</tr>
<tr>
<td>b) Puncture test (for porcelain insulator only)</td>
<td></td>
</tr>
</tbody>
</table>

3.11 INSPECTION:

i. Purchaser and its representative shall at all times be entitled to have access to the works and to all places of manufacturer where insulators are manufactured and the supplier shall afford all facilities to them for unrestricted inspection of the works, inspection of materials, inspection of manufacturing process of insulators and for conducting necessary tests as specified herein.

ii. The supplier shall keep the purchaser informed in advance of the time of starting and of progress of manufacture of insulators in its various stages so that arrangements could be made for inspection.

iii. No material shall be dispatched from its point of manufacture unless the materials has been satisfactorily inspected and tested.

iv. The acceptance of any quantity of insulators shall in no way relieve the supplier of his responsibility for meeting all the requirement of this specification and shall not prevent subsequent rejection, if such insulators are later found to be defective.

3.12 IDENTIFICATION MARKING:

a) Each unit of insulator shall be legibly and indelibly marked with the trade mark of the supplier, the year of manufacture, the guaranteed combined mechanical and electrical strength in kilo-Newton abbreviated by ‘KN’ to facilitate easy identification and proper use.

b) The marking shall be on porcelain for porcelain insulators. The marking shall be printed and not impressed and the same shall be applied before firing.
3.14 **CHEMICAL ANALYSIS OF ZINC USED FOR GALVANIZING.**

Samples taken from the zinc ingot shall be chemically analyzed as per IS: 209. The purity of zinc shall not be less than 99.95%.

3.15 **TESTS FOR FORGINGS:**

The chemical analysis hardness tests and magnetic particle inspection for forgings will be as per the internationally recognized procedures for these tests. The sampling will be based on heat number and heat treatment batch. The details regarding test will be as discussed and mutually agreed to by the supplier and purchaser in quality assurance programme.

3.16 **TESTS ON CASTING:**

The chemical analysis mechanical and metallographic tests and magnetic particle inspection for castings will be as per the internationally recognized procedures for these tests. The samplings will be based on heat number and heat treatment batch. The details regarding test will be as discussed and mutually agreed to by the supplier and purchaser in quality assurance programme.

3.17 **HYDRAULIC INTERNAL PRESSURE TEST ON SHELLS:**

The test shall be earned out on 100% shells before assembly. The details regarding test will be as discussed and mutually agreed to by the suppliers and purchaser in Quality Assurance Programme.

3.18 **THERMAL MECHANICAL PERFORMANCE TEST:**

The thermal mechanical performance test shall be carried out on minimum 15 number of disc insulators units as per the procedure given in IEC 575. The performance of the insulator unit shall be determined by the same standard.

3.19 **ECCENTRICITY TEST:**

The insulator shall be vertically mounted on a future using dummy pin and socket. A vertical scale with horizontal slider shall be used for the axial run out. The pointer shall be positioned in contact with the bottom of the outermost petticoat of the disc. The disc insulators shall be rotated with reference to the fixture and the slider shall be allowed to move up and down on the scale but always maintaining contact with the bottom of the outermost petticoats. After one full rotation of the disc the maximum and minimum position the slider has reached on the scale can be found out. Difference between the above two readings shall satisfy the guaranteed value for axial run out.

Similarly using a horizontal scale with veridical slider the radial run out shall be measured. The slider shall be positioned on the scale to establish contact with the circumstance of the disc insulator and disc insulator rotated on its future always maintaining the contact. After one full rotation of the disc the maximum and minimum position the slider has reached on the
scale can be found out. Difference between the above two readings shall satisfy the guaranteed value for axial run out.

3.20 CRACK DETECTION TEST:

Crack detection test shall be carried out on each ball and pin before assembly of disc unit. The supplier shall maintain complete record of having conducted such tests on each and every piece of ball pin. The bidder shall furnish full details of the equipment available with him for crack test and also indicate the test procedure in detail.

POST INSULATORS

4.0 Post insulator shall conform in general to IS 2544, IEC 168 and IEC 815.

Technical Parameters

<table>
<thead>
<tr>
<th>SI No.</th>
<th>Parameters</th>
<th>33kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Type</td>
<td>Confirming to IEC 273 (solid core)</td>
</tr>
<tr>
<td>2</td>
<td>Voltage class (kV)</td>
<td>36</td>
</tr>
<tr>
<td>3</td>
<td>Dry and wet one minute withstand voltage (kV rms)</td>
<td>70</td>
</tr>
<tr>
<td>4</td>
<td>Dry lightning impulse withstand voltage (kV p)</td>
<td>170</td>
</tr>
<tr>
<td>5</td>
<td>Wet switching surge withstand voltage (kV p)</td>
<td>NA</td>
</tr>
<tr>
<td>6</td>
<td>Max. RIV at corona extinction voltage (micro volts)</td>
<td>NA</td>
</tr>
<tr>
<td>7</td>
<td>Corona extinction voltage (kV rms)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Total minimum cantilever strength (kg)</td>
<td>Not &lt; 300</td>
</tr>
<tr>
<td>10</td>
<td>Minimum torsion moment</td>
<td>As per IEC 273</td>
</tr>
<tr>
<td>11</td>
<td>Total height of insulator (mm)</td>
<td>325</td>
</tr>
<tr>
<td>12</td>
<td>Minimum PCD (mm) top/bottom</td>
<td>127/ 254</td>
</tr>
<tr>
<td>13</td>
<td>No. of bolts top/bottom</td>
<td>4/ 8</td>
</tr>
<tr>
<td>14</td>
<td>Diameter of bolt holes (mm) top/bottom</td>
<td>M16/ 18</td>
</tr>
<tr>
<td>15</td>
<td>Pollution level as per IEC 815</td>
<td>Heavy</td>
</tr>
<tr>
<td>16</td>
<td>Minimum total creepage distance (mm)</td>
<td>900</td>
</tr>
</tbody>
</table>

4.1 Constructional features

Post type insulators shall consist of a porcelain part permanently secured in a metal base to be mounted on the supporting structures. They shall be capable of being mounted upright and be
designed to withstand any shocks to which they may be subjected to by the operation of the associated equipment. Only solid core insulators will be acceptable. Porcelain used shall be homogeneous, free from lamination, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture. Glazing of the porcelain shall be of uniform brown in colour, free from blisters, burrs and other similar defects. The insulator shall have alternate long and short sheds with aerodynamic profile. The shed profile shall also meet the requirements of IEC 815 for the specified pollution level. When operated at normal rated voltage there shall be no electric discharge between conductor and insulators which would cause corrosion or injury to conductors or insulators by the formation of substance produced by chemical action. The design of the insulators shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration. All ferrous parts shall be hot dip galvanized in accordance with the latest edition of IS: 2633, and IS: 4579. The zinc used for galvanizing shall be grade Zn 99.95 as per IS: 209. The zinc coating shall be uniform, adherent, smooth, reasonably bright, continuous and free from imperfections such as flux ash, rust stains, bulky while deposits and blisters. The metal parts shall not produce any noise generating corona under the operating conditions. Flat washer shall be circular of a diameter 2.5 times that of bolt and of suitable thickness. Where bolt heads/nuts bear upon the beveled surfaces they shall be provided with square tapered washers of suitable thickness to afford a seating square with the axis of the bolt. Bidder shall make available data on all the essential features of design including the method of assembly of shells and metals parts, number of shells per insulator, the manner in which mechanical stresses are transmitted through shells to adjacent parts, provision for meeting expansion stresses, results of corona and thermal shock tests, recommended working strength and any special design or arrangement employed to increase life under service conditions.

4.2 TEST DETAILS
The following Type, acceptance and routine tests shall be carried out and results given along with certification as appropriate in the Technical Data Schedule and Test Certificates Schedule of this specification.

4.2.1 TYPE TESTS:
The post insulators shall be subjected to the following type test:
- Visible discharge test
- Impulse voltage withstand test
- Dry power frequency voltage withstand test
- Wet power frequency voltage withstand test
- Mechanical strength test for post insulators as per IEC 168 / IS: 2544.

4.2.2 Acceptance Tests
The test samples having withstood the routine tests shall be subjected to the following tests according to the sampling procedure of IEC 383 clause 23:

- Verification of dimensions
- Temperature cycle test
- Mechanical strength test for post insulators as per IEC 168/ IS 2544
- Porosity test on post insulators
- Puncture test
- Test for galvanization of ferrous parts

4.2.3 Routine Tests

- Visual examination
- Power frequency voltage dry test
- Tests to prove mechanical strength.

HARDWARES

5.0 TECHNICAL SPECIFICATION FOR HARDWARE FITTINGS

5.1 SCOPE
This Specification covers design manufacture, testing at manufacturer’s Works, supply and delivery of power conductor accessories, insulator and hardware fittings for string insulators suitable for use in 33 KV Over-head transmission lines and sub-stations of SOUTHCO. The hardwares to be supplied shall be as per approved drawings of SOUTHCO. Any change there of shall be with due permission of Project Manager. The firm shall submit his drawings for approval of SOUTHCO and only after which the manufacturing shall be started.

The materials/equipment offered, shall be complete with all components, which are necessary or usual for the efficient performance and satisfactory maintenance. Such part shall be deemed to be within the scope of contract.

5.2 STANDARDS
The materials covered under this Specification shall comply with the requirement of the latest version of the following standards as amended upto date, except where specified otherwise.

i) IS:2486 Part-II & III Insulator fitting for overhead power lines with a nominal voltage greater than 1,000 volts.

ii) IS:2121 Part I & II Conductor & earth wire accessories for overhead power lines.

iii) IS:9708 Stock Bridge Vibration Dampers on overhead power lines.
iv) IS:2633  Method of testing of uniformity of coating on zinc coated articles


vi) BS:916  Specification for Hexagonal bolts and nuts.

5.3 MATERIALS AND DESIGN

Aluminium and aluminium alloys, malleable iron and forget steel, having required mechanical strength, corrosion resistance and mach inability depending on the types of application for which accessories / fittings are needed, shall be employed.

In manufacturer of the accessories / fittings, the composition of the aluminium alloys used shall be made available to Employer if required for verification.

The materials offered shall be of first class quality, workmanship, well finished and approved design. All castings shall be free from blow-holes, flaws, cracks of other defects and shall be smooth, close grained and true forms and dimensions. All machined surfaces should be free, smooth and well finished.

Metal fittings of specified material for conductor and earth wire accessories and string insulator fittings are required to have excellent mechanical properties such as strength, toughness and high resistance against corrosion. All current carrying parts shall be so designed and manufactured that contact resistance is reduced to the minimum.

All bolts, nuts, bolt-heads shall be the white worth’s standard thread. Bolt heads and nuts shall be hexagonal. Nuts shall be locked in an approved manner. The treads in nuts and tapped holes shall be cut after galvanizing an shall be well fabricated and greased. All other treads shall be cut before galvanizing. The bolt treads shall be undercut to take care of increase in diameter due to galvanizing.

All nuts shall be made of materials to Clause 4.8 of IS:1367 (latest edition) with regard to its mechanical properties.

The general design conductor and earth wire accessories and insulator fittings shall be such as to ensure uniformity, high strength, free from corona formation and high resistance against corrosion even in case of high level of atmosphere pollution.

All hooks, eyes, pins, bolts, suspension clamps and other fittings for attaching to the tower or to the line conductor or to the earth wire shall be so designed that the effects of vibration, both on the conductor and the fittings itself, are minimized.

Special attention must be given to ensure smooth finished surface throughout. Adequate bearing area between fittings shall be provided and point or line contacts shall be avoided.
All accessories and hard wares shall be free from cracks, shrinks, slender air holes, burrs or rough edges.

The design of the accessories and hard wares shall be such as to avoid local corona formation or discharge likely to cause interference to tele-transmission signals of any kind.

5.4 GALVANISING:

All ferrous parts of conductor and ground wire accessories and insulator hard wares shall be galvanized in accordance with IS: 2629-Recommended Practice for hot dip galvanizing of iron and steel or any other equivalent authorities standards. The weight of zinc coating shall be determined as per method stipulated in IS: 2633 for testing weights, thickness and uniformity of coating of hot dip galvanized articles or as per any other equivalent authoritative standards. The zinc used or galvanization shall conform to grade zn 98 of IS: 209. The galvanized parts shall withstand four (4) dips of 1 minute each time while testing uniformity of zinc coating as per IS: 2633. Spring washers shall be electro galvanized.

5.5 INSULATOR HARDWARES

The insulator disc hardware and string assemblies to be offered by the bidder shall be suitable to meet the requirement given in the specific technical particulars as detailed hereinafter. Hardware for suspension and tension insulator shall be suitable for insulator with normal pin shank diameter of 20 mm. in case of tension string unit and 16mm. for suspension string unit. Each insulator string shall generally include the following hardware components.

<table>
<thead>
<tr>
<th>Single Suspension Set.</th>
<th>Double Suspension Set.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Ball Hook.</td>
<td>i) Ball Hook.</td>
</tr>
<tr>
<td>b) tower side arcing horn</td>
<td>(i) Socket clevis with R-Type security clip-3 Nos.</td>
</tr>
<tr>
<td>c) Socket Eye with R-Type security clip.</td>
<td>(ii) Yoke Plate-2 Nos.</td>
</tr>
<tr>
<td>d) Line side arcing horn.</td>
<td>(iii)Tower side arcing horns-2Nos.</td>
</tr>
<tr>
<td>e) Suspension clamps</td>
<td>(iv) Ball clevis – 2 Nos.</td>
</tr>
<tr>
<td></td>
<td>(v) Line side arcing homs-2 Nos.</td>
</tr>
<tr>
<td></td>
<td>(vi) Clevis Eye.</td>
</tr>
<tr>
<td></td>
<td>(vii) Suspension Clamp.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Single Tension Set :
<table>
<thead>
<tr>
<th>Double Tension Set :</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Anchor Shackles.</td>
</tr>
<tr>
<td>b) Ball Eye.</td>
</tr>
<tr>
<td>c) Tower side arcing horn.</td>
</tr>
<tr>
<td>d) Socket Clevis with R-Type</td>
</tr>
<tr>
<td>security clip.</td>
</tr>
</tbody>
</table>
e) Line side arcing horn  e) Ball Clevis – 2 Nos.
f) Bolted type dead end clamp. f) Socket Clevis with R-Type security 
clip – 2 Nos.
g) Line side arcing horns. g) Line side arcing horns.
h) Bolted type dead end clamps.

5.6 SUSPENSION CLAMPS

This clamp will be envelope type made out of aluminum alloy suitable for accommodating 
preformed armored rod.

5.7 TENSION CLAMPS

The Tension Clamps shall be made out of aluminium alloy and of 4 pair bolted (M-16) type 
suitable for 345 mm² AAA PANTHER – up conductor (In case of lines it will be suitable for 
80mm²100 mm² 150 mm²) The tension clamps shall not permit slipping or damage to failure 
of the complete conductor or any part thereof at a load less than 90% of the ultimate strength 
of conductor. The mechanical efficiency of tension / clamps shall not be affected by method 
of erection involving come / along or similar clamps or tension stringing operation during or 
after assembly and erection of tension clamp itself. The tension clamp shall be of a design that 
will ensure unrestricted flow of current without use of parallel groove clamps. 
The clamps shall be as light as possible.

5.8 ARCING HORNS

Each hardware assembly shall have provision for attaching arcing horns of both adjustable 
and non/adjustable type across the suspension and tension strings or tower side. However each 
hardware assembly shall be provided with arching horn of fixed type on line side only.

5.9 TESTS, TEST CERTIFICATE AND PERFORMANCE REPORTS

The fittings and accessories for the power conductor, insulator and hardware shall be tested in 
accordance with IS:2121, IS:2486, BS:916 for hexagonal bolts and nuts or any other 
authoritative equivalent standards. Six sets of type and routine test certificates and 
performance reports are to be submitted by the bidder.
The Employer however, reserves the right to get all the tests performed in accordance with the 
relevant I.S. Specification as Acceptance Test in presence of Employer’s representatives. 
The bidder shall clearly state the testing facilities available in the laboratory at his Works and 
his ability to carry out the tests in accordance with this Specification. All the specified tests 
shall be carried out without any extra cost.
Acceptance Test for power conductor accessories.
a) Visual examination
b) Dimensional verification
c) Failing load test
d) Slip strength test (for clamps)
e) Electrical resistance test  
f) Fatigue test (for vibration dampers)  
g) Mass pull off test (for vibration dampers)  
h) Galvanizing test.

5.10 ACCEPTANCE TEST FOR HARDWARES
i) Dimensional verification.  
ii) Ultimate tensile test.  
iii) Slip strength test.  
iv) Electrical resistance test.  
v) Heating cycle test  
vi) Breaking strength of full string assembly.  
vii) Galvanizing test.

5.11 BONDING PIECES:

a) material : flexible copper bond (37/7/0.417 mm. tinned copper flexible stranded cable).  
b) Length : Not less than 750 mm.  
c) Bolt size : 16mm x 40 mm.  
d) Copper area. : 34 sq.mm.  
e) Thickness of long : 6 mm.  
f) Material for connecting socket : Tinned Brass

5.12 FASTENERS: Bolts, Nuts & Washers

1. All bolts and nuts shall conform to IS-6639 – 1972. All bolts and nuts shall be galvanized. All bolts and nuts shall have hexagonal heads, the heads being truly concentric, and square with the shank, which must be perfectly straight.
2. Bolts up-to M16 and having length up-to ten times the diameter of the bolt should be manufactured by cold forging and thread rolling process to obtain good and reliable mechanical properties and effective dimensional control. The shear strength of bolt for 5.6 grades should be 310 Mpa minimum as per IS-12427. Bolts should be provided with washer face in accordance with IS-1363 Part-I to ensure proper bearing.
3. Fully threaded bolts shall not be used. The length of the bolt shall be such that the threaded portion shall not extend into the place of contact of the component parts.
4. All bolts shall be threaded to take the full depth of the nuts and threaded enough to permit the firm gripping of the component parts but not further. It shall be ensured that the threaded portion of the bolt protrudes not less than 3 mm and not more than 8 mm when fully tightened. All nuts shall fit and be tight to the point where shank of the bolt connects to the head.
5. Flat washers and spring washers shall be provided wherever necessary and shall be of positive lock type. Spring washers shall be electro-galvanized. The thickness of washers shall conform to IS-2016-1967.
6. The bidder shall furnish bolt schedules giving thickness of components connected, the nut and the washer and the length of shank and the threaded portion of the bolts and size of holes and any other special details of this nature.
7. To obviate bending stress in bolt, it shall not connect aggregate thickness more than three times its diameter.
8. Bolts at the joints shall be so staggered that nuts may be tightened with spanners without fouling.
9. Fasteners of grade higher than 8.8 are not to be used and minimum grade for bolts shall be 5.6.

5.13 **GENERAL:**

1. All ferrous parts including fasteners shall be hot dip galvanized, after all machining has been completed. Nuts may however be tapped (threaded) after galvanizing and the threads oiled. Spring washers shall be electro-galvanized. The bolt threads shall be undercut to take care of the increase in diameter due to galvanizing. Galvanizing shall be done in accordance with IS-2629-1985 and shall satisfy the tests mentioned in IS: 2633-1986. Fasteners shall withstand four dips while spring washers shall withstand three dips of one-minute duration in the standard Preece test. Other galvanized materials shall be guaranteed to withstand at least six successive dips each lasting one minute under the Standard Preece test for galvanizing.
2. The zinc coating shall be perfectly adherent of uniform thickness, smooth, reasonably bright, continuous and free from imperfections such as flux, ash, rust stains, bulky white deposits and blisters. The zinc used for galvanizing shall be of grade Zn 99.95 as per IS 209-1979.
3. Pin balls shall be checked with the applicable “G” gauges in at least two directions, one of which shall be across the line of die flashing and the other 90 deg. to this line. ‘NO GO’ gauges shall not pass in any direction.
4. Socket ends, before galvanizing shall be of uniform contour. The bearing surface of socket ends shall be uniform about the entire circumference without depressions or high spots. The internal contours of socket ends shall be concentric with the axis of the fittings as per IS 2486/IEC-120. The axis of the bearing surfaces of socket ends shall be coaxial with the axis of the fittings. There shall be no noticeable tilting of the bearing surfaces with the axis of the fittings.
5. All current carrying parts shall be so designed and manufactured that contact resistance is reduced to minimum.
6. Welding of aluminum shall be by inert gas shielded tungsten arc or inert gas, shielded metal arc process. Welds shall be clean, sound, smooth, and uniform without overlaps, properly fused and completely sealed. There shall be no cracks, voids incomplete penetration, incomplete fusion, under-cutting or inclusions. Porosity shall be minimized so that mechanical properties of the aluminum alloys are not affected. All welds shall be properly finished as per good engineering practices.

5.14 **Electrical Design:**
The normal duty and heavy duty suspension, light duty, normal duty and heavy duty tension insulator sets shall all comply with the technical requirements and satisfy the test requirements.

5.15 **Mechanical design:**
The mechanical strength of the insulators and corresponding insulator fittings must match. The design shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to the development of defects.
Insulating material shall not engage directly with hard metal. All fixing materials shall be of approved quality, shall be applied in an approved manner and shall not enter into chemical action with the metal parts or cause fracture by expansion in service. Where cement is used as a fixing medium, cement thickness shall be as small and even as possible and proper care shall be taken to correctly centre and locate the individual parts during cementing.


5.16.1 Type tests:

The following type tests shall be conducted on hardware fittings.

A. On suspension hardware fittings only.

(i) Magnetic power loss test.
(ii) Clamp slip strength Vs torque
(iii) Mechanical strength test.
(iv) On one test on elastomer.

B. On Tension hardware fittings only.

(i) Electrical resistance test for IS 2486 (Part-I) 1971
   Dead end assembly.
(ii) Heating cycle test for -do-
   dead end assembly.
(iii) Slip strength test for IS 2486 (Part-I)
   dead end assembly.
(iv) Mechanical strength test.

C. On both suspension and tension hardware fittings.

(i) Visual examination. IS-2486 (Part-I) 1971
(ii) Verification of dimension. -do-
(iii) Galvanizing / electroplating test. -do-
(iv) Mechanical strength test of each component (including corona control ring/grading ring and arcing horn)
(v) Mechanical strength test of welded joint.
(vi) Mechanical strength test for corona control ring/grading ring and arcing horn. BS-3288 (Part-I)
(vii) Test on locking device for ball and socket coupling. IEC – 3721984
(viii) Chemical analysis, hardness tests, grain size, inclusion rating and magnetic particle inspection for forging/casting.

D. On suspension hardware fittings only.

(i) Clamp slip strength ver as torque test for suspension clamp.
(ii) Shore hardness test of elastomer cushion for AG suspension clamp.
(iii) Bend test for armour rod set. IS-2121 (Part-I)
(iv) Resilience test for armour rod set. -do-
(v) Conductivity test for armour rod set. -do-

All the acceptance tests stated at clause shall also be carried out on composite insulator unit, except the eccentricity test at clause. In addition to these, all the acceptance tests indicated in IEC 1109 shall also be carried out without any extra cost to the employer.

E. For hardware fittings.
   (a) Visual examination. IS-2121 (Part-I)
   (b) Proof & test.

F. Tests on conductor accessories.

G. Type tests.

H. Mid span compression joint for conductor and earth wire.
   (a) Chemical analysis of materials.
   (b) Electrical resistance tests. IS-2121 (Part-II) 1981 clause 6.5 & 6.6
   (c) Heating cycle test. -do-
   (d) Slip strength test. -do-

EQUIPMENT CLAMPS AND CONNECTORS

6.0 TECHNICAL SPECIFICATION FOR EQUIPMENT CLAMPS & CONNECTORS

6.1 SCOPE
This specification covers design, manufacture, assembly, testing at manufacturer’s works, supply and delivery at site of all terminal connectors of 33KV equipments (mainly breaker, isolator, CT,PT,CVT,BPI and LA) and all other clamps and dropper connectors required for the switch yard as per approved lay out and system design.

6.2 STANDARDS
The terminal connectors under this specification shall conform strictly to the requirements of the latest version of the following standards as amended up-to-date, except where specified otherwise.

i) IS: 556 Power Connectors.
ii) IS: 617 Aluminium & Aluminium Alloy
iii) IS: 2629 Recommended Practice for hot dip galvanizing of iron and steel.
iv) IS: 2633 Method of testing uniformity of coating of zinc coated articles.

The materials conforming to any other authoritative standards which ensure equal or better performance shall also be acceptable. The salient point of these specifications and points of difference between these and the above specifications shall be clearly brought out in the bid.
6.3 MATERIAL & WORKMANSHIP

The terminal connectors shall be manufactured from Aluminium Silicon Alloy and conform to designation A6 of IS: 617 (latest edition).

The connectors shall be of best quality and workmanship, well finished and of approved design. Specific materials for clamps and connectors should have high current carrying capacity, high corrosion resistance and be free from corona formation.

All connectors or its components to be connected with conductor shall be of bolted type having aluminium purity not less than 99.5%.

All bus bar clamps shall be made preferably from forged aluminium of purity not less than 99.5%. The thickness and contact surface should be maintained in such a way that the clamp should conform to IS: 5561/1970 or any latest revision thereof.

6.4 RATING

The connector rating shall match with the rating of the respective equipments for the terminal connectors and the connectors for bus bar and dropper should be of the following rating. Minimum thickness at any part of connector shall be 10(ten) mm. Indicative ratings are given below:

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Rating</th>
<th>33 KV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Main bus bar connectors high level and low level (Amps)</td>
<td>1250</td>
</tr>
<tr>
<td>2</td>
<td>High level bus sectionalisation Isolator (Amps)</td>
<td>1250</td>
</tr>
<tr>
<td>3</td>
<td>-do- for CT</td>
<td>As per CT rating</td>
</tr>
<tr>
<td>4</td>
<td>-do- for PI</td>
<td>As per PI rating</td>
</tr>
<tr>
<td>5</td>
<td>-do- for LA</td>
<td>As per LA rating</td>
</tr>
<tr>
<td>6</td>
<td>-do- for PT</td>
<td>As per PT rating</td>
</tr>
</tbody>
</table>

6.5 EQUIPMENT CONNECTORS

Bimetallic connectors shall be used to connect conductors of dissimilar metal. The following bimetallic arrangement shall be preferred.

i) Copper cladding of minimum 4 mm. thickness on the aluminium portion of connector coming in contact with the copper palm or stud of the equipment.

ii) Alternatively, to provide cold rolled aluminium copper strip between the aluminium portions of the connection, the sheet thickness shall not be less than 2 mm.

Sufficient contact pressure should be maintained at the joint by the provision of the required number of bolts or other fixing arrangements, but the contact pressure should not be so great as to clause relaxation of the joint by cold flow, the joint should be such that the pressure is maintained within this range under all conditions of service, to avoid excessive local pressure, the contact pressure should be evenly distributed by use of pressure plates, washers or suitable saddles of adequate area of thickness should be less than that of an equal length of conductor where measured individually test results showing the milli drop test and resistance should be enclosed with the bid.
All connectors shall be so designed and manufactured as to offer ease of installation as these are to be used in overhead installations, design shall be such that full tightening of nuts and bolts should be possible with the use of double wrench. The connectors shall be such as to avoid local corona, sound or visible discharge.

6.6 TEMPERATURE RISE

The temperature rise of connectors when carrying rated current shall not exceed 45°C above reference design temperature of 50°C.

i) Acceptance Tests
   a) Tensile Test
   b) Temperature rise test
   c) Temperature rise test

ii) Routine Test

   a) Visual Inspection
   b) Dimensional Check

Type test reports from a recognized laboratory shall have to be submitted.

6.7 WEIGHTS

Weights of different materials used in manufacture, such as aluminium, silicon, copper etc. should be clearly indicated in the bid.

6.8 INTERCHANGE ABILITY

Corresponding parts of similar clamps and connectors shall be made to gauge or jig and shall be interchangeable in every respect.

6.9 TECHNICAL SPECIFICATION FOR ACSR BUS-BAR

6.9.1 SCOPE

The specification covers design, engineering, manufacture, testing at manufacturer’s works, supply and delivery of heavy duty AAAC bus-bar for use in 33 kV sub-station.

6.9.2 MATERIALS

The 345 sq. mm AAAC bus bar shall be drawn. The strung bus-bar shall be of heavy duty type and design to operate within set temperature limits and to withstand thermal and electromechanical forces developed due to short circuits.

6.9.3 MECHANICAL CHARACTERISTICS
The mechanical strength of the strung bus-bar shall be limited to be maximum allowable tension for specific size of conductor as per ISS.

6.9.4 DIMENSIONAL TOLERANCE

Dimensional tolerances shall be as per relevant ISS.

SURGE ARRESTERS

TECHNICAL SPECIFICATION FOR SURGE ARRESTERS

7.0 SCOPE

7.1 This Specification provides for the design, manufacture, inspection and testing before dispatch, packing and delivery F.O.R. (destination) of metal oxide (gapless) Surge Arresters with discharge counters, insulating base, terminal connectors and other accessories as specified here in.

Following is the list of documents constituting this Specification:

| (i) | Technical Specification (TS) |
| (ii) | Check-List. |
| (iii) | Calibration Status of testing equipments and meters/ Instruments. |
| (iv) | Check-list towards Type Test Reports. |

Note: Annexure-B, C, & D are to be filled up by the Bidder.

All the above along with amendments thereof shall be read and interpreted together. However, in case of a contradiction between the Technical Specification and any other volume, the provisions of this volume will prevail.

7.2 The Surge Arrester shall conform in all respects to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of offer and purchaser shall have the power to reject any work or materials, which in his judgment is not in full accord ance therewith.

7.3 STANDARDS:

Except to the extent modified in the Specification, the Surge Arrester shall conform to the latest editions and amendments of the standards listed hereunder.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Standard</th>
<th>Title</th>
</tr>
</thead>
</table>

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Surge Arresters with the requirement of other authoritative standards, which ensure equal or better quality than the standards, mentioned above shall also be acceptable. Where the equipment offered by the supplier conforms to other standards, salient points of difference between the standards adopted and the specified standards shall be clearly brought out in the offer. 4 (Four) copies of the reference standards in English language shall be furnished along with the offer.

**7.5 GENERAL TECHNICAL REQUIREMENTS:**

7.5.1 The Surge Arrester shall confirm the technical requirements
7.5.2 The energy handling capability of each rating of Arrester offered, supported by calculations, shall be furnished with the offer.
7.5.3 The Surge Arresters shall be fitted with pressure relief devices and arc diverting paths and shall be tested as per the requirements of IEC for minimum prospective symmetrical fault current as specified in Appendix-I.

7.5.4 A grading ring shall be provided if required, (for attaining all the relevant technical parameters) on each complete Surge Arrester.

**7.6 PROTECTIVE LEVELS:**

Surge Arresters shall be capable of providing protection to sub-station equipments, designed for the withstand levels, given in the following table.
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Equipment to be protected</th>
<th>Insulation Level of 36KV System</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>L.I. Level (KVP)</td>
</tr>
<tr>
<td>1</td>
<td>Power Transformers.</td>
<td>170</td>
</tr>
<tr>
<td>2</td>
<td>Instrument Transformers.</td>
<td>170</td>
</tr>
<tr>
<td>3</td>
<td>Reactors</td>
<td>170</td>
</tr>
<tr>
<td>4</td>
<td>Circuit Breakers/Isolators.</td>
<td>170</td>
</tr>
<tr>
<td>(i)</td>
<td>Phase to ground.</td>
<td>170</td>
</tr>
</tbody>
</table>

Surge arrester shall be suitable for the following duty cycles of circuit breaker at the following system voltages:

36 KV Circuit Breaker 0-0.3 sec-co-3 min-co

7.7 **DUTY REQUIREMENT:**

7.7.1 Surge Arresters shall be of heavy-duty station class and gapless type without any series or shunt gaps.

i. Surge Arresters shall be capable of discharging over voltages occurring during switching of un-loaded transformers, lines, capacitors and reactors.

ii. The Surge Arresters shall be capable of discharging lightning and switching surges and temporary power frequency over-voltages.

iii. The Surge Arresters shall be capable of discharging the energy equivalent to class 3 of IEC-99-4.

7.7.2 The reference current of the arrester shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage. The supplier shall submit values and the supporting evidence along with calculations on above.

7.7.3 Surge Arresters shall be fully stabilized thermally to give a life expectancy as per standard under site conditions.

7.7.4 Surge Arresters shall be able to withstand maximum wind load of 260 Kg./sq.m.

7.7.5 Surge Arresters shall be capable of withstanding effects of direct solar radiation

7.7.6 Surge arresters shall be capable of spark over on severe switching Surges and multiple strokes.
7.7.7 The Surge Arrester should be adequately designed to operate satisfactorily under temporary power frequency over-voltage as given in specific technical requirements, after discharging two shots of respective long duration surges.

7.7.8 Unless otherwise brought out separately by the Bidder in the schedule of deviations, the Surge Arresters, offered shall conform to the specification scrupulously. All deviations from the specification shall be brought out in the schedule of deviations. The discrepancies between the specification and the catalogues or literature, submitted as part of the offer shall not be considered as valid deviations unless specifically brought out in the schedule of deviations.

7.8 CONSTRUCTION:

7.8.1 Non linear blocks shall be sintered metal oxide material. These shall be provided in such a way as to obtain robust construction with excellent electrical and mechanical properties even after repeated operations.

7.8.2 All the units of arresters of same rating shall be inter-changeable without adversely affecting the performance.

7.8.3 The Surge Arresters shall be suitable for pedestal type mounting.

7.8.4 All the necessary flanges, bolts, nuts, clamps etc. required for assembly of complete arrester with accessories and mounting on support structure to be supplied by the purchaser, shall be included in supplier’s scope of supply.

7.8.5 The drilling details for mounting the Arrester on owner’s support shall be supplied by the supplier.

7.8.6 The minimum permissible separation between the Surge Arrester and any earthed object shall be indicated by the Bidder in his offer.

7.8.7 Surge Arresters shall be designed to incorporate pressure relief devices and arc diverting paths to prevent shattering of the blocks or the porcelain housing, following prolonged current flow or internal flash over and providing path for flow of rated fault currents in the event of arrester failure.

7.8.8 Surge Arresters shall incorporate anti-contamination feature to prevent arrester failure, caused by uneven voltage gradient across the stack, resulting from contamination of the arrester porcelain.

7.8.9 Seals shall be provided in such a way that these are always effectively maintained even when discharging rated lightning current.
7.8.10 The heat treatment cycle details along with necessary quality checks used for individual blocks along with insulation layer, formed across each block are to be furnished. Metalized coating thickness for reduced resistance between adjacent discs is to be furnished along with the procedure for checking the same. Details of thermal stability test for current distribution of current on individual disc is to be furnished.

7.8.11 Each individual unit of Surge Arresters shall be hermetically sealed and fully protected against ingress of moisture. The hermetic seal shall be effective for the entire lifetime of the arrester and under the service conditions as specified. The supplier shall furnish sectional view of the arrester showing details of sealing employed.

7.8.12 The Surge Arresters shall be suitable for hot line washing.

7.9 PORCELAIN HOUSING:

7.9.1 All porcelain Housings shall be free from lamination cavities or other flaws, affecting the maximum level of mechanical and electrical strengths.

7.9.2 The porcelain shall be well vitrified and non-porous.

7.9.3 The minimum creep age distance of the arrester housing shall be as per Cl 7.21 of the TS.

7.9.4 The porcelain petticoat shall be preferably of self-cleaning type (Aerofoil design). The details of the porcelain housing such as height, angle of inclination, shape of petticoats, gap between the petticoats, diameter (ID and OD) etc. shall be indicated by the Bidder in his offer in the form of detailed drawing.

7.9.5 Porcelain housings shall be so co-coordinated that external flash over will not occur due to application of impulse or switching Surge voltages up to the maximum design value for arrester.

7.10 GALVANISATION, NICKEL PLATING ETC.:

7.10.1 All ferrous parts exposed to atmosphere shall be hot dip galvanized as per IS: 2629, as amended from time to time. Tinned copper/brass lugs shall be used for internal wiring of discharge counter. Screws used for electrical connections shall be either made of brass or shall be nickel-plated.

7.10.2 Ground terminal pads and nameplate brackets shall be hot dip galvanized.

7.10.3 The material shall be galvanized only after completing all shop operations

7.11 ACCESSORIES AND FITTINGS:

7.11.1 Surge Counters
7.11.2 A self-contained Surge counter, suitably enclosed for outdoor use and requiring no auxiliary of battery supply for operation shall be provided for each unit. The surge counter shall be operated by the discharge current, passed by the surge arrester and shall be suitable for mounting on the support structure of the Arrester.

7.11.3 Surge counters shall be of the Electro-mechanical type and designed for continuous service.

7.11.4 The cyclometer counter shall be visible through an inspection window from ground level. The counter terminals shall be robust and adequate size and shall be so located that the incoming and outgoing connections are made with minimum possible bends.

7.11.5 Internal parts shall be unaffected by atmospheric conditions at site. Alternatively, a weather proof housing to IP 55 shall be provided and this shall be designed to allow the recording device to be read from ground level without exposing the internal parts to the atmosphere.

7.11.6 The Surge Counter shall be connected in the main earth lead from the arrester in such a manner that the direction of the earth lead is not changed or its surge impedance materially altered. A bolted link shall be provided so that the surge counter may be short circuited and removed without taking the arrester out of service.

7.11.7 All necessary accessories and earthing connection leads between the bottom of the Arrester and discharge counter shall be in the supplier’s scope of supply.

7.12 LEAKAGE CURRENT METERS: (In case of 33 Kv surge arrester only)

7.12.1 Leakage current meters (suitable milli-ammeter) shall be connected in the earthing path of the surge arresters to measure the resistor grading leakage current. Meters shall be designed for continuous service.

7.12.2 The ammeter shall be suitable for mounting on the support structure of the arrester. The push buttons shall be mounted such that it can be operated from the ground level.

7.12.3 The internal parts shall be fully weather-proof to IP 55 or better with a transparent cover to provide an unobstructed view of the ammeter.

7.12.4 Arresters shall be complete with insulating base having provision for bolting to flat surface of the structure.

7.12.5 The grounding terminals shall be suitable for accommodating purchaser’s grounding connection to steel earth mat.
7.12.6 The Bidder has to quote unit rates of the insulting base and the surge counter separately. The purchaser reserves its option to procure insulting base and surge counter.

7.12.7 Clamp type terminal connector, suitable for 33KV-AAA Panther-up Conductor shall be provided having both horizontal and vertical take-off.

7.12.8 Two clamp type ground terminal connectors, suitable for G. I. Strip (50 x 6) or (50 x 8) should be provided.

7.12.9 All interconnecting hardware such as nuts, bolts, spring washers etc. with 5% spares shall be supplied for different units.

7.12.10 Pollution Shunt (Copper braid) shall be supplied along with each surge Arrester for by-passing the surface current.

Other standard accessories, which are specifically not mentioned, but are usually provided with Surge Arrester of such type and rating for efficient and trouble free operation should be supplied.

7.13 NAME PLATE:

Each single pole Arrester shall be provided with non-corrosive legible name plate, at the base bearing thereon, voltage rating of the complete pole and the number of demountable sections with the following data, indelibly marked

i) SOUTHCO  
ii) Purchase order No. & Date.  
iii) Name of device.  
iv) Manufacturer’s name and trademark and identification no. of the arrester being supplied.  
v) Year of manufacture  
vi) Rated voltage  
vii) Rated Frequency  
viii) Maximum continuous operating voltage.  
ix) Type  
x) Nominal discharge current.  
xi) Long duration discharge class.  
pii) Pressure relief current in KA(rms)  
xiii) Energy discharge capability ( KJ / KV rating).

7.14 TEST:  

7.14.1 Type Tests:
The surge Arrester offered should have been subjected to the following type tests in an independent Government approved test laboratory. The bidder shall furnish four sets of type test reports along with the offer. These tests must not have been conducted earlier than five years from the date of opening of technical bid. For any change in the design, type already type tested and the design type offered against this specification, the purchaser reserves the right to demand repetition of some or all type tests without any extra cost to SOUTHCO in the presence of Purchaser’s representative at the cost of the supplier.

1. **Insulation withstands tests:**
   (a) Lightning Impulse Voltage Test.
   2. Residual voltage tests.
   3. Long duration current impulse withstands tests.
   4. Operating duty tests.
   5. Pressure relief tests.
   (a) High current test.
   (b) Low current test.
   6. Power frequency voltage vs. time curve.
      (Temporary over voltage test)
   8. Seismic withstand test.
   9. IP-55 test on surge counter.
   10. Minimum current operation tests of the surge counter.
   11. Maximum current withstand test of the surge counter.
   12. Mechanical terminal load test on bushing.
   13. Partial discharge test.

**N.B.** :-Even if the condition i.e. the dry arcing distance or the sum of the partial dry arcing distances is larger than the test voltage divided by 500 KV/m’, the lightning impulse voltage test must have been conducted or is to be conducted without any financial liability to SOUTHCO.

Even if the type test reports are found to be valid as per this specification, the purchaser reserves the right to demand repetition of some or all the type tests in the presence of purchaser’s representative. For this purpose, the bidder shall quote unit rates for carrying out each type test. These prices, if necessary, will be taken into consideration for bid evaluation.

**7.14.2 ROUTINE TESTS:**

The following routine tests shall be conducted at the supplier’s cost on each surge arrester and shall be submitted along with or before offering for inspection for purchaser’s approval.

(a) Measurement of reference voltage.
(b) Residual voltage tests.
(c) Measurement for partial discharge and contact noise.
(d) Sealing test for units with sealed housings.
### 7.14.3 ACCEPTANCE TESTS:

The following tests, considered as acceptance tests, shall be conducted in the presence of purchasers representative for which no charges will be payable by SOUTHCO. The acceptance tests, whenever possible shall be conducted on the complete arrester unit. The number of samples to be subjected to acceptance test shall be decided by the purchaser at the time of actual testing.

I  Temperature Cycle Test on Housing.

II  Measurement of Power Frequency Voltage at the reference current.

III  Measurement of leakage current and capacitive current at M.C.O.V.

IV  Lightning Impulse Residual Voltage Test at N.D.C., 50% of N.D.C. & 200% of N.D.C.

V  Partial Discharge Tests on complete arresters/units at 1.05 times M.C.O.V.

VI  Special Thermal stability test.

VII  Porosity test on porcelain components.

VIII  Galvanization test on metal parts.

IX  The functional (operational) test on the Surge Counter by way of checking its operation at following nominal discharge currents:

   a) 100 Amps with 8/20 micro second wave shape.

   b) 10 KA with 8/20 micro second wave shape.

X  Check of calibration of leakage current meters.

### 7.15 INSPECTION:

I  The purchaser shall have access at all time to the works and all other places of manufacture, where the Surge Arresters are being manufactured and the supplier shall provide all facilities for unrestricted inspection of the supplier’s works, raw materials, manufacture of all the accessories and for conducting the necessary tests.

II  The supplier shall keep the purchaser informed in advance of the time of starting and the progress of manufacture of equipment in its various stages so that arrangements could be made for inspection.

III  No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected tested and dispatch schedule attached to this specification.
IV  The acceptance of any quantity of equipment shall in no way relieve the supplier of his responsibility for meeting all the requirements of this specification and shall not prevent subsequent rejection, if such equipments are later found to be defective.

7.17  DOCUMENTATION:

7.17.1 All drawings shall conform to relevant Indian Standard as per relevant IS. All drawings shall be in ink and suitable for microfilming. All dimensions and data shall be in S.I. Units.

7.17.2 The supplier shall furnish four sets of following drawings / documents along with his offer.

(i) General outline drawings of the complete Arrester with technical parameters.
(ii) Drawings showing clearance from grounded and other line objects and between adjacent poles of Surge Arresters, required at various heights of Surge Arresters.
(iii) Drawings showing details of pressure relief devices.
(iv) Detailed drawing of discharge counters along with the wiring and schematic drawing of discharge counter and meter.
(v) Outline drawing of insulating base.
(vi) Details of grading rings, if used.
(vii) Mounting details of Surge Arresters.
(viii) Details of line terminal and ground terminals.
(ix) Volt-time characteristics of Surge Arresters.
(x) Details of galvanization being provided on different ferrous parts.
(xi) The detailed dimensional drawing of porcelain Housing such as ID, OD, thickness and insulator details such as height, profile of petticoats, angle of inclination and gap between successive petticoats, total creepage distance etc.
(xii) Cross-sectional view of the Surge Arrester Units showing all components.

7.18  TEST REPORTS:

(i) Four copies of type test reports shall be furnished to the purchaser with the tender specification. Copies of acceptance test reports and routine test reports shall be furnished to the purchaser. One copy will be returned duly certified by the purchaser and only thereafter shall the materials be dispatched.
(ii) All records of routine test reports shall be maintained by the supplier at his works for periodic inspection by the purchaser.

(iii) All test reports of tests, conducted during manufacture shall be maintained by the supplier. These shall be produced for verification as and when requested for by the purchaser.

7.19 PACKING AND FORWARDING:

7.19.1 The equipment shall be packed in suitable crates so as to withstand handling during transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable material shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper arrangement of lifting such as lifting hooks etc. shall be provided. Any material found short inside the packing cases shall be supplied by the supplier without any extra cost.

7.19.2 Each consignment shall be accompanied by a detailed packing list containing the following information:

| (a) | Name of the consignee : |
| (b) | Details of consignment : |
| (c) | Destination : |
| (d) | Total weight of consignment : |
| (e) | Sign showing upper/lower side of the crate : |
| (f) | Handling and unpacking instructions : |
| (g) | Bill of materials indicating contents of each package : |

The supplier shall ensure that the bill of materials is approved by the purchaser before dispatch.

7.20 QUANTITY AND DELIVERY REQUIREMENT:

The scope of supply shall include a supply of 2.5% extra quantity of bolts, nuts, washers, split pins, cotter pins and such other small loose items free of cost.

TECHNICAL REQUIREMENTS FOR METAL OXIDE (GAPLESS)

7.21 SURGE ARRESTERS

7.21.1 The Surge Arrester under this Specification shall conform to the parameters given below:-

<table>
<thead>
<tr>
<th>Sl.</th>
<th>Particulars.</th>
<th>Technical Parameters for Surge Arrestors</th>
</tr>
</thead>
</table>

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<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>30 KV</th>
<th>9 KV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nominal system voltage (phase to phase) (KV rms).</td>
<td>33</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>Highest system voltage (phase to phase) (KV rms).</td>
<td>36</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>System Frequency (HZ).</td>
<td></td>
<td>50 ±5%</td>
</tr>
<tr>
<td>4</td>
<td>System Neutral earthing.</td>
<td></td>
<td>Effectively earthed</td>
</tr>
<tr>
<td>5</td>
<td>Installation.</td>
<td></td>
<td>Outdoor</td>
</tr>
<tr>
<td>6</td>
<td>Class.</td>
<td></td>
<td>Station class, 10 KA, heavy duty type.</td>
</tr>
<tr>
<td>7</td>
<td>Type of construction for 10 KA rated arrester.</td>
<td></td>
<td>Single column, single phase</td>
</tr>
<tr>
<td>8</td>
<td>No. of phases.</td>
<td></td>
<td>Three</td>
</tr>
<tr>
<td>9</td>
<td>Maximum duration of earth fault (Sec.)</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>Maximum prospective symmetrical fault current at arrester location (KA rms.)</td>
<td></td>
<td>40</td>
</tr>
<tr>
<td>11</td>
<td>Rated arrester voltage (KV rms)</td>
<td>30</td>
<td>9</td>
</tr>
<tr>
<td>12</td>
<td>Nominal discharge current (KAP) Discharge current at which insulation co-ordination will be done</td>
<td>10 KA of 8/20 µsec Wave.</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Minimum energy discharge capability (KJ/KV)</td>
<td>As per relevant ISS/IEC</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Maximum continuous operating voltage at 50º C (KV rms)</td>
<td>25</td>
<td>9.6</td>
</tr>
<tr>
<td>15</td>
<td>Maximum switching surge residual voltage (KVP)</td>
<td>72 at 500A</td>
<td>28</td>
</tr>
<tr>
<td>16</td>
<td>Maximum residual voltage at 8/20 micro second(KVP)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(i) 5 KA.</td>
<td>85</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>(ii) 10 KA Nominal discharge current.</td>
<td>90</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>(iii) 20 KA.</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Long duration discharge class</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>18</td>
<td>High current short duration test value (KAP) (4/10 Micro-second wave).</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>19</td>
<td>Current for pressure relief test (KA-rms)</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Minimum total creepage distance (mm).</td>
<td>900</td>
<td>380</td>
</tr>
<tr>
<td>21</td>
<td>One minute dry and wet power frequency withstand voltage of Arrester housing (KV-rms).</td>
<td>70</td>
<td>28</td>
</tr>
<tr>
<td>22</td>
<td>Impulse withstand voltage of arrester housing with 1.2/50 Micro-second wave (KVP). Switching Impulse Voltage (Wet) (KVP)</td>
<td>110.5</td>
<td>41.6</td>
</tr>
<tr>
<td>23</td>
<td>Pressure relief class.</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>24</td>
<td>Corona extinction voltage (KV-rms).</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>25</td>
<td>RIV at 92 KV rms.</td>
<td>Less than 500 micro volts</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Partial discharge at 1.05 times continuous over-voltage.</td>
<td>Nor more than 50 PC</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Seismic acceleration.</td>
<td>0.3g horizontal 0.15g vertical</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Reference ambient temperature.</td>
<td>50ºC</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>(a) IR at MCOV.</td>
<td>Less than 400 micro amperes</td>
<td></td>
</tr>
<tr>
<td>(b) IC at MCOV.</td>
<td>Less than 1200 micro amperes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>a) Reference Current (mA)</td>
<td>1 to 5 mA</td>
<td></td>
</tr>
<tr>
<td>b) Reference voltage at reference current.</td>
<td>Greater than rated voltage.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Maximum steep current Impulse RDV (KVP). at KAP | 100
---|---
Maximum cantilever strength of the arresters (KGM). | 325
TOV(KVP). | 
(i) 0.1 sec. | 53
(ii) 1.0 sec. | 51
(iii) 10.0 sec. | 49
(iv) 100.0 sec. | 47

**AB SWITCHES**

**TECHNICAL SPECIFICATIONS FOR AB SWITCHES**

8 **SCOPE:-**

This specification covers manufacturing testing and supply of 3 Pole, 400 AMP, 50 Hz, Single break, 33 KV & 11 KV class Air Break switches for outdoor installations to be used at 33/11 KV Sub-stations and for incoming & outgoing Lines suitable for operation under off load conditions.

8.1 **DESCRIPTION OF THE MATERIALS:-**

The A.B. Switch sets shall confirm to the following parameters:-

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Parameters of AB Switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>i)</td>
<td>Number of poles</td>
<td>3</td>
</tr>
<tr>
<td>ii)</td>
<td>Number of Post insulator per pole</td>
<td>4 nos. 22/24 KV class</td>
</tr>
<tr>
<td>iii)</td>
<td>Nominal system voltage (KV)</td>
<td>33</td>
</tr>
<tr>
<td>iv)</td>
<td>Highest System Voltage (KV)</td>
<td>36</td>
</tr>
<tr>
<td>v)</td>
<td>Rated frequency</td>
<td>50HZ</td>
</tr>
</tbody>
</table>
vI) System earthing

<table>
<thead>
<tr>
<th>System earthing</th>
<th>Effectively earthed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>vII) Rated nominal current Amp.</td>
<td>400</td>
</tr>
<tr>
<td>viii) Altitude of installation</td>
<td>Not exceeding 1000 M</td>
</tr>
</tbody>
</table>

The post insulators used in the A.B. Switches shall have the following ratings

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Parameters P.I. of AB Switches for 33 KV</th>
<th>Parameters P.I. of AB Switches for 11 KV</th>
</tr>
</thead>
<tbody>
<tr>
<td>i)</td>
<td>Power frequency withstand voltage (dry) KV (RMS)</td>
<td>95</td>
<td>35</td>
</tr>
<tr>
<td>ii)</td>
<td>Power frequency withstand voltage (wet) KV (RMS)</td>
<td>75</td>
<td>35</td>
</tr>
<tr>
<td>iii)</td>
<td>Impulse withstand voltage (dry) KV (Peak)</td>
<td>170</td>
<td>75</td>
</tr>
<tr>
<td>iv)</td>
<td>Power frequency puncture withstand voltage</td>
<td>1.3 times the actual dry flashover voltage of the unit</td>
<td></td>
</tr>
</tbody>
</table>

8.2 **STANDARDS**: The AB Switch Set shall conform to the following standards:

i) IS-9920 (Part-I to V.)

ii) IS-2544/1973 (for porcelain post insulators)

iii) Is-2633 (for galvanization of ferrous parts.) or its latest amendments if any.

8.3 **INSULATORS**:  

12 KV class (for 11 KV AB Switches) and 22 KV / 24 KV class (for 33 KV AB Switches) Post Insulators complete with pedestal cap duly cemented to be used in the AB Switch Set conforming to IS-2544/1973

The bidder shall furnish the type test certificate of the post insulators from their manufacturer for reference.
The bidder shall mention make, type of insulation materials, metal fittings, Creep age distance, protected Creep age distance, tensile strength, compression strength, torsion strength and cantilever strength.

8.4 CLIMATIC CONDITIONS:-

The A.B. Switch set shall be suitable for operation under the following climatic conditions.

1. Maximum ambient air temperature. 45°C
2. Maximum daily average air temperature 35°C
3. Maximum yearly average ambient air temperature 30°C
4. Maximum temperature attainable by a body exposed to the sun. 50°C
5. Minimum ambient air temperature 0°C
6. Maximum relative humidity. 100%
7. Minimum number of rainy days per annum 70
8. Average number of rainy days per annum 120
9. Average annual rain fall. 150 cm.
10. Number of months of tropical monsoon conditions 4
11. Maximum wind pressure. 260 Kg./mm²

8.5 TECHNICAL DETAILS:-

8.5.1 The 33 KV A.B. Switch Set shall be gang operated (with double tandem pipe) single air break outdoor type horizontal mounting having 4 nos. 22/24 KV post insulator per phase and the 11 KV A.B. Switch Set shall be gang operated single (with double tandem pipe) air break outdoor type horizontal mounting having 2 nos. 12 KV post insulator per phase. The operating mechanism shall be suitable for manual operation from the ground level and shall be so designed that all the three phases shall open or close simultaneously. The Switches shall be robust in construction, easy in operation and shall be protected against over travel or straining that might adversely affect any of its parts. The required base M.S. Channel, phase coupling rod, operating rod with intermediate guide braided with flexible electrolytic copper,
tail piece of required current carrying capacity and operating mechanism with ‘ON’ & ‘OFF’ positions shall be provided. The operating rod shall be medium gauge of 32mm diameter nominal bore G.I. pipe single piece 6 meters. The phase coupling rod for gang operation shall medium gauge 25mm dia nominal bore G.I. Pipe. Rotating post insulators shall be provided with suitable bearing mounted on a base channel with 6 mm thick thrust collar and 6mm split pin made out of stainless steel. The operating down rod shall be coupled to the spindle (minimum dia - 32mm) for gang operation through another suitable bearing by two numbers 10mm dia through stainless steel bolts with double nuts. The post insulators should be fixed with the base channel using Galvanized Nuts and Bolts.

All the bearings shall be provided with grease nipple. All ferrous parts shall be galvanized and polished. The pipes shall be galvanized in accordance with IS-4736/1968.

8.5.2 Mounting: - The A.B. Switches shall be suitable for horizontal mounting in all type of sub-station structures.

8.5.3 Switching Blades: - It shall be made out of electrolytic copper with silver plated. The approximate size shall be 250mm x 50 x 8mm for 11 KV. The switch shall have such a spring mechanism so as to ensure that the speed of the opening of contact is independent of speed of manual operation

8.5.4 Fixed Contracts:- The fixed jaw type female contracts (50x8x95 )mm for 11 KV shall be made of electrolytic copper ( minimum 95 % copper composition) duly electroplated controlled by Phosphor bronze high pressure spring housed in robust G.I. Cover.

It is essential that provision shall be made in fixed female contracts to take the shock arising from the closing of moving contract blade without the same being transmitted to the post insulator. The arrangement made in this regard shall be specifically shown in the drawing.

8.5.5 Arcing Horn:- As the switches are generally meant for isolating transmission line and distribution transformers, suitable arcing horns shall be provided for breaking the charging current horn shall be made of 10 mm dia G.I. Rod with spring assisted operation.
8.5.6 **Terminal Connectors**: Terminal connectors shall be robust in design. The size of fixed connector shall be (80 x 50 x 8 mm) and size of movable connector shall be of (80 x 50) x (80 x 50) x 8 mm of copper casting with uniform machine finishing duly silver plated made out of minimum 95% copper composition with 2 nos. 12 mm dia holes provided with suitable brass bolts and double nuts, flat washers & 2 nos. bimetallic solderless sockets suitable up to ACSR Panther or AAAC 232 mm² conductor.

8.5.7 **Spacing**: The minimum clearance between phase to the switch shall be 1200 mm. The operating down rod shall be at a transverse distance of 300 mm from the outer limb of the switch. The centre spacing between two post insulators of the same phase shall be 560 mm. In the open position of the A.B. Switches the moving blade shall rotate through an angle of 90°. This shall be exhibited in the drawing.

8.5.8 **Drawing & Literatures**: Drawings of each item i.e. 11 KV, 400 amp and 33 KV 400 amp, 3 Pole, single break A.B. Switch shall be furnished along with the tender.

The details of construction and materials of different parts of the A.B. Switches shall clearly be indicated in the tender and illustrative pamphlet / literature for the same shall be submitted along with the tender.

8.6 **TESTS & TEST CERTIFICATE**

8.6.1 **Type Test**: Certificates for the following type tests conducted within five years proceeding to the date of opening of tender on prototype set of A.B Switch in a Govt. Approved Testing Laboratory preferably at CPRI, Bhopal/ Bangalore shall have to be submitted for reference and scrutiny.

i. Impulse voltage dry test

ii. Power frequency voltage dry test

iii. Power frequency voltage wet test

iv. Temperature of resistance.

v. Measurement of resistance.
vi. Test to prove the capability of carrying the rated peak short circuit current and the rated short time current.

vii. Mainly active load breaking capacity test.

viii. Transformer off-load breaking test.

ix. Line charging breaking capacity test.

x. Operation tests.

xi. Mechanical endurance test.


Besides, mechanical endurance test will have to be conduct on one set in the presence of our authorized person who shall be deputed to carryout acceptance tests before delivery of the materials.

8.6.2 Routine Tests: - The following routine tests shall have to be conducted on each sets and results are to be furnished for consideration of deputing inspecting officer for inspection and conducting testing of the materials.

1. Power frequency voltage dry test
2. Measurement of resistance of main circuit
3. Tests to prove satisfactory operation.
4. Dimension check
5. Galvanization test.

8.7 GUARANTEED TECHNICAL PARTICULARS:-
The Bidder shall furnish the guaranteed technical particulars duly filled in the format at Appendix-I along with the tender.

8.8 COMPLETENESS OF EQUIPMENT:-
Any fittings, accessories for apparatus which may not have been specifically mentioned in this specification but which are usual or necessary in equipment of similar plant shall be deemed to be included in the specification and shall be supplied by the Tender without extra charge.
All plant and equipment shall be completed in all details whether such details are mentioned in the specification or not.

8.9 **INSPECTION**:–

Routine and acceptance tests shall be conducted at the place of manufacturer. The bidder are requested to furnish details of equipment which will be used for testing along with tender. The bidder of those manufacturers who do not have adequate testing facilities for conducting routine and acceptance test are liable for cancellation. The successful bidder has to furnish routine test certificate and guaranteed certificate for approval prior to offer of materials for inspection for each consignment of offer.

**GUARANTEED TECHNICAL PARTICULARS FOR 33KV, 400A, 50 HZ, 3 POLE, SINGLE BREAK TYPE**

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Particulars</th>
<th>Desired values</th>
<th>Bidder’s offer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1. Maker’s name and country of origin</td>
<td>To be specified by the tenderer</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2. Type of Switch</td>
<td>Rotating type only</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3. Suitable for mounting</td>
<td>Horizontal only</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5. Post Insulator.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>a) Maker’s name and country of origin</td>
<td>To be specified by the tenderer</td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td>b) Type of cementing</td>
<td>To be quoted for original cemented only &amp; as per IS-2544-1973 &amp; relevant IEC.</td>
<td></td>
</tr>
<tr>
<td>c)</td>
<td>c) One minute power frequency withstand voltage Dry</td>
<td>95 KV RMS.</td>
<td></td>
</tr>
<tr>
<td>d)</td>
<td>d) One minute power frequency withstand voltage Wet</td>
<td>75 KV RMS.</td>
<td></td>
</tr>
<tr>
<td>e)</td>
<td>e) Visible discharge voltage</td>
<td>27 KV RMS.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dry Flashover Voltage</td>
<td>To be specified by the tenderer</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------</td>
<td>---------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>g</td>
<td>Power frequency puncture with stand voltage</td>
<td>1.3 times of actual dry flash over voltage</td>
<td></td>
</tr>
<tr>
<td>h</td>
<td>Impulse withstand voltage (switch in position)</td>
<td>170 KV (peak)</td>
<td></td>
</tr>
<tr>
<td>i</td>
<td>Creepage distance (mm)</td>
<td>380 mm minimum. (actual creepage distance for which type test have been conducted is to be specified by the tenderer)</td>
<td></td>
</tr>
</tbody>
</table>

6. Impulse withstand voltage for positive and negative polarity 1.2 / 50 micro-second wave

<table>
<thead>
<tr>
<th></th>
<th>Across the isolating distance</th>
<th>195 KV (peak)</th>
</tr>
</thead>
<tbody>
<tr>
<td>b</td>
<td>To earth &amp; between poles</td>
<td>170 KV (peak)</td>
</tr>
</tbody>
</table>

7. One minute power frequency withstand voltage

<table>
<thead>
<tr>
<th></th>
<th>Across the isolating distance</th>
<th>80 KV (RMS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>b</td>
<td>To earth &amp; between poles</td>
<td>70 KV (RMS)</td>
</tr>
</tbody>
</table>

8. Rated normal current and rated frequency

<table>
<thead>
<tr>
<th></th>
<th>400 amps. 50 Hz</th>
</tr>
</thead>
</table>


<table>
<thead>
<tr>
<th></th>
<th>16 KA (RMS)</th>
</tr>
</thead>
</table>

10. Rated short circuit making capacity

<table>
<thead>
<tr>
<th></th>
<th>25 KA (RMS)</th>
</tr>
</thead>
</table>

11. Rated peak withstand current

<table>
<thead>
<tr>
<th></th>
<th>40 KA (Peak)</th>
</tr>
</thead>
</table>

12. Rated cable charging breaking capacity

<table>
<thead>
<tr>
<th></th>
<th>40 KA (RMS)</th>
</tr>
</thead>
</table>

13. Rated Transformer off load breaking capacity

<table>
<thead>
<tr>
<th></th>
<th>16 Amp (RMS)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>14.</td>
<td>Rated line charging breaking capacity</td>
</tr>
<tr>
<td>15.</td>
<td>Minimum clearance between adjacent phases</td>
</tr>
<tr>
<td>a)</td>
<td>Switch Closed (centre to centre)</td>
</tr>
<tr>
<td>b)</td>
<td>Switch Opened (centre to edge of blade)</td>
</tr>
<tr>
<td>16.</td>
<td>Temperature rise</td>
</tr>
<tr>
<td>a)</td>
<td>Temperature rise shall not exceed the maximum limit as specified below at an ambient temperature not exceeding in 40°C</td>
</tr>
<tr>
<td>b)</td>
<td>Copper contacts in air</td>
</tr>
<tr>
<td>c)</td>
<td>Terminal of switch intended to be connected to external conductor by bolts</td>
</tr>
<tr>
<td>17.</td>
<td>Vertical Clearance from top of insulator cap to mounting channel</td>
</tr>
<tr>
<td>18.</td>
<td>Type of Contact: -</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>19. Connectors:-</strong></td>
<td>b) Solid rectangular blade type moving contact of electrolytic copper size 250 mm x 50 mm x 8 mm duly silver plated ensuring a minimum deposit of 10 micron of silver on copper contacts or as may be prescribed under relevant ISS / IEC.</td>
</tr>
<tr>
<td></td>
<td>c) Pressure spring to be used in jaw contacts shall be Stainless Steel having 8 nos of turn x 28 mm height x 14.4 mm diameter with 14 SWG wire (minimum six nos springs shall be used)</td>
</tr>
<tr>
<td><strong>20. Moving Contacts:-</strong></td>
<td>Terminal connectors for both movable and fixed should be of copper flats of same size similar to that of moving contact blades (minimum 95% copper composition). The fixed connector shall of size 80 mm x 50 x 8 mm and the size of movable connector shall be size 80 x 50 x 8 mm with machine finishing duly silver plated with 2 nos. of 3/8” stainless steel bolts, nuts, plain washers &amp; spring washers should be provided along with 2 nos solder less bimetallic sockets for each connector suitable sockets for each connector suitable up to 232 mm² AAA conductor.</td>
</tr>
<tr>
<td><strong>21. Galvanization</strong></td>
<td>Movable contact is to be supported by galvanized angle of 50 x 50 x 5 mm in each phase and the moving contact are to be bolted through 2 no stainless steel bolts and nuts with suitable stainless steel flat and spring washers.</td>
</tr>
<tr>
<td><strong>22. Details of Phase</strong></td>
<td>a) Iron parts shall be dip galvanized as per IS-2633/1972.</td>
</tr>
<tr>
<td></td>
<td>b) The pipe shall be galvanized as per IS-4736/1968.</td>
</tr>
<tr>
<td>a) Coupling Rod</td>
<td>25 mm nominal bore G.I. pipe medium gauge.</td>
</tr>
</tbody>
</table>
### Operating Rod

32 mm nominal bore G.I. pipe medium gauge single length 6 mtrs. The detailed dimension of the G.I. pipe as per IS-1239 (Pt. I) as mentioned below:

<table>
<thead>
<tr>
<th>Nominal base (mm)</th>
<th>Outside diameter (mm)</th>
<th>Diameter thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max</td>
<td>Min</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>34.2</td>
<td>33.3</td>
</tr>
<tr>
<td>32</td>
<td>42.9</td>
<td>42</td>
</tr>
</tbody>
</table>

### Arcing Horns

10 mm dia G.I. rod with spring assisted operation.

### Force of Fixed contact spring

To be specified by the tenderer.

### Copper braided flexible tapes:

450 mm length of flexible electrolytic copper tape or braided chord (with tin coated) having minimum weight 450 gms per meter and both ends shall be crimped with copper sockets through brass bolts and nuts with brass flat washers. Two nos of suitable copper sockets shall be used at both ends. The minimum no. of flexible wires should be 1536 of 36 SWG for each flexible chord.

### Quick break device

Lever mechanism.

### Bearings

4 nos. self lubricated bearing to be provided with grease nipple including 4th bearing being a thrust bearing.

### Locking arrangement

Pad Lock & Key arrangement at both ‘ON’ & ‘OFF’ position.

### Earth Terminal:

To be provided at base channels.

### Supporting Channels

100 mm x 50 mm M.S. Channel hot dip galvanized.

### Weight of each pole complete

To be specified by the tender

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GUARANTEED TECHNICAL PARTICULARS FOR 11 KV, 400 A, 3 POLE, 50 HZ, SINGLE BREAK A.B. SWITCHES

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<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Particulars</th>
<th>Desired values</th>
<th>Bidder’s offer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Maker’s name and country of origin</td>
<td>To be specified by the tenderer</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Type of Switch</td>
<td>Rotating type only</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Suitable for mounting</td>
<td>Horizontal only</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Number of supporting post insulators per phase</td>
<td>2 nos.12 KV Post Insulators per phase as per ISS-2544/1973.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Post Insulator.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>Maker’s name and country of origin</td>
<td>To be specified by the tenderer</td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td>Type of cementing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>To be quoted original cemented only &amp; as per IS-2544-1973 &amp; relevant IEC.</td>
<td></td>
</tr>
<tr>
<td>c)</td>
<td>One minute power frequency withstand voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dry</td>
<td>35 KV RMS.</td>
<td></td>
</tr>
<tr>
<td>d)</td>
<td>One minute power frequency withstand voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wet</td>
<td>35 KV RMS.</td>
<td></td>
</tr>
<tr>
<td>e)</td>
<td>Visible discharge voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>9 KV RMS.</td>
<td></td>
</tr>
<tr>
<td>f)</td>
<td>Dry Flashover Voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g)</td>
<td>Power frequency puncture with stand voltage</td>
<td>1.3 times of actual dry flash over voltage</td>
<td></td>
</tr>
<tr>
<td>h)</td>
<td>Impulse withstand voltage (switch in position)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>75 KV (peak)</td>
<td></td>
</tr>
<tr>
<td>i)</td>
<td>Creepage distance (mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>320 mm minimum. (Confirming to ISS-2544 / 1973 &amp; relevant IEC)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Impulse withstand voltage for positive and negative polarity 1.2 / 50 micro-</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>second wave</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>Across the isolating distance</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>85 KV (peak)</td>
<td></td>
</tr>
</tbody>
</table>
### 7. One minute power frequency withstand voltage

| a)   | Across the isolating distance | 32 KV (RMS) |
| b)   | To earth & between poles       | 28 KV (RMS) |

### 8. Rated normal current and rated frequency

| 400 Amps. 50 Hz |


| 25 KA (RMS) |

### 10. Rated short time current.

| 16 KA (RMS) |

### 11. Rated peak withstand current

| 40 KA (Peak) |

### 12. Rated mainly active load breaking capacity

| 400 Amp (RMS) |

### 13. Rated Transformer off load breaking capacity

| 6.3 Amp (RMS) |

### 14. Rated line charging breaking capacity

| 2.5 Amps (RMS) |

### 15. Minimum clearance between adjacent phases

| a) Switch Closed (centre to centre) | 760 mm |
| b) Switch Opened (centre to edge of blade) | 380 mm |

### 16. Temperature rise

<p>| Temperature rise shall not exceed the maximum limit as specified below at an ambient temperature not exceeding in 40°C |
| 40°C |
| Copper contacts silver plated | 65°C |</p>
<table>
<thead>
<tr>
<th></th>
<th>Terminal of switch intended to be connected to external conductor by bolts</th>
<th>50 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.</td>
<td>Vertical Clearance from top of insulator cap to mounting channel</td>
<td>254 mm (minimum)</td>
</tr>
<tr>
<td>18.</td>
<td>Type of Contact: -</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Self aligned, high pressure jaw type fixed contacts of electrolytic copper of size 80 mm x 50 mm x 8 mm duly silver plated. Each contact should be revetted with three nos. Copper rivets with a bunch (minimum 3 mm thick) consisting of copper foils, each may vary from 0.15 mm to 0.25 mm. This total thickness of copper foils per jaw should be 6 mm. Jaw assemblies are to be bolted through stainless steel bolts and nuts with stainless steel flat and spring washer.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) Solid rectangular blade type moving contact of electrolytic copper size 220 mm x 50 mm x 8 mm duly silver plated ensuring a minimum deposit of 10 micron of silver on copper contacts or as may be prescribed under relevant ISS / IEC.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c) Pressure spring to be used in jaw contacts shall be Stainless Steel having 8 no’s of turn x 28 mm height x 14.4 mm diameter with 14 SWG wire (minimum six no’s springs shall be used)</td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>Connectors:-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Terminal connectors for both movable and fixed should be of copper flats of same size similar to that of moving contact blades (minimum 95% copper composition). The fixed connector shall of size 80 mm x 50 mm x 8 mm and the size of movable connector shall be size 80 x 50 x 8 mm with machine finishing duly silver plated with 2 nos. of 3/8” stainless steel bolts, nuts, plain washers &amp; spring washers should be provided along with 2 no’s solder less bimetallic sockets for each connector suitable sockets for each connector suitable up to 80 Sq.mm conductor.</td>
<td></td>
</tr>
</tbody>
</table>
20. Moving Contacts:-  
Movable contact is to be supported by galvanized angle of 50 x 50 x 5 mm in each phase and the moving contact are to be bolted through 2 no stainless steel bolts and nuts with suitable stainless steel flat and spring washers.

21. Galvanization  
a) Iron parts shall be hot dip galvanized as per IS-2633/1972.  
b) The pipe shall be galvanized as per IS-4736/1968.

22. Details of Phase  

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>Coupling Rod</td>
<td>25 mm nominal bore G.I. pipe medium gauge.</td>
</tr>
<tr>
<td>b)</td>
<td>Operating Rod</td>
<td>32 mm nominal bore G.I. pipe medium gauge single length 6 mtrs. The detailed dimension of the G. I. pipe as per IS-1239 (Pt. I) as mentioned below :-</td>
</tr>
<tr>
<td></td>
<td>Nominal base (mm)</td>
<td>Outside diameter (mm)</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>Max</td>
<td>Min</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>34.2</td>
</tr>
<tr>
<td></td>
<td>32</td>
<td>42.9</td>
</tr>
<tr>
<td>c)</td>
<td>Arcing Horns</td>
<td>10 mm dia G.I. rod with spring assisted operation.</td>
</tr>
<tr>
<td>d)</td>
<td>Force of Fixed contact spring</td>
<td>To be specified by the tenderer.</td>
</tr>
<tr>
<td>e)</td>
<td>Copper braided flexible tapes:-</td>
<td>320 mm length of flexible electrolytic copper tape or braided chord (with tin coated) having minimum weight 450 gms per meter and both ends shall be crimped with copper sockets through brass bolts and nuts with brass flat washers. Two no’s of suitable copper sockets shall be used at both ends. The minimum no. of flexible wires should be 1536 of 36 SWG for each flexible chord.</td>
</tr>
<tr>
<td>f)</td>
<td>Quick break device</td>
<td>Lever mechanism.</td>
</tr>
</tbody>
</table>
9.0 SCOPE

This specification covers the design manufacture, shop testing, loading, transportation and delivery at sub-station site of 33KV, 400Amp, 3Pole & 11KV, 400Amp, 3Pole H.G. Fuse Sets for outdoor installations to be used at 33/11KV Sub-stations suitable for operation under off load conditions.

9.1 DESCRIPTION OF THE MATERIALS:-

9.1.1 The 33KV. 400Amps, 3 Pole H.G Fuse Sets shall confirm to the following parameters:-

i) Number of Poles: - 3
ii) No. of insulator per pole: - 4nos. 22/24KV Post Insulator/ Phase
iii) Nominal system voltage 33 KV
iv) Highest system voltage: - 36KV
Office of the Executive Engineer (Elect)  Construction Division  Jeypore

v) Rated frequency: - 50 Hz
vi) System Earthing: - Effectively earthed
vii) Rated normal current - 400 Amps
viii) Altitude of installation not exceeding 1000 M.

The post insulator used in the H.G. Fuse set shall have the following ratings:

i) Power frequency withstand voltage (dry) 95KV (RMS)
ii) Power frequency withstand voltage (wet) 75 KV (RMS)
iii) Impulse withstand voltage (dry) 170 KV (Peak)
iv) Power frequency puncture withstand voltage 1.3 times the actual dry
Flashover voltage of the unit.

9.1.2 The 11KV, 400Amps, 3 Pole H.G Fuse Sets shall confirm to the following parameters:

i) Number of Poles:- 3
ii) No. of insulator per pole:- 2nos. 12KV Post Insulator/ Phase
iii) Nominal system voltage 11KV
iv) Highest system voltage:- 12KV
v) Rated frequency:- 50 Hz
vi) System earthing:- Effectively earthed
vii) Rated normal current 400 Amps
viii) Altitude of installation Not exceeding 1000 M.

The post insulator used in the H.G. Fuse set shall have the following ratings:

i) Power frequency withstand voltage (dry) 35KV (RMS)
ii) Power frequency withstand voltage (wet) 35 KV (RMS)
iii) Impulse withstand voltage (dry) 75 KV (Peak)
iv) Power frequency puncture withstand voltage 1.3 times the actual dry
Flashover voltage of the unit.

9.2. STANDARDS:- The H.G. Fuse Set shall conform to the following standards:-
9.3 INSULATORS:

The 12KV & 22KV/ 24KV post insulators complete with pedestal cap duly cemented to be used in the H.G. Fuse sets confirming to IS-2544/1973.

The bidder shall mention make, type of insulation materials, metal fittings, Creepage distance, protected Creepage distance, tensile strength, compression strength, torsion strength and cantilever strength.

The bidder shall furnish the type test certificate of the post insulators from their manufacturer for reference & scrutiny.

9.4 CLIMATIC CONDITIONS: - The H.G. Fuse Set shall be suitable for operation under the following climatic conditions:

i) Maximum ambient air temperature \( 49^\circ C \)

ii) Maximum daily average air temperature \( 35^\circ C \)

iii) Maximum yearly average ambient air temperature \( 30^\circ C \)

iv) Maximum temperature attainable by a body Exposed to the sun \( 50^\circ C \)

v) Minimum ambient air temperature \( 10^\circ C \)

vi) Maximum relative humidity \( 100\% \)

vii) Minimum number of rainy days per annum \( 70 \)

viii) Average number of rainy days per annum \( 120 \)

ix) Average annual rain fall \( 150 \text{ cm} \)

x) Number of months of tropical monsoon conditions \( 4 \)

xi) Maximum wind pressure \( 260 \text{ Kg.}/\text{mm}^2 \)

xii) Degree of exposure to atmospheric pollution Normally polluted atmosphere.
9.5 TECHNICAL DETAILS:-

The H.G. Fuses shall have adjustable arcing horns made of solid copper rod having 8.23 mm dia. The horns shall be fitted with screwing devices with flynuts for fixing and tightening the fuse wire. It shall have robust terminal connector 5s of size 80mm x 50 mm x 8 mm made of copper casting (95% minimum copper composition) duly silver plated with two numbers of 12mm dia brass bolts and double nuts with flat brass washers. The connector should be capable of connecting crimp able conductor up to 232 Sq.mm. size (ACSR/ AAAC) with bimetallic solder less sockets. The H.G. Fuse Set shall suitable for horizontal mounting on sub-station structures. The minimum clearance between the adjacent phases of the fuse set shall be 1200 mm and the centre to centre (distance between two post insulators of the same phase) shall be 760 mm. All metal (ferrous) parts shall be galvanized and polished. Only post insulator (original cemented and not pin insulators shall be used for the H.G. Fuse Set.

9.6 DRAWING & LITERATURES:-

Three copies of drawings of each item of 33KV & 11KV, 400Amp, 3 Pole H.G. Fuse shall be furnished along with the tender for reference. The details of construction and materials of different parts of the H.G Fuse shall clearly be indicated in the tender and illustrative pamphlet/literature for the same shall be submitted along with the tender.

9.7 TESTS & TEST CERTIFICATE:-

9.7.1 Type Test:- Certificates for the following type tests conducted within five years proceeding to the date of opening of tender on a prototype set of H.G. Fuse in a NABL Accredited Laboratory preferably at CPRI Bangalore shall be submitted along with the tender.

i) Impulse voltage dry test

ii) Power frequency voltage dry test

iii) Power frequency voltage wet test

iv) Temperate of resistance.
v) Test to prove the capability of carrying the rated peak short circuit current and the rated short time current.
vi) Mainly active load braking capacity test.
vii) Transformer off-load breaking test.
viii) Line charging breaking capacity test.
ix) Operation tests.
x) Mechanical endurance test.
xi) Mechanical strength test for the post insulator as per IS:2544/1973, 5350 (Pt-II)/1970 & relevant IEC.
xii) Test for galvanization of metal (ferrous) parts as per IS- 2633/1973.

Besides above, mechanical endurance test will have to be conducted on one set in the presence of our authorized person who shall be deputed to carryout acceptance test before delivery of the materials.

9.7.2 Routine Tests:-
The following routine tests shall have to be conducted on each sets and results are to be furnished for consideration for acceptance of deputing inspecting Officer for inspection & conducting testing of the materials.
i) Power frequency voltage dry test.
ii) Tests to prove satisfactory operation.
iii) Dimension check.
iv) Galvanization test.

9.8 GUARANTEED TECHNICAL PARTICULARS:-
The bidders are required to furnish the guaranteed technical particulars at Schedules attached to this specification duly filled in along with the tender.

9.9 COMPLETENESS OF EQUIPMENT:-
Any fittings accessories or apparatus which may not have been specifically mentioned in this specification but which are usually necessary in equipment of similar plant shall be deemed to
be included in the specification and shall be supplied by the bidder without extra charge. All plant and equipment shall be complete in all details whether such details are mentioned in the specification or not.

9.10 INSPECTION AND TESTING:

The Purchaser shall have free entry at all times, while work on the contract is being performed, to all parts of the manufacturer’s works which concern the processing of the equipment ordered. The manufacturer shall afford the Purchaser without charge, all reasonable facilities to assure that the equipment being furnished is in accordance with this specification.

The equipment shall successfully pass all the type tests and routine tests referred to and those listed in the most recent edition of the standards given in this specification.

The Purchaser reserves the right to reject an item of equipment if the test results do not comply with the values specified or with the data given in the technical data schedule.

Type tests shall have been / shall be carried out at CPRI / National Govt. approved Laboratory and be witnessed by a representative of such laboratory or some other representative acceptable to the Purchaser. Routine tests shall be carried out by the Supplier at no extra charge at their works.

Adequate facility with calibrated testing equipment must be provided by the manufacturer free of cost to carry out the tests. Type test certificates must be furnished along with the tender for reference of the Purchaser.

All costs in connection with the testing, including any necessary re-testing, shall be borne by the Supplier who shall provide the Purchaser with all the test facilities which the latter may require, free of charge. The Purchaser shall have the right to select the samples for test and shall also have the right to assure that the testing apparatus is duly calibrated and correct. Measuring apparatus for routine tests shall be calibrated at the expense of the Supplier at an approved laboratory and shall be approved by the Purchaser.
The Supplier shall be responsible for the proper testing of the plant or materials supplied by sub-suppliers to the same extent as if the work, plant or materials were completed or supplied by the Supplier.

Any cost, incurred by the Purchaser in connection with inspection and re-testing as a result of failure of the equipment under test or damage during transport or offloading shall be to the account of the Supplier.

The supplier shall submit to the Purchaser five signed copies of the test certificates, giving the results of the tests as required. No materials shall be dispatched until the test certificates have been received by the Purchaser and the Supplier has been informed that they are acceptable.

The test certificates must show the actual values obtained from the tests, in the units used in this specification, and not merely confirm that the requirements have been met.

In the case of components for which specific type tests or routine tests are not given in this specification, The Supplier shall include a list of the tests normally required for these components. All materials used in the Contract shall withstand and shall be certified to have satisfactorily passed such tests.

The Purchaser at his discretion may re-confirm the Test Results in his own laboratory or laboratory of his choice.

No inspection or lack of inspection or passing by the Purchaser’s Representative of equipment or materials whether supplied by the Supplier or sub-supplier, shall relieve the Supplier from his liability to complete the contract works in accordance with the contract or exonerate him from any of his guarantees.

**GURANTEED TECHNICAL PARTICULARS FOR 400 AMP, 3 POLE, H.G. FUSES.**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Particulars</th>
<th>Desired Values for</th>
<th>Bidder’s Offer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>33 KV</td>
<td>11 KV</td>
</tr>
<tr>
<td></td>
<td>1. Maker's name and country or origin</td>
<td>2. Suitable for mounting</td>
<td>3. Number of supporting post insulator per phase</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------</td>
<td>-------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>To be specified by the bidder.</td>
<td>Horizontal only.</td>
<td>4 nos. 22KV/24KV Post Insulator per phase as per ISS - 2544/1973</td>
</tr>
<tr>
<td>2</td>
<td>Post Insulator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>(a) Maker's name and country or origin</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(b) Type of cementing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(c)</td>
<td>One minute power frequency withstand voltage dry</td>
<td>95KV RMS</td>
<td>35KV RMS</td>
</tr>
<tr>
<td>(d)</td>
<td>One minute power frequency withstand voltage wet.</td>
<td>75 KV RMS.</td>
<td>35KV RMS</td>
</tr>
<tr>
<td>(e)</td>
<td>Visible discharge voltage</td>
<td>27KV RMS</td>
<td>9KV RMS</td>
</tr>
<tr>
<td>(f)</td>
<td>Dry Flashover Voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(g)</td>
<td>Power frequency puncture withstand voltage</td>
<td>1.3 times of actual dry flash over voltage.</td>
<td></td>
</tr>
<tr>
<td>(h)</td>
<td>Impulse withstand voltage (switch in position)</td>
<td>170KV (peak)</td>
<td>75KV (peak)</td>
</tr>
<tr>
<td>(i)</td>
<td>Creepage distance</td>
<td>380mm minimum. (actual creepage distance for which type test have been conducted is to be specified by the bidder)</td>
<td>230mm minimum. (actual creepage distance for which type test have been conducted is to be specified by the bidder)</td>
</tr>
<tr>
<td></td>
<td>Impulse withstand voltage for positive and negative polarity (1.2/50 micro second wave)</td>
<td></td>
<td></td>
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<tr>
<td>---</td>
<td>------------------------------------------------------------------------------------------------</td>
<td></td>
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<tr>
<td>5</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>(a) Across the isolating distance 195 KV (peak) 85KV (peak)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(b) To earth &amp; between poles 170 KV (peak) 75 KV (peak)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>One minute power frequency withstand voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(a) Across the isolating distance 100 KV (RMS) 32 KV (RMS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>(b) To earth &amp; between poles 75 KV (RMS) 28 KV (RMS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rated normal current and rated frequency. 400 amps, 50 Hz, 3 Pole</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Operating Voltage 33 KV 11 KV</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Vertical clearance from top of insulator cap to mounting Channel 508 mm (minimum) 254 mm (minimum)</td>
<td></td>
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</tr>
<tr>
<td>7</td>
<td>Height of the riser for carrying the horns. 250mm from the cap (top) of insulator. 150mm from the cap (top) of insulator.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Details of Arcing Horns Copper rod having 8.32 mm dia Silver-plated provided with screwing arrangement for fixing use wire made of copper casting. (Total length 995mm). All the bolts, nuts and washers should be made out of brass. Copper rod having 7.62 mm dia Silver-plated provided with screwing arrangement for fixing use wire made of copper casting. (Total length 635mm). All the bolts, nuts and washers should be made out of brass.</td>
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</tr>
<tr>
<td>12</td>
<td>Riser Unit (250mm height)</td>
<td>(a) The shape of connectors may be made of straight copper Flat of size adequate enough to carry a current density not less than 1.5 Amp/mm². 2 Nos of 3/8” G.I. Bolts, double nuts, plain and spring washers and 2 nos. solder less bimetallic shockets per each connector suitable up to 232 mm² AAA conductor.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(a) The shape of connectors may be made of straight copper Flat of size adequate enough to carry a current density not less than 1.5 Amp/mm². 2 Nos of 3/8” G.I. Bolts, double nuts, plain and spring washers and 2 nos. solder less bimetallic shockets per each connector suitable up to 100 mm² AAA conductor.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) 170mm height G.I. Riser made of 25mm nominal bore medium gauge G.I. Pipe welded with 2 nos. G.I. Flat of 35 x 5 mm at both ends fixed with 10mm dia stainless steel, bolts and nuts with flat stainless steel spring washers.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) 100mm height G.I. Riser made of 19mm nominal bore medium gauge G.I. Pipe welded with 2 nos. G.I. Flat of 30 x 5 mm at both ends fixed with 10mm dia stainless steel, bolts and nuts with flat stainless steel spring washers.</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Supporting Channels</td>
<td>100 x 50 x 6 mm M.S. Channel (galvanized)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>75 x 40 x 6 mm M.S. Channel (galvanized)</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Galvanization</td>
<td>All ferrous parts should be galvanized as per IS-2633/1972 &amp; all non-ferrous part should be duly electroplated with silver.</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Weight of each pole (complete)</td>
<td>To be specified by the tendered.</td>
<td></td>
</tr>
</tbody>
</table>
CONTROL CABLES

13.0 TECHNICAL SPECIFICATION FOR CONTROL CABLES

13.1 PART 1 : SCOPE AND CONDITIONS

This specification covers the testing and performance requirements of control cables for installation on the Distribution System of SOUTHCO.

The equipment offered shall have been successfully type tested and the design shall have been in satisfactory operation for a period not less than preceding two years on the date of bid opening. Compliance shall be demonstrated by submitting with the bid, (i) authenticated copies of the type test reports and (ii) performance certificates from the users.

The control cables shall conform in all respects to highest standards of engineering, design, workmanship, this specification and the latest revisions of relevant standards at the time of offer and the Engg In-charge shall have the power to reject any work or material, which, in his judgment, is not in full accordance therewith.

13.2 STANDARDS

Except where modified by this specification, the control cables shall be designed, manufactured and tested in accordance with the latest editions of the following standards.

<table>
<thead>
<tr>
<th>IEC / ISO</th>
<th>Indian Standard</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC 811</td>
<td>IS-18-10810:1982</td>
<td>Testing cables</td>
</tr>
<tr>
<td>IEC 502</td>
<td>IS-7098:1985 (part 2) LT and 3.3 - 33kVXLPE cables</td>
<td></td>
</tr>
<tr>
<td>IEC 502</td>
<td>IS - 1554:1988 (part 1)</td>
<td>PVC Cables .65/1.1kV</td>
</tr>
<tr>
<td>IEC 227</td>
<td>IS - 5819:1970</td>
<td>Short circuit ratings for PVC cables</td>
</tr>
<tr>
<td>IEC 228</td>
<td>15-8130:1984</td>
<td>Conductors for insulated cables</td>
</tr>
<tr>
<td>IEC 502</td>
<td>IS - 6474: 1984</td>
<td>XLPE Cables</td>
</tr>
</tbody>
</table>
IEC 502 Extruded solid dielectric insulated power cables for rated voltages from 1.1kV to 30kV

IEC 540 IS - 5831: 1984 Test Methods for insulation and sheaths of electric cables and cords

IEC 287 Calculation of the continuous current rating of cables.

IS - 3975 : 1979 Mild steel wires, strips and tapes for armoring of cables

The Bidder may propose alternative standards, provided it is demonstrated that they give a degree of quality and performance equivalent to or better than the referenced standards. Acceptability of any alternative standard is at the discretion of the Project Manager. The Bidder shall furnish a copy of the alternative standard proposed along with his bid. If the alternative standard is in a language other than English, an English translation shall be submitted with the standard. In the case of conflict the order of precedence shall be 1) IEC or ISO Standards, 2) Indian Standards, 3) other alternative standards.

This list is not to be considered exhaustive and reference to a particular standard or recommendation in this Specification does not relieve the Contractor of the necessity of providing the goods complying with other relevant standards or recommendations.

13.3 SERVICE CONDITIONS

The service conditions shall be as follows:

- Maximum altitude above sea level 1,000m
- Maximum ambient air temperature 50°C
- Maximum daily average ambient air temperature 35°C
- Minimum ambient air temperature 0°C

(a) Maximum temperature attainable by an object exposed to the sun 60°C
(b) maximum yearly weighted average ambient temperature 32°C
(c) maximum relative humidity 100%
(d) average number of thunderstorm days per annum (isokeraunic level) 70
(e) average number of rainy days per annum 120
(f) average annual rainfall 150cm
(g) wind pressures as per IS 802 (Part I/ Sec. I) : 1995

Environmentally, the region where the work will take place includes coastal areas, subject to high relative humidity, which can give rise to condensation. Onshore winds will frequently be salt laden. On occasions, the combination of salt and condensation may create pollution conditions for outdoor insulators.

Therefore, outdoor material and equipment shall be designed and protected for use in exposed, heavily polluted, salty, corrosive and humid coastal atmosphere.

13.4 SYSTEM CONDITIONS

The cables shall be suitable for installation in supply systems of the following characteristics:

- Frequency 50 Hz
- Nominal system voltages 33 kV
- 11 kV
- 400 / 230 V
- Maximum system voltages: 33kV System 36.3 kV
- 11 kV System 12.1 kV
- LV System 476 V
- Minimum LV voltage 340 V
### Part 2: Technical

All control cables to be used in the SOUTHCO distribution system shall be of the cross-linked polyethylene (XLPE) or polyvinyl chloride (PVC) insulated with PVC sheathing types.

### 13.6 1.1KV Polyvinyl Chloride (PVC) Insulated Cables

### 13.7 Rated Voltage and Temperature

Control and Panel Wiring Cables (PVC insulated)
The conductor shall be of round stranded plain copper wires complying with IS - 8130:1984/IEC 228.
The conductors shall be of Flexibility Class 2 as per IS - 8130 : 1984.

13.8 Conductor screening not required

13.9 Insulation

The insulation shall be of Polyvinyl Chloride (PVC) compound. 'Heat Resisting' Type C for the Control and Panel Wiring cables. Both shall conform to the requirements of IS - 5831:1984.

<table>
<thead>
<tr>
<th>Type of Insulation</th>
<th>Normal Continuous Operation</th>
<th>Short Circuit Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Purpose</td>
<td>70°C</td>
<td>160°C</td>
</tr>
<tr>
<td>Heat Resisting</td>
<td>85°C</td>
<td>160°C</td>
</tr>
</tbody>
</table>

The PVC insulation shall be applied by extrusion and the average thickness of insulation shall not be less than the specified nominal value and the maximum value not more than 0.1 mm plus 0.1 of nominal and as specified in IS – 1554 (part 1): 1988.
The insulation shall be applied so that it fits closely on to the conductor and it shall be possible to remove it without damage to the conductor.

13.10 Insulation Screening not required

13.11 Core Identification and Laying up of Cores

In multi-core cables, the cores shall be laid up together with a suitable lay as recommended in IS - 1554 (Part 1): 1988. The layers shall have successive right and left hand lays with the outermost layer having a right hand lay.

13.12 Inner Sheath

The laid up cables shall be covered with an inner sheath made of thermoplastic material (PVC) applied by extrusion.
The thickness of the sheath shall conform to IEC 502/IS - 1554: 1988. Single core cables shall have no inner sheath.

The outer serving shall incorporate an effective anti-termite barrier and shall be capable of withstanding a 10kV DC test voltage for five minutes after installation and annually thereafter.

Cables shall be installed as a single four core cable or three single phase cables plus neutral in a close trefoil formation.

Current ratings shall be calculated in accordance with IEC 287 "Calculation of the continuous current rating of cables with 100% load factor".

13.13 Conductor Sizes
The following shall be used for Control and Panel Wiring:
2.5 mm² single core, 2.5 and 4.0 mm² four core and 1.5 and 2.5 mm² multicore

13.14 Cable Drum Length
The cable shall be supplied in 500metre lengths.

13.15 CABLE IDENTIFICATION
The manufacturer's and Employer's name or trade mark, the voltage grade, cable designation and year of manufacture shall be indented or embossed along the whole length of the cable. The indentation or embossing shall only done on the outer sheath. The alphanumerical character size shall be not less than 20% of the circumference of the cable and be legible.

13.17 NUMBER OF TESTS AND CRITERION FOR CONFORMITY
Suitable lengths of test samples shall be taken from each of the selected drums. These samples shall be subjected to each of the acceptance tests. A test sample shall be classed as defective if it fails any of the acceptance tests. If the number of defective samples is less than or equal to the corresponding number given in 8.3 the lot shall be declared as conforming to the requirements of acceptance test.

13.18 TESTS ON 1.1 KV PVC INSULATED CABLES
13.18.1 Type Tests

Certification of type tests already completed by independent test laboratories shall be presented with the bid for each cable type. These tests shall be carried out in accordance with the requirements of IS -8130: 1984/IEC 502, IS - 5831:1984/IEC 540 and IEC 811 unless otherwise specified.

Type testing of 33kV, 11kV and 1.1 kV cables shall include the following:

<table>
<thead>
<tr>
<th>Test</th>
<th>Requirement Reference</th>
<th>Test Method as a Part of IS-10810/IEC 811</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Tests on conductor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annealing test (copper)</td>
<td>IS-8130: 1984/IEC 502</td>
<td>1</td>
</tr>
<tr>
<td>Tensile test (aluminium)</td>
<td>IS-8130: 1984/IEC 502</td>
<td>2</td>
</tr>
<tr>
<td>Wrapping test (aluminium)</td>
<td>IS-8130: 1984/IEC 502</td>
<td>3</td>
</tr>
<tr>
<td>Resistance test</td>
<td>IS-8130: 1984/IEC 502</td>
<td>5</td>
</tr>
<tr>
<td>(b) Tests for Armour wires/ strips</td>
<td>IS - 3975: 1979/IEC 502</td>
<td>36 - 42</td>
</tr>
<tr>
<td>(c) Tests for thickness of insulation and sheath</td>
<td>IS-5831:1984/IEC 540</td>
<td>6</td>
</tr>
<tr>
<td>(d) Physical tests for Insulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tensile strength and elongation at break</td>
<td>IS-5831:1984/IEC 540</td>
<td>7</td>
</tr>
<tr>
<td>Ageing in air oven</td>
<td>IS-5831:1984/IEC 540</td>
<td>11</td>
</tr>
<tr>
<td>Hot test</td>
<td>IS-5831:1984/IEC 540</td>
<td>30</td>
</tr>
<tr>
<td>Shrinkage test</td>
<td>IS-5831:1984/IEC 540</td>
<td>12</td>
</tr>
<tr>
<td>Water absorption (gravimetric)</td>
<td>IS-5831:1984/IEC 540</td>
<td>33</td>
</tr>
<tr>
<td>(e) Physical tests for outer sheath</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tensile strength and elongation at break</td>
<td>IS-5831: 1984/IEC 540</td>
<td>7</td>
</tr>
<tr>
<td>Ageing in air oven</td>
<td>IS-5 831: 1984/IEC 540</td>
<td>11</td>
</tr>
</tbody>
</table>
Shrinkage test IS-5831: 1984/IEC 540 12
Hot deformation IS-5831: 1984/IEC 540 15

<table>
<thead>
<tr>
<th>Test</th>
<th>Requirement Reference</th>
<th>Test Method as a Part of IS-10810/IEC811</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of mass in air oven</td>
<td>IS-5831: 1984/IEC540</td>
<td>10</td>
</tr>
<tr>
<td>Heat shock</td>
<td>IS-5831: 1984/IEC540</td>
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<tr>
<td>(f) Partial discharge test</td>
<td>Section 13.2 of this specification</td>
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<td>(11 and 33kV only)</td>
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<tr>
<td>(g) Bending test (11 and 33kV only)</td>
<td>Section 13.2 of this specification</td>
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<td>(h) Dielectric power factor test</td>
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<td>(j) Insulation resistance test</td>
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Tests (g), (h), (j), (l) and (m) are only applicable to screened cables.
13.18.2 Acceptance Tests

The following shall constitute acceptance tests:

- Tensile test (aluminium)
- Annealing test (copper)
- Wrapping test
- Conductor resistance test
- Test for thickness of insulation and sheath
- Hot set test for insulation*
- Tensile strength and elongation at break test for insulation and outer sheath
- Partial discharge test (for screened cables only)**
- High voltage test
- Insulation resistance (volume resistivity) test.
- XLPE insulation only

** Test to be completed on full drum of cable

13.18.3 Routine Tests

Routine tests shall be carried out on all of the cable on a particular order. These tests shall be carried out in accordance with the requirements of IS - 8130: 1984/IEC 502 and IS - 5831:1984/IEC 540 unless otherwise specified.

The following shall constitute routine tests.

- Conductor resistance test
- Partial discharge test (for 11 kV and 33kV screened cables only)*
- High voltage test

* Test to be completed on full drum of cable

13.18.4 Optional Test
Cold impact test for outer sheath (IS - 5831 - 1984), which shall be completed at the discretion of the Project Manager and at the same time as test at low temperature for PVC as stipulated in the section on special tests.

13.18.5 Special tests

Special tests shall be carried out at the Project Manager's discretion on a number of cable samples selected by the Project Manager from the contract consignment. The test shall be carried out on 10% of the production lengths of a production batch of the same cable type, but at least one production length. Special tests shall be carried out in accordance with the requirements of IEC 502 and IEC 540 unless otherwise specified.

The following special tests shall be included:

• Conductor Examination (IEC-228)
• Check of Dimensions
• Test at low temperature for PVC

13.19 DETAILS OF TESTS

13.19.1 General

Unless otherwise stated, the tests shall be carried out in accordance with the appropriate part of IS -10810/IEC 502: 1994 and the additional requirements as detailed in this specification.

13.19.2 Partial Discharge Test

Partial discharge tests shall only be made on cables insulated with XLPE of rated voltages above 1.9/3.3kV.

For multicore cables, the test shall be carried out on all insulated cores, the voltage being applied between each conductor and the metallic screen.

13.19.3 Bending Test

The diameter of the test cylinder shall be 20 (d +D) ± 5% for single core cables and 15 (d+D) ± 5% for multicores, where D is the overall diameter of the completed cable in millimeters and d is the diameter of the conductor. After completing the bending operations, the test
samples shall be subjected to partial discharge measurements in accordance with the requirements of this specification.

13.19.4 Dielectric Power Factor Test

Tan δ as a Function of Voltage

For cables of rated voltage 1.1 kV and above

The measured value of tan δ at Uo shall not exceed 0.004 and the increment of tan δ between 0.5 Uo and 2 Uo shall not be more than 0.002.

13.19.5 Heating Cycle Test

The sample which has been subjected to previous tests shall be laid out on the floor of the test room and subjected to heating cycles by passing alternating current through the conductor until the conductor reaches a steady temperature 10°C above the maximum rated temperature of the insulation in normal operation. After the third cycle the sample shall subjected to a dielectric power factor as a function of voltage and partial discharge test.

13.19.6 High Voltage Test

1. Type/ Acceptance Test

The cable shall withstand, without breakdown, at ambient temperature, an ac voltage equal to 3Uo, when applied to the sample between the conductor and screen/ armor (and between conductors in the case of unscreened cable). The voltage shall be gradually increased to the specified value and maintained for a period of 4 hours.

If while testing, interruption occurs during the 4 hour period the test shall be prolonged by the same extent. If the interruption period exceeds 30 minutes the test shall be repeated.

2. Routine Test
Single core screened cables, shall withstand, without any failure, the test voltages given in this specification for a period of five minutes between the conductor and metallic screen.

Single core unscreened cables shall be immersed in water at room temperature for one hour and the test voltage then applied for 5 minutes between the conductor and water.

Multicore cables with individually screened cores, the test voltage shall be applied for 5 minutes between each conductor and the metallic screen or covering.

Multicore cables without individually screened cores, the test voltage shall be applied for 5 minutes in succession between each insulated conductor and all the other conductors and metallic coverings, if any.

When a DC voltage is used, the applied voltage shall be 2.4 times the power frequency test voltage. In all instances no breakdown of the insulation shall occur.

13.19.7 Flammability Test

The period for which the cable shall burn after the removal of the flame shall not exceed 60 seconds and the unaffected portion (uncharred) from the lower edge of the top clamp shall be at least 50mm.

13.20 CONTROL / LV WIRING ACCESSORIES

13.20.1 Terminations

Control wire terminations shall be made with solderless crimping type and tinned copper lugs which firmly grip the conductor. Insulated sleeves shall be provided at all the wire termination. Engraved core identification plastic ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wire and shall not fall off when the wire is disconnected from terminal blocks. All wires directly connected to trip circuit breaker or device shall be distinguished by the addition of red coloured unlettered ferrule. Numbers 6 and 9 shall not be included for ferrules purposes except where underlined and identified as 6 and 9.
LVAC cable terminals shall be provided with adequate size crimp type lugs. The lugs shall be applied with the correct tool, which shall be regularly checked for correct calibration. Bimetallic joints between the terminals and lugs shall be provided where necessary.

Terminals shall be marked with the phase colour in a clear and permanent manner.

A removable gland plate shall be provided by the contractor at every cable entry to mechanism boxes, cabinets and kiosks. The Contractor shall be responsible for drilling the cable gland plate to the required size.

PART 3: GENERAL PARTICULARS AND GUARANTEES

13.21 COMPLIANCE WITH SPECIFICATION

The control cables shall comply in all respects with the requirements of this specification. However, any minor departure from the provisions of the specification shall be disclosed at the time of bidding in the Non Compliance Schedule in this document.

The mass and dimensions of any item of equipment shall not exceed the figures stated in the schedules.

13.25 Inspection and testing

The authorized representative of SOUTHCO shall have free entry at all times, while work on the contract is being performed, to all parts of the manufacturer's works which concern the processing of the equipment ordered. The manufacturer shall afford the Project Manager without charge, all reasonable facilities to assure that the equipment being furnished is in accordance with this specification.

The equipment shall successfully pass all the type tests, acceptance tests and routine tests referred to in the section on Tests and those listed in the most recent edition of the standards given in this specification.

The Project Manager reserves the right to reject an item of equipment if the test results do not comply with the values specified or with the data given in the technical data schedule.
Type tests shall be carried out at an independent testing laboratory or be witnessed by a representative of such laboratory or some other representative acceptable to the Project Manager. Routine and acceptance tests shall be carried out by the Contractor at no extra charge at the manufacturer's works.

Type Test certificates shall be submitted with the bid for evaluation. The requirement for additional type tests will be at the discretion of the Project Manager.

The Project Manager may witness routine, acceptance and type tests. In order to facilitate this, the Contractor shall give the Project Manager a minimum of four weeks’ notice that the material is ready for testing. If the Project Manager does not indicate his intention to participate in the testing, the manufacturer may proceed with the tests and shall furnish the results thereof to the Project Manager.

Full details of the proposed methods of testing, including connection diagrams, shall be submitted to the Project Manager by the Contractor for approval, at least one month before testing.

All costs in connection with the testing, including any necessary re-testing, shall be borne by the Contractor, who shall provide the Project Manager with all the test facilities which the latter may require, free of charge. The Project Manager shall have the right to select the samples for test and shall also have the right to assure that the testing apparatus is correct. Measuring apparatus for routine tests shall be calibrated at the expense of the Contractor at an approved laboratory and shall be approved by the Project Manager.

The Contractor shall be responsible for the proper testing of the materials supplied by sub-contractors to the same extent as if the materials were completed or supplied by the Contractor.

Any cost incurred by the Project Manager in connection with inspection and re-testing as a result of failure of the equipment under test or damage during transport or off-loading shall be to the account of the Contractor.
The Contractor shall submit to the Project Manager five signed copies of the test certificates, giving the results of the tests as required. No materials shall be dispatched until the test certificates have been received by the Project Manager and the Contractor has been informed that they are acceptable.

The test certificates must show the actual values obtained from the tests, in the units used in this specification, and not merely confirm that the requirements have been met.

In the case of components for which specific type tests or routine tests are not given in this specification, the Contractor shall include a list of the tests normally required for these components. All materials used in the Contract shall withstand and shall be certified to have satisfactorily passed such tests.

No inspection or lack of inspection or passing by the Project Manager's Representative of equipment or materials whether supplied by the Contractor or sub-contractor, shall relieve the Contractor from his liability to complete the contract works in accordance with the contract or exonerate him from any of his guarantees.

13.26 Guarantee

The Contractor shall guarantee the following:

• Quality and strength of materials used;
• Satisfactory operation during the guarantee period of one year from the date of commissioning, or 18 months from the date of acceptance of the equipment by the Project Manager following delivery, whichever is the earlier.
• Performance figures as supplied by the Bidder in the schedule of guaranteed particulars.

13.29 PACKING AND SHIPPING

13.29.1 Packing

The cable shall be wound on strong drums or reels capable of withstanding all normal transportation and handling.
Each length of cable shall be durably sealed before shipment to prevent ingress of moisture. The drums, reels or coils shall be lagged or covered with suitable material to provide physical protection for the cable during transit and during storage and handling operations.

In the case of steel drums adequate precautions shall be taken to prevent damage being caused by direct contact between the cable sheath and the steel. These precautions shall be subject to the approval of the Project Manager.

If wooden drums are used then the wood shall be treated to prevent deterioration from attack by termites and fungi.

Each drum or reel shall carry or be marked with the following information:

• Individual serial number
• Employer's name
• Destination
• Contract Number
• Manufacturer's Name
• Year of Manufacture
• Cable Size and Type
• Length of Conductor (meters)
• Net and Gross Mass of Conductor (kg)
• All necessary slinging and stacking instructions.
• Destination;
• Contractor's name;
• Name and address of Contractor's agent in Odisha;
• Country of origin;

The direction of rolling as indicated by an arrow shall be marked on a flange.

13.29.2 Storage
The site selected for the storage of cable drums shall be well drained and preferably have a concrete/firm surface which will prevent the drums sinking into the ground or being subjected to excess water thus causing flange rot.

All drums shall be stood on battens, in the upright position, and in such a manner to allow sufficient space between them for adequate air circulation. During storage the drums shall be rotated 90° every three months. In no instances shall the drums be stored "flat" on their flanges or one on top of each other.

13.29.3 Shipping

The Contractor shall be responsible for the shipping of all cables, drums and reels supplied from abroad to the ports of entry and for the transport of all goods to the various specified destinations including customs clearance, offloading, warehousing and insurance.

The Contractor shall inform himself fully as to all relevant transport facilities and requirements and loading gauges and ensure that the equipment as packed for transport shall conform to these limitations. The Contractor shall also be responsible for verifying the access facilities specified.

The Contractor shall be responsible for the transportation of all loads associated with the contract works and shall take all reasonable steps to prevent any highways or bridges from being damaged by his traffic and shall select routes, choose and use vehicles and restrict and distribute loads so that the risk of damage shall be avoided. The Contractor shall immediately report to the Project Manager any claims made against the Contractor arising out of alleged damage to a highway or bridge.

All items of equipment shall be securely clamped against movement to ensure safe transit from the manufacturer's facilities to the specified destinations (work sites.)

The Contractor shall advise the storage requirements for any plant and equipment that may be delivered to the Project Manager's stores. The Contractor shall be required to accept responsibility for the advice given in so far as these arrangements may have a bearing on the behavior of the equipment in subsequent service.
13.29.4 Hazardous substances

The Contractor shall submit safety data sheets in a form to be agreed for all hazardous substances used with the equipment. The Contractor shall give an assurance that there are no other substances classified as hazardous in the equipment supplied. The Contractor shall accept responsibility for the disposal of such hazardous substances, should any be found.

The Contractor shall be responsible for any injuries resulting from hazardous substances due to non compliance with these requirements.

14.0 ERECTION WORK

14.1 CIVIL WORKS

Civil works includes the following items.

The scope shall generally cover sub- station structures, including gantries and equipment support structures and their foundations, cable trenches along with covers, cable trench crossings of road and rails, sump pits, marshalling box/control cubicle foundations, switchyard dressing and levelling, site clearance, soil investigation, roads, drains, fencing, gravel filling and, transformer foundations, firewalls, control room building, Any other items, not specifically mentioned here but required for the commissioning of substation shall be deemed to be included in the scope of this Specification. The scope shall further cover design, engineering, erection, testing and commissioning of all civil works at each substation. All civil works shall also satisfy the General Technical Clauses specified in other sections of this specification and as detailed below.

Excavation, dewatering, carriage of excavated earth, plain cement concrete (PCC), casting of reinforced cement concrete (RCC) foundations, super-structures for sub- station structures, equipment supports, their control cubicles, bus post supports, lighting poles and panels, brick and stone masonry, cable trenches, pipe trenches with necessary pre cast RCC removable covers, with lifting facility(In every 5th slab) and sump pits, cable supports and their embedment in cable trenches and cable trench crossings road or rail track with backfilling complete as per drawings approved by SOUTHCO, shall be carried out by the contractor. The
cable trenches inside the control room shall be provided with GI chequered plate with angle stiffeners at the bottom for mechanical strength and painting there of as per the standard practice.

The Contractor shall furnish all designs, (unless otherwise specified) drawings, labour, tools, equipment, materials, temporary works, constructional plant and machinery, fuel supply, transportation and all other incidental items not shown or specified but as may be required for complete performance of the Works in accordance with approved drawings, specifications and as per direction of the Engg In-charge (Divisional Engr.).

The work shall be carried out according to the design/drawings to be developed by the Contractor, and approved by the GM o/o SOUTHCO or supplied to the bidder by the Engg In-charge (Divisional Engr.). For all buildings, structures, foundations etc. necessary layout, levels and details shall be developed by the Contractor keeping in view the functional requirement of the plant and facilities and providing enough space and access for operation, use and maintenance based on the input provided by the Engg In-charge (Divisional Engr.). Certain minimum requirements are indicated in this specification for guidance purposes only. However, the Bidder shall quote according to the complete requirements.

14.1.1 SOIL INVESTIGATION

General

The Contractor shall perform a detailed soil investigation to arrive at sufficiently accurate general as well as specific information about the soil profile/strata and the necessary soil parameters of the site in order that the foundations of the various structures can be designed and constructed safely and rationally. Foundation systems adopted by the contractor shall ensure that relative settlement shall be as per provision in IS 1904 and any latest IS and other Indian Standards.

A report to the effect will be submitted by the Contractor for the Engg In-charge specific approval giving details regarding his assumed data for Civil structures design.
Any variation in soil data shall not constitute a valid reason for any additional cost and shall not affect the terms and condition of the Contract. Nothing extra what so ever shall be paid to the Contractor on account of any variation in subsoil properties /or conditions. Tests must be conducted under all the critical locations i.e. Control room building & transformer location etc. However, some of the soil parameters given below for substations have to be determined and submitted to Engg In-charge.

(a) **Recommendation** The report should contain specific recommendations for the type of foundation for the various structures envisaged at site. The Contractor shall acquaint himself about the type of structures and their functions from the Engg In-charge. The observations and recommendations shall include but not be limited to the following:

(b) Recommended type of foundations for various structures. If piles are recommended the type, size and capacity of pile shall be given.

(c) Recommendations regarding slope of excavations and dewatering schemes, if required.

Recommendations for additional investigation beyond the scope of the present work, if Contractor considers such investigation necessary

14.1.2 **EXCAVATION AND BACKFILL**

Excavation and backfill for foundations shall be in accordance with the relevant Code. Backfilled materials in the pit to be levelled maximum up to a height of 200-250 mm and then to be compacted to 150mm after sprinkling of required quantity of water.

Whenever water table is met during the excavation, it shall be dewatered and water table shall be maintained below the bottom of the excavation level during excavation, concreting and backfilling.

14.1.3 **Rock excavation**

The rock to be excavated shall be classified under the following categories:
1. **Ordinary rock**

   Rock which does not require blasting, wedging or similar means for excavation is considered as ordinary rock. This may be quarried or split with crowbars or pickaxes and includes limestone, sandstone, hard laterite, hard conglomerate and reinforced cement concrete below ground level. It will also include rock which is normally hard requiring blasting when dry but can be excavated without blasting, wedging or similar means when wet. It may require light blasting for loosening materials, but this will not any way entitle the material to be classified as hard rock.

2. **Hard Rock (Blasting prohibited)**

   This shall cover any hard rock requiring blasting as described in above but where blasting is prohibited for any reason and excavation has to be carried out by chiselling, wedging, drilling or any other approved method.

14.2 **Authority for classification**

   The classification of excavation shall be decided by the Engg In-charge and his decision shall be final and binding on the Contractor.

**Excavations for foundations and other purposes**

   Excavations shall be of the minimum sizes necessary for the proper construction of the works, and excavations shall not be kept open for periods longer than that reasonably required to construct the works. The Contractor shall take all precautions necessary to ensure that the bottoms of excavations are protected from deterioration and that the excavations are carried out in such a manner that adjacent foundations, pipes or such like are not undermined, damaged or weakened in any way. Any excavation taken out below the proper level without approval shall be made good at the expense of the Contractor using concrete or other material as directed.

14.2.1 **Support of excavations**

   The Contractor shall be responsible for the stability of the sides of the excavations. Excavation surfaces shall be close timbered or sheeted, planked and strutted as and when
necessary during the course of the work and shall ensure the safety of personnel working within them. If any slips occur, they shall, as soon as practicable, be made good in an approved manner at the expense of the Contractor. Shoring shall not be removed until the possibility of damaging the works by earth pressure has passed. No payment for shoring or timber left in shall be made, unless agreed in writing by the Engg In-charge.

14.2.2 Works to be in dry

All excavations shall be kept free from water and the Contractor shall take whatever action is necessary to achieve this. Pumping, hand dewatering and other means necessary to maintain the excavations free from water shall be at the expense of the Contractor, and carried out in an approved manner.

14.3 Backfill

As soon as possible after the permanent foundation works are sufficiently hard and have been inspected and approved, backfill shall be placed where necessary and thoroughly consolidated in layers not exceeding two hundred (200) millimetres in depth.

On completion of structures, the earth surrounding them shall be accurately finished to the line and grade as shown on the drawings. Finished surfaces shall be free of irregularities and depressions.

The soil to be used for back filling purposes shall be from the excavated earth or from borrowed pits, as directed by the Engg In-charge.

14.4 Disposal of surplus

Surplus excavated material not required or not approved for backfilling shall be loaded and deposited either on or off site as directed. The Contractor shall not delay disposal of surplus material after receipt of instructions from the Engg In-charge.

14.5 Requirement for fill material under foundations

The thickness of fill material under the foundations shall be such that the maximum pressure from the footing, transferred through the fill material and distributed onto the original
undisturbed soil will not exceed the allowable soil bearing pressure of the original undisturbed soil.

Where compacted fill is required it shall consist of suitable sand, or other selective inorganic material, RRHG mixed with sand subject to approval by the Engg In-charge. The filling shall be done with locally available sand. The filled in sand shall be kept immersed in water for sufficient time to ensure compaction, if so desired by the Engg In-charge.

14.6 SITE LEVELLING

14.6.1 Scope of Work

The contractor shall furnish all labour, equipment and materials required for complete performance of the work in accordance with the drawings, specification and direction of the Engg In-charge. Contour survey of proposed sub-station area including the control room area has to be done by taking levels at an interval of two meters in both the ways in the presence of JE/Engineer in charge. The detail contour survey should be traced over the tracing graph paper and after duly signed by JE/ SDO has to be submitted to concern Engineer in charge for approval. The concern Engineer in charge will approve the contour after taking decision of height of the ground level to be maintained by considering the HFL, surrounded land scape, etc with minimum cutting and filling if any.

14.6.2 General Requirement

The material required for site surfacing/gravel filling shall be free from all types of organic materials and shall be of standard approved quality, and as directed by the Engg In-charge. The Contractor shall furnish and install the site surfacing to the lines and grades as shown in the drawing and in accordance with the requirements and direction of the Engg In-charge. The soil of the entire switchyard area shall be levelled before placing the site surfacing/gravel fill material. After all the structures and equipment have been erected and accepted the site shall be maintained to the lines and grades indicated in the drawing and rolled or compacted with suitable water sprinkling to form a smooth and compact surface condition, which shall be matching with finished ground level of the switchyard area. After due compaction of the
surface of the entire switchyard area shall be provided with plain cement concrete of 75 mm thickness (1:4:8) mix. after proper compaction. Care shall be taken for proper gradient for easy discharge of rain water.

After the PCC is applied and surface prepared to the required slope and grade a base layer of uncrushed/crushed broken gravel of 20 mm nominal size shall be spread, rolled and compacted to a thickness 100 mm. The 20 -40 mm. nominal size (for both layers) shall pass 100% through IS sieve designation 37.5 mm and nothing through 16.0 mm. IS sieve.

14.7 SITE DRAINAGE

14.7.1 General

Adequate site drainage system (By using 1st. class Brick masonry of 1:5 cement motor, PCC 1:4:8 & 1:2:4 ratio, Cement plastering & punning) shall be provided by the Contractor. The Contractor shall obtain rainfall data and design the storm water drainage system, (culverts, ditches, drains etc.) to accommodate the most intense rainfall that is likely to occur over the catchments area in one hour period on an average of once per ten years. The surfaces of the site shall be sloped to prevent the ponding of water.

The Contractor shall ensure that water drains are away from the site area and shall prevent damage to adjacent property by this water. Adequate protection shall be given to site surfaces, roads, ditches, culverts, etc., to prevent erosion of material by water.

The drainage system shall be adequate without the use of cable trenches.

All manholes deeper than 1.2 m shall be provided with galvanised M.S. foot rests. Foot rests shall be of 20 mm M.S. square bars.

Open storm water drains shall be provided on both sides of the roads and shall be designed to drain the road surface as well as all the free and covered areas.

Invert of the drainage system shall be decided in such a way that the water can easily be discharged above the High Flood Level (HFL) outside substation boundary at suitable
location and approved by Engg In-charge. Pumping of drainage water, if required, shall be provided by Contractor.

All internal site drainage systems, including the final connection and disposal to Engg In-charge acceptance points shall be part of Contractor’s scope including all required civil work, mechanical and electrical systems. The Contractor shall connect his drain(s) at one or more points.

Suitable pumping arrangement shall be provided by the Contractor to pump out the water from sump to the open channel; automatic float valve type pump shall be provided and installed by Contractor.

The Contractor shall locate the outfall point outside the substation vicinity and the substation storm drainage must be connected to this point.

The drainage scheme and associated drawings shall be subject to approval of the Engg In-charge.

14.7.2 Excavation and backfill

Trench excavations for drains shall be carried out with the minimum disturbance to adjacent ground and in such a way that existing or new work shall not be undermined. No backfill shall be placed until it has been inspected, tested and approved. Backfill shall be carefully placed by hand tools and rammed in layers not exceeding one hundred (100) millimetres thick in a manner which will not cause damage.

14.8 SEWAGE SYSTEM (AT URBAN SUB-STATION)

A sewage system shall be provided for all utility buildings including the Control room building and other auxiliary buildings.

The Contractor shall construct suitable septic tank and soak pit for the discharge of effluents.

Sewers shall be designed for a minimum self cleansing velocity of 0.6m/sec and the maximum velocity shall not exceed 2.4m/sec.
The sewage system shall consist of all necessary piping, pumps, if required, fittings, manholes, clean-outs, piping connections and all other materials required for safe and efficient sewage collection. Sewer pipes and fittings shall conform to the relevant Indian Standards.

Cast iron pipes shall be used below ground level for sewage disposal.

14.8.1 ROADS AND CULVERTS

The Contractor shall be responsible for constructing approach roads, sub-station roads and service roads etc. within the substation area. Layout of the roads shall be based on general details and arrangement drawings for the substation. Roads to the transformer bays shall be as short and straight as possible. The roads shall be with 3.75 mts. In width.

Finished top (crest) of roads shall be a minimum of 300 mm above the surrounding grade level (Formation level).

A) CONCRETE ROAD:

All the roads in front of Transformer shall be of concrete road. The other approach roads should be black topping. In case of switch yard road (concrete road) the shoulder would be compacted earth 600 mm wide on the sides of the road. The concrete road shall have 100 mm thick PCC (1:2:4 nominal ratio). Below it 100 mm thick PCC (1:4:8) shall be provided. 300 mm thick water bound macadam (WBM) in three equal layers of 100 mm each at the bottom.

The road within the switch yard area the PCC and WBM shall placed only up to the width of the road. Expansion joints (12mm thick) shall be provided at every 5 mtrs.

B) BITUMINOUS ROAD:

The approach road beyond the concrete road shall be bituminous type. The following procedure shall be followed for the construction of bituminous roads.

1. Compacted WBM at the bottom end of the road up to a thickness of 300 mm in three equal layers 100 mm each. The compaction shall be done by laying stone aggregates of size 100mm.
each layer shall be laid and compacted with water spreading and using rollers as per the standard practice adopted in the CPWD guide line.

2. Above, the compacted WBM 1st filing as stated under (!), 200 mm thick consolidated WBM in two layers with stone aggregates of size 90 – 45mm shall be laid. Each layers shall be laid and compacted with water spreading and using rollers as per recommended.

3. Above the compacted 2nd layer of WBM, 75 mm thick consolidated WBM in two layers with stone aggregates of size 63mm-45mm shall be laid. Each layers shall be compacted with water spreading and using rollers as per recommended.

4. Above the compacted 3rd layer of WBM, 75 mm thick consolidated WBM in two layers with stone aggregates of size 53mm-22.4mm shall be laid. Each layers shall be compacted with water spreading and using rollers as per recommended.

5. Above the 4th layer of compacted WBM, 25mm thick pre mix carpet surfacing has to be done. The carpet surfacing shall be done with 2.25 cum and 1.12 cum of stone chippings of 13.2 mm size and 11.2 mm size respectively per 100 sq mtrs and 52 Kgs of hot bitumen per cum of stone chippings. Complete with paving ASPHALT 80/100 heated and thin mixed with solvent @70g/Kg of ASPHALT. Hot bitumen of grade 80/100 shall be spread on road surface @750g/Kg per sqmtr. There shall be shoulder on both side of the roads as per given data. The curvature of the road shall be R=7M and additional metal lining for turning has to be maintained. The shoulder shall also be made compacted morrum filling and other as specified.

14.9 TRANSFORMER FOUNDATION, RAIL TRACK

14.9.1 General

All the transformer foundations should be designed for 5 MVA power transformers & shall be of RCC, M15 (1:2:4 mix) grade. The rails shall be first quality 52 kg/m medium manganese steel as per Indian Railway specification T-12-64.

The station transformer (owner supply materials) has to be column mounted with provision of LA, HG Fuse, AB Switch etc. has to be done by the contractor.
Oil Recovery System

14.9.2 General

An oil recovery system shall be provided for all transformers (containing insulating oil or any flammable or polluting liquid) in order to avoid spread of fire by the oil, and for environmental protection by providing suitable common sump pits which can accommodate 125% oil of one of the 12.5/8/5 MVA Transformer. The required drawing should be approved by Engineer in charge before taking up the foundation work.

14.10 FIRE PROTECTION WALLS

14.10.1 General

Fire protection walls shall be provided in accordance with Tariff Advisory Committee (TAC) recommendations.

14.10.2 Application criteria

A fire wall shall be erected between the transformers if the free distance between the various pieces of equipment is less than 10 m, to protect each one from the effects of fire on another.

Fire walls shall also be erected between the power transformers if the free distance is less than ten metres.

14.10.3 Fire resistance

The fire wall shall have a minimum fire resistance of three hours. Fire walls shall be designed in order to protect against the effect of radiant heat and flying debris from an adjacent fire. The column of the fire walls shall be RCC, M15 (1:2:4 mix).

14.10.4 Dimensions

Fire walls shall extend at least two metres on each side of the power transformers and at least one metre above the conservator tank or safety vent.

These dimensions might be reduced in special cases where there is lack of space.
14.11 BOUNDARY WALL/COMPOUND WALL:

The scope includes the design, engineering and construction of the boundary wall all along the property line of SOUTHCO on each sub-station.

The one and half brick wide boundary shall be constructed to a height of 2.5 mtrs above finished ground level of the substation area and below virgin soil a minimum of 900 mm depth. Galvanised barbed wire fencing shall be provided on top of the boundary wall to a height of 0.5 mtr. G.I Barbed wires (12 SWG) of 3-rows each limb of Y shaped frame (Total 6 nos) shall be provided. A minimum length of 300 mm (bottom portion of the Y shaped frame) shall be grouted and a clear height of 500 mm from the finished portion of the top of the wall shall be maintained for the Y shaped frame with GI barbed wires. A 50mm height of finished concrete (ratio 1:2:4) shall be provided on the top of the boundary wall.

A) The below mentioned brick works is for construction of pillar where the Y shaped frame shall be grouted.

Inside the Virgin soil:-

The masonry work in foundation and plinth shall be done in 1:5 cement mortar above a layer (height of 75mm and width of 900 mm as per requirement) of cement concrete 1:3:6. The Brick work shall be as below.

i. **Inside the Virgin soil:**

First layer above the PCC of 75 mm: Height: 300mm & Width: 750 mm (as per requirement)

Second layer above first layer brick: Height: 300mm & Width: 625 mm (as per requirement)

Third layer above second layer brick: Height: 300mm & Width:500 mm (as per requirement)

ii **Above ground level:**

DPC of 50 mm above the third layer of Brick work.

Brick work of thickness of 250 mm having height of 2.5 mtrs.
Expansion joint shall be provided at 10 mtr intervals of the boundary wall and in every 2.5 mts. 375x375 pillars of Brick masonry has to be provided.

The even face of the brick work shall be plastered with 12mm thick in 1:6 cement sand and uneven face shall be plastered with 18mm thick in 1:6 cement sand (in two layers) above the ground level.

Both faces of the walls shall be provided with two coats of cement painting (weather proof) using approved quality of cement paint.

Boundary shall have one main gate as per stipulation elsewhere in the spec. The gate shall be supported by gate pillars of RCC (1:1.5:3). A separate wicket gate shall be provided adjacent to the main gate.

In case the stability of the boundary wall as mentioned is not suitable for the soil, the bidder has to consider for putting RCC(1:1.5:3) tie beam to be rested on the RCC pillars. The size of the beam and pillar has to be carried out as per the soil condition for proper stability of the boundary walls.

### 14.12 CABLE TRENCHES

#### 14.12.1 General

The cable trenches should be primarily of Brick masonry `supported with RCC pillars 250*250mm at an interval of 2500mm over 75 mm RCC base. In each pillar, 2 nos of MS flats of 50*6*200mm shall be suitably embedded to hold 2nos of cable racks. The cable trench wall inside the control room will be of 100mm thick RCC only. The top of the cable trench should be RCC to hold the RCC covers (as per the approved drawing, enclosed). For main power cables separate cable trench should be made.

Cable trenches and pre-cast removable RCC covers (with lifting arrangement) shall be constructed using RCC of M15 grade.

The cable trenches shall be designed for the following loads.

(a) Dead load of 155 kg/ m length of cable support plus 75 kg on one tier at the end.
(b) Cable trench covers shall be designed for (i) self weight of top slab plus concentrated load of 200 kg at centre of span on each panel and a surcharge load of 2 tonnes per sq. metre.

Cable trench crossings of roads should be designed accordingly and to be submitted to Engineer in charge for approval. Trenches shall be drained. Necessary sumps be constructed and sump pumps shall be supplied. Cable trenches shall not be used as storm water drains.

The top of trenches shall be kept at least 300 mm above the finished ground level (FGL). The FGL means the finish level of the soil but not the top of metalling surface. The top of cable trench shall be such that the surface rain water does not enter the trench.

All metal parts inside the trench shall be connected to the earthing system.

Cables from trench to equipments shall run in hard conduit pipes (GI pipe and necessary G.I bends and sockets)

A suitable clear gap shall be maintained between trench walls and foundations.

A clear (vertical) space of at least 200 mm shall be available for each tier in cable trench. From trench bed to lowest tier, a minimum clearance of 100 mm shall be available for all tier trench. The spacing between stands (cable tray supports) shall be 2000mm. No sharp bending of cable trench is permissible, it should be done as per 15D principle.

The trench bed shall have a slope of 1/500 along the run and 1/250 perpendicular to the run.

Cable tray supports (all galvanised structures) shall be designed and constructed to be a single complete fabrication or assembly such that every layer of the horizontal cable tray supports are fixed, either bolted or welded, to a vertical steel support that is embedded in the concrete wall of the cable trough. It shall not be permitted to embed a horizontal support beam directly into the wall of the trough in order to use the concrete wall as a means of load bearing.

Concrete troughs shall be provided with concrete covers of suitable load bearing strength. Where the cable troughs are run across or within 3 m of substation roads, the trough covers shall be capable of bearing an accidental wheel load of 20 kN. The drawings showing the details of fixing of cable racks in concrete cable trench walls, fixing of cable tray, no. of
layers to be provided has to be provided by the contractor and to be get approved by the GM o/o CPIO.

**NB:** - All the relevant drawings related to construction of Sub-station should submit within 15 days from the detail work order to the concern Engineer in charge positively.

The thickness of the RCC wall of the trench shall be 100mm and thickness of the raft shall be 75mm. All the frames for fixing of cable trays shall be of hot dip galvanized. A running earth strip has to run all through the cable trench for proper earthing of the cable trays and stand (frame). The size of the earth strip is of 50X6mm G.I flats. Welding the G.I flats to the frame to be carried out. Earthing strips to be welded with the running earth mat at 10mtrs interval.

The bidder also to supply and fix G.I perforated cable trays (of thickness 2mm) of appropriate size before laying of cables on the cable tray stand.

The covers of the slab are also of RCC with ratio mixing1:2:4. The thickness of the slab shall be 50 mm (MS Rods to be used 8mm), The MS rods to be used shall be placed at 100 mm centre to centre both way and properly bided. The cover slab shall have provision of lifting hooks at two points for easy lifting of the slabs. Slabs having lifting hooks shall be placed at every 10th slabs, it should remain inside the top of concrete surface of the slab.

The covers for the cable trench inside the control room shall be provided with GI chequered plate with MS angle stiffeners at the bottom for proper mechanical strength.

Once the trench covers have been made they are to be stored and not laid until all trench cabling, is finished. Any covers laid before this time which become damaged shall be replaced at the Contractor’s expense.

Trench covers and bridging beams for covers, except where heavy duty, shall be light enough for two men to lift.
14.12.2 Buried cables

Cables are to be laid in neat lines and at suitable levels. Their depth below ground level will depend upon the voltage associated with the cables but in all cases the excavation must provide a clear trench. Sand filling below, around and above the cables will always be required and protection covers or tiles /bricks will be placed in position over the sand filling before final backfilling to the ground level. The line of the cable trenches shall be marked with suitable posts as required by relevant section of this Specification.

14.13 FOUNDATION DESIGN

14.13.1 General

All foundations shall be of reinforced cement concrete. The design and construction of RCC structures shall be carried out as per IS 456 and minimum grade of concrete shall be M15 corresponding to 1:2:4 nominal mix ratio with 12-20 mm coarse aggregate. Higher grades of concrete than specified above may be used at the discretion of the Bidder without any financial implication to the owner.

Limit state method of design shall be adopted unless stated otherwise in the Specification.

For design and construction of steel-concrete composite beams ARE: 11384 shall be followed.

For detailing of reinforcement IS 2502 shall be followed. Cold twisted deformed bars (Fe= 415 N/sq mm) conforming to IS 1786 shall be used as reinforcement. However, in specific areas, mild steel (Grade1) conforming to IS 432 can also be used. Two layers of reinforcement (on inner and outer face) shall be provided for wall and slab sections having thickness of 150 mm and above. Clear cover to reinforcement towards the earth face shall be minimum 40 mm.

The procedure used for the design of the foundations shall be the most critical loading combination of the steel structure and /or equipment and /or superstructure, and other conditions which produce the maximum stresses in the foundation or the foundation component, and as per the relevant IS Codes of foundation design. The design calculations shall be submitted by the bidder showing complete details of piles/pile groups proposed to be used.
All foundations shall rest below virgin ground level and the minimum depth of foundation below the virgin ground level (minimum one meter below the virgin ground level) shall be maintained.

Design shall consider any sub-soil water pressure that may be encountered.

Necessary protection to the foundation work, if required, shall be provided to take care of any special requirements for aggressive alkaline soil, black cotton soil or any other type of soil which is detrimental or harmful to the concrete foundations.

RCC columns shall be provided with rigid connection at the base.

All building sub-structures shall be checked for sliding and overturning stability during both construction and operating conditions for various combinations of loads. Factors of safety for these cases shall be as stated in relevant IS Codes or as stipulated elsewhere in the Specifications.

Earth pressure for all underground structures shall be calculated using coefficient of earth pressure at rest, coefficient of active or passive earth pressure (whichever is applicable).

The following conditions shall be considered for the design of water tanks, pump houses, channels, sumps, trenches and other underground concrete structures such as basements etc.

(a) Full water pressure from inside and no earth pressure, ground water pressure and surcharge pressure from outside (applicable only to structures which are liable to be filled with water or any other liquid).

(b) Full earth pressure, surcharge pressure and ground water pressure from outside and no water pressure from inside.

The Twin pole and equipment foundations shall be checked for a factor of safety of 2.2 for normal condition and 1.65 for short circuit condition against sliding, overturning and pullout. The same factor shall be used as partial safety factor over loads in limit state design also.

All underground concrete structures such as basements, pump houses, water retaining structures etc. shall have plasticizer cum water proofing cement additive conforming to IS 9103. In addition, the limit on permeability as given in IS 2645 shall also be met. The concrete
surface of these structures in contact with earth shall also be provided with two coats of bituminous painting for water /damp proofing.

In case of water leakage in the above structures, leakage repair shall be achieved by the injection method.

14.13.2 Other Foundations

All foundations shall be designed in accordance with the provisions of the relevant parts of latest revisions of IS 2911 and IS 456.

Type of foundation system i.e. isolated footing; raft or piling shall be decided based on the load intensity and soil strata.

Twin Pole foundations shall be designed for an additional factor of safety of 1.1 for normal/broken wire conditions and for short circuit condition.

Circuit breaker foundations shall be designed for impact loading and shall be strictly in accordance with the Manufacturer’s recommendations.

Switchyard foundation plinths and building plinths shall be minimum 300 mm and 500 mm above finished ground level respectively or as per minimum required safety electrical clearance stipulated in IE Rule.

14.13.3 Cement

The cement to be used shall be the best quality of its type and must not be more than 3 months old in stock.

All cement shall be sampled and tested in accordance with Indian Standards.

The Portland cement used in concrete shall confirm to IS 269.

Requirement of sulphate resistant cement (SRC) for sub structural works shall be decided in accordance with the Indian Standards based on the findings of the detailed soil investigation to be carried out by the contractor.

High Alumina cement shall NOT be used.
14.13.4 Aggregate

Coarse and fine aggregate shall conform to the requirements of IS 383-1970.

Sampling and testing of aggregates shall be in accordance with the relevant Indian Standard.

Fine and coarse aggregates shall be obtained from the same source and the Contractor shall ensure that material from the source is known to have a good service record over a long period of time.

Aggregate shall be hard and dense and free from earth, clay, loam and soft, clayey, shale or decomposed stone, organic matter and other impurities.

14.13.5 Storage of aggregates

Coarse and fine aggregates shall be stored on site in bins or on clean, dry, hard surfaces, and be kept free from all sources of contamination. Aggregates of different grading’s shall be stored separately, and no new aggregate shall be mixed with existing stocks until tested, and approved by the Engg In-charge.

14.13.6 Water

Water used for mixing concrete and mortar shall be clean, fresh water obtained from an approved source and free from harmful chemicals, oils, organic matter and other impurities. Normally potable water may be considered satisfactorily for mixing and curing concrete and masonry work.

14.13.7 Steel bar reinforcement

Reinforcement shall comply with the appropriate Indian Standards.

All bar reinforcement shall be hot rolled steel except where the use of cold worked steel is specified on the drawings or otherwise approved.

The bars shall be round and free from corrosion, cracks, surface flaws, laminations, rough, jagged and imperfect edges and other defects.
The bar reinforcement shall be new, clean and of the lengths and diameters described on the Drawings and Schedules. Bars shall be transported and stored so that they remain clean, straight, undamaged and free from corrosion, rust or scale. Bars of different diameters shall be separately bundled.

14.13.8 Welding of reinforcement

Spot or tack welding for positioning bars in heavily reinforced areas will only be allowed with the express permission of the Engg In-charge. Extension of lengths of reinforcement by welding will not be permitted.

Welding will be approved only in low stress members, and lap welding will not be approved in any circumstances.

14.13.9 Fixing of reinforcement

Before fixing in the works bars shall be seen to be free from pitting, mud, oil, paint, loose rust or scale or other adherents harmful to the bond or strength of the reinforcement. Bars shall be fixed rigidly and accurately in position in accordance with the working drawings, unless otherwise approved by the Engg In-charge. Reinforcement at all intersections shall be securely tied together with 1.5 mm soft annealed tying wire the ends of which shall be cut and bent inwards. Cover to the reinforcement shall be in accordance permissible standard and sufficient spacers and chairs of precast concrete of approved design shall be provided to maintain the specified cover and position. No insertion of bars in previously placed concrete shall be permitted. Projecting bars shall be adequately protected from displacement. The fixing of reinforcement in the works shall be approved by the Engg In-charge (Divisional Engr.) before concrete is placed. Measurement will be based on the calculated weights of steel actually used in tonnes corrected to second place of decimal.

Concrete cover to reinforcement

For durability the minimum concrete cover to any reinforcing bar shall be as follows:

Concrete above ground.

(a) Internal faces of slabs 25 mm
(b) Internal faces of beams and walls 30 mm
(c) Exposed faces of slabs, beams and walls 50 mm
(d) All faces of columns 50 mm

**Concrete below ground (including piles).**

(a) Faces in contact with soil including blinding concrete 75 mm
(b) All other faces (i.e. internal faces of basement wall) 50 mm

Only concrete or steel spacers shall be used to achieve the required minimum thickness of concrete cover to reinforcement. Concrete spacers shall have non metallic ties. Timber blocks for wedging the steel off the formwork will not be allowed.

**14.13.10 Formwork**

Formwork shall be constructed from timber, metal, lined as necessary for special finishes and designed with the quality and strength required to ensure rigidity throughout placing, ramming, vibration and setting of the concrete, without detrimental effect.

Formwork shall be erected true to line, level and shapes required using a minimum of approved internal ties. Faces in contact with the concrete shall be true and free from defect, jointed to prevent loss of water or fines; in panels or units which permit easy handling Ties or spaces remaining embedded shall have the minimum cover specified for reinforcement. Forms for exposed concrete beams, girder casings and columns shall provide for a twenty five millimetre chamfer on external corners.

Wedges and clamps shall be kept tight during vibration operations. Before commencement or resumption of concreting, the interior of forms shall be cleaned and free of sawdust, shavings, dust, mud or other debris and openings shall be formed to facilitate this cleaning and inspection. The inside of the forms shall be treated with a coating of an approved substance to prevent adhesion. Care shall be taken to prevent this substance being in contact with the reinforcement.
14.14 Grades of concrete

Concrete shall be either ordinary or controlled and in grades designated M10, M15, M20 and M25 as specified in IS: 456 (latest edition). In addition, nominal mixes of 1:3: 6 and 1: 4: 8 of nominal size 40 mm maximum, or as indicated on drawings, or any other mix without any strength requirements as per mix design shall be used where specified.

Ordinary concrete

Ordinary concrete shall be used for all plain cement concrete work and where shown on drawings or allowed by the Engg In-charge. Ordinary concrete shall not require preparation of trial mixes.

In proportioning concrete, the minimum quantity of cement shall be as specified in of this clause and the amount to be used shall be determined by actual weight. The quantities of fine and coarse aggregate may be determined by volume, but preferably by weight.

The water cement ratio shall not be more than those specified in IS 456.

<table>
<thead>
<tr>
<th>Grade of Concrete</th>
<th>Minimum cement content per c.m. of finished concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 10</td>
<td>236 kg</td>
</tr>
<tr>
<td>M 15</td>
<td>310 kg</td>
</tr>
<tr>
<td>M 20</td>
<td>400 kg</td>
</tr>
</tbody>
</table>

As a guide to perform the mix design properly, the relationship between water cement ratio, aggregate to cement ratio, workability and strength of concrete will be as per relevant IS.

The cement /total aggregate ratio is not to be increased beyond 1: 9.0 without specific permission of the Engg In-charge. It should be noted that such high aggregate/cement ratios will be required for concretes of very low slump and high water cement ratios which may be required to be used in mass concrete work only.

The actual cement aggregate ratios are to be worked out from the specific gravities of coarse aggregates and sand being used, and from trial mixes.
14.15 Strength requirements

The mix proportions for all grades of concrete shall be designed to produce the grade of concrete having the required workability and a characteristic strength not less than the value given below:

<table>
<thead>
<tr>
<th>Grade Designation</th>
<th>Characteristic Compressive Strength at 28 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 10</td>
<td>10 N / sq. mm</td>
</tr>
<tr>
<td>M 15</td>
<td>15 N / sq. mm</td>
</tr>
<tr>
<td>M 20</td>
<td>20 N / sq. mm</td>
</tr>
</tbody>
</table>

The strength of concrete given above is the 28 days characteristic compressive strength of 15 cm cube.

The placing of concrete shall be a continuous operation with no interruption in excess of 30 minutes between the placing of continuous portions of concrete. When fresh concrete is required to be placed on previously placed and hardened concrete, special care should be taken to clean the surface of all foreign matter. For securing a good bond and water tight joint, the receiving surface should be made rough and a rich mortar placed on it unless it has been poured just before. The mortar layer should be about 15 mm thick with cement and sand proportion as that of the mix in use, and have the same water-cement ratio as the concrete to be placed.

After the concrete has been placed it shall be thoroughly compacted by approved mechanical vibration to a maximum subsidence without segregation and thoroughly worked around reinforcement or other embedded fixtures into the correct form and shape. Vibrators must be operated by experienced men and over vibration shall not be permitted. Care should be taken to ensure that the inserts, fixtures, reinforcement and formwork are not displaced or disturbed during placing of concrete. No concrete shall be placed in open while it rains. If there is any sign of washing of cement and sand, the concrete shall be entirely removed immediately. Slabs, beams and similar structure shall be poured in one operation normally. In special circumstances with the approval of Engg In-charge these can be poured in horizontal layers.
not exceeding 50 cm. in depth. When poured in layers, it must be ensured that the under layer is not hardened. Bleeding of under layer if any shall be effectively removed.

14.16 Compaction of Concrete

Compaction is necessary for production of good concrete. After the concrete has been placed it shall be thoroughly compacted by approved mechanical vibrator to a maximum subsidence without segregation and thoroughly worked around reinforcement or other embedded fixtures into the correct form and shape. Vibrators must be operated by experienced men. Care should be taken to ensure that the inserts, fixtures, reinforcement and formwork are not displaced or disturbed during the vibration of the concrete. The Contractors shall provide standby vibrators. Vibration is commonly used method of compaction of concrete, the use of mechanical vibrators complying with IS 2505, IS 2506, IS 2514 and IS 4656 for compacting concrete is recommended.

For all practical purposes, the vibration can be considered to be sufficient when the air bubbles cease to appear and sufficient mortar appears to close the surface and facilitate easy finishing operations. The period of vibration required for a mix depends upon the workability of the mix.

14.17 Curing of Concrete

In order to achieve proper and complete strength of the concrete, the loss of water from evaporation should be prevented. Eighty to eighty five per cent of the strength is attained in the first 28 days and hence this 28-day strength is considered to be the criterion for the design and is called characteristic strength. The concrete after setting for 24 hours shall be cured by keeping the concrete wet continuously for a period of 10 days after laying.

The curing increases compressive strength, improves durability, impermeability and abrasion resistance. Failure to carry out satisfactory curing can lead to cracking in the concrete. This in turn can lead to salt attack of the reinforcement and consequential failure of the structure. If cracks occur in a structure which is severe enough to affect the structure, the Contractor shall cut out and replace the defective concrete at his own cost. The Contractor’s attention is, therefore, drawn to this particular aspect of proper and adequate curing.
14.18 Removal of formwork

Formwork shall be kept in position fully supported, until the concrete has hardened and gained sufficient strength to carry itself and any loads likely to be imposed upon it. Stripping must be effected in such a manner and at such a time that no shock or other injury is caused to the concrete. The responsibility for safe removal rests with the Contractor but the Engg In-charge may delay the time of striking if he deems it necessary.

Minimum periods, in the absence of agreement to the contrary, between completion of concreting and removal of forms are given below but due regard must be paid to the method of curing and prevailing conditions during this period.

Removal of forms is to be done as under

i) Sides of foundations, columns, beams and wall 2days

ii) Under side of slabs up to 4.5 m span 7days

iii) Under side of slabs above to 4.5 m span

and underside of beams and arches up to 6m span 14days

iv) Under side of beams and arches above 6m and up to 9m span 21days

14.19 FENCING

14.19.1 General

Fencing shall be designed for the most critical loading combination taking into account wind forces, stability, tension on wires, minimum requirements as per this clause and relevant IS recommendations.

The un-climbable or security, or anti-intruder fencing shall consist of chain link mesh, all as soon on the drawings and as specified, supported on approved sections of structural steel. The posts shall be erected truly vertical, and all posts and struts shall be set in concrete block foundations.
14.20 Product materials

14.20.1 General

Chain Link fence fabric in accordance to IS: 2721, and shall also meet the following requirements.

(a) Size of mesh 75 mm
(b) Size of coated wire 3.15 mm diameter
(c) Width of chain link 2000 mm
(d) Class of zinc coating medium

The posts shall be of medium M.S tube of 50 mm diameter confirming to Yst-22 (Kg / sq. mm). The tubes shall be also confirm to IS:1161/IS 806. The length of the tubular post shall be 3200mm.

An M.S base plate of size 160X160X6mm thick shall be welded with the tubular post. The post shall be provided on the top with M.S plate.

The tubular post shall be welded with 8 numbers of M.S flat of size 50X6mm – 75 mm long. Two numbers of 13.5 mm dia holes on each cleats shall be provided to bolt the fence fabric panel. The cleats shall be welded at equal spacing in such a way that 4 nos of cleats are on the opposite side and remaining 4 nos cleats are on the opposite side of the post. The cleats on the corner posts shall be welded in such a way that it suits the site requirement.

The whole assembly of tubular post shall be hot dip galvanised. The zinc coating shall be minimum 615 gram per sq mm. The purity of the zinc shall be 99.95% as per IS: 209.

Fence fabric panel:

Chain link fencing shall be fabricated in the form of panel 2000X2928 mm. An MS flat of at least 50X6 mm size shall be welded all round fence fabric to form a panel. Four pairs of 13.5 mm diameter holes on the vertical MS flat matching the spacing of holes in cleats fixed with pipe shall be provided to fix the fence panel with tubular posts. A washer shall also be provided below each nut. 12 mm diameter bolts and nuts including washers shall also be
supplied. All bolts, nuts and washer shall be hot dip galvanised. The fence panel shall be also of hot dip galvanised.

**Installations:**

Fence shall be installed along switch yard line as per the approved GA drawing.

Post holes shall be excavated by approved method.

All posts shall be 3 mtrs apart measured parallel to ground surface.

Posts shall be set in 1:2:4 plain cement concrete block of minimum 0.4X0.4X1.2mtr depth. 75 mm thick PCC 1:4:8 shall be provided below concrete block.

Fence fabric panel shall be fixed to the post at 4 nos. M.S flat each of 50X6 mm, 75mm long through 2 nos of 12 mm dia bolts on each flat.

Paintings as per decision of the Engineer in charge have to be carried out.

Continuous running earth by using 50 X 6 mm GI flats to be provided for safety purpose.

A 345/380 mm thick (one and a half brick size) toe wall of Brick/Rubble missionary or concrete with notches shall be provided below all fencing and shall be minimum 200 mm above and 500 mm below finished ground level. All exposed surfaces for brick toe wall shall be provided with 15 mm 1:6 cement sand plaster and coated with two coats of water proofing snowcem cement paint. In case if rubble masonry is provided suitable pointing shall be done.

**Gates:**

Gates shall be installed in locations shown on drawings. Next to the main gate, a wicket gate (1.25 m wide, single leaf) shall also be provided.

Bottom of gates shall be set approximately 40 mm above ground surface and necessary guiding mechanism (with roller on the bottom of the gate and fixed guider in the road) shall be fitted to avoid hanging of the main gate.

Flexible cooper bond has to be provided to link earthing of the sub station.
14.21 CONTROL ROOM BUILDING

14.21.1 General

The scope includes the design, engineering and construction of control room building. For control room the tentative layout showing the facilities to be provided is indicated. However, the size and layout of the building may be modified as per requirements of Single Line Diagram (SLD) with the approval of the Project Manager.

14.21.2 Dimensions

An open space of one metre minimum shall be provided on the periphery of the rows of panels, and equipment generally, in order to allow easy operator movement and access as well as maintenance.

The building design shall also take into consideration the layout of the panels, switchboards, switchgear and other equipment in order to allow enough area for the future extension of switchyard depending upon the availability of substation area.

The building auxiliary services such as air conditioning and ventilation systems, fire protection and detection systems and all other miscellaneous services shall be designed in accordance with the requirements specified in relevant sections of this Specification to allow for easy access to equipment and maintenance of the equipment.

The doors and windows of the building shall be of aluminium extruded channels, angles etc. The windows shall be provided with sliding shuttering facilities and also to be provided with aluminium make grills.

In rural area of traditional 33/11 Kv S/S the Control Room area is 10x7 Mts.

14.21.3 Submission of data for approval

The following information shall be submitted for review and approval to the Engg In-charge:

a. Design criteria for structural steel and reinforced concrete design. The criteria shall comprise the codes and standards used, applicable climatic data including wind loads, earthquake factors and maximum and minimum temperatures applicable to the
building locations, assumptions of dead and live loads, including equipment loads, impact factors, safety factors and other relevant information.

b. Structural design calculations and drawings including those for construction and fabrication for all reinforced concrete and structural steel structures.

c. Fully dimensioned floor plans, cross sections, longitudinal sections and elevations of each building. These drawings shall be drawn at a scale not less than 1:50 and shall identify the major building components.

d. Fully dimensioned drawings showing details and sections, drawn to scales of sufficient size to clearly show sizes and configuration of the building components and the relationship between them.

e. Product information of building components and materials, including walls, partitions, flooring, ceilings, roofing, doors and windows and building finishes.

f. A detailed schedule of building finishes including colour schemes.

g. A door and window schedule showing door types and locations, door lock sets and latch sets and other door hardware.

h. Anti Termite treatment of Control Room to be done by the contractor.

Approval of the above information shall be obtained before ordering materials or starting fabrication or construction as applicable.

14.22 Flooring (52 mm Thick)

50mm thick cement concrete 1:2:4. & finishing with vitrified tiles in the main control room area, in other areas plain flooring. There shall be dado of 9 inches by the same materials used in flooring. The toilets and bath rooms shall be provided with antiskid ceramic tiles and the walls are also to be provided with ceramic tiles of adequate height as per standard practice.

14.23 Walls

Control room buildings shall have framed superstructure. All walls shall be non-load bearing walls. Minimum thickness of external walls shall be 230 mm with 1:6 cement sand mortar. A
100 mm thick (RCC, M-15 mix) DPC shall be provided at plinth level before starting masonry work.

14.24 Plastering

All internal walls shall have minimum 12mm thick 1:6 cement sand plaster. The ceiling shall have 6mm thick 1:4 cement sand plaster.

14.25 External Finish

All external surfaces shall have painted with weather proof synthetic paints over 18mm thick cement sand plaster in two layers. Under layer 12mm thick cement plaster 1:5 (1 cement:5 coarse sand) and a top layer 6mm thick cement plaster 1:3 (1 cement:3 coarse sand) finished rough with sponge.

All ceilings shall be white based plastic emulsion paints and the internal walls are also to be provided with plastic emulsion synthetic paints. The outer of the building shall be provided with weather seal coats of synthetic paints.

14.26 Roof

Roof of the building shall consist of cast in situ R.C.C. slabs (M-20) grade. Extra heavy waterproofing treatment of approved standard shall be done after grading under bed with 1:4 cement sand plaster of 25mm thickness. The under bed shall be laid to provide an ultimate run off gradient of 1:120. The extra heavy treatment shall be concrete based with water proof treatment as per the standard to protect the roof from damage due to water logging. Proper slope and adequate no of water drains outlets shall be provided for easy discharge of water from the roof. These drains shall be connected to the main drain.

14.27 Glazing (glass)

Minimum thickness of glazing shall be 6 mm. The glazing for the control room area, which will be air-conditioned, shall be provided with double toughened glass each of 6mm thickness.

14.28 Plumbing and Sanitation
All plumbing and sanitation work shall be executed to comply with the requirements of the appropriate bye laws, rules and regulations of the Local Authority having jurisdiction over such matters. The Contractor shall arrange for all necessary formalities to be met in regard to inspection, testing, obtaining approval and giving notices etc.

An overhead water tank of adequate capacity depending on the number of users for 24 hours storage shall be provided.

Galvanised MS pipe of medium class conforming to IS: 1239 shall be used for internal piping works for portable water supply.

Sand C I pipes with lead joints conforming to IS: 1729 shall be used for sanitary works above ground level.

A list of toilet fittings will be approved by the Engg In-charge before procurement by the contractor and same will be inspected by the Engg In-charge before installation. Required nos of wash basins (stand type) with good quality mirrors and other accessories as required are also to be provided.

14.29 Building storm water drainage

Cast iron rain water down comers conforming to IS: 1230 with water tight lead joints or medium class galvanised mild steel pipes conforming to IS:1239 / IS:3589, shall be provided to drain off the rain water from the roof. These shall be suitably concealed with masonry work of cement concrete or cladding material. The number and size of down comers shall be governed by IS: 1742 and IS: 2527.

All drains inside the buildings shall have minimum 40 mm thick grating covers and in areas subject to movement heavy equipment loads, pre cast RCC covers shall be provided in place of steel grating.

For all buildings, suitable arrangement for draining water collected from equipment blow downs, leakages, floor washings, fire fighting etc. shall be provided for each floor.
**Plinth protection Flooring**

Entire area around the control room building (outside) shall be provided with PCC paving starting from the building up to 2 mtrs clear distance for the full length of the building.

The above specified PCC paving shall be with M15 mix grade concrete over suitable under bed arrangement as specified for other ground floor slab.

Above the PCC paving suitable cement pavers chequered plate of size as per the standard to be provided. The colour of the chequered plate shall be fixed over the PCC paving by using cement mortar and the colour of such plate shall be red.

The cable vault below the main control room shall have 50 mm thick smooth floor finish units of cement concrete.

Anti termite chemical treatment shall be given to column pits, wall trenches, foundations of buildings, filling below the floors etc. as per IS: 6313 and other relevant Indian Standards.

**14.30 WATER SUPPLY**

The Contractor shall be overall responsible for supply of water within switchyard / control room for fire fighting, drinking purposes and other miscellaneous purposes. Water shall be made available at a single point by the Employer. The scope is also inclusive of supply and erection of all over head tanks, pipes, fittings etc. required for the water supply to be taken from the terminal point to the respective required areas. A scheme shall be prepared by the contractor indicating the layout and details of water supply which shall subject to the approval of the Engg In-charge before actual start of work. Any extra bore holes required shall be within the scope of the contractor.

There shall be pump houses for the bore wells and approach road to the pump houses shall be provided.

The Contractor shall have overall responsibility to provide a suitable arrangement for permanent supply for and retention of water within switchyard building and to the yard for watering to the earth pits, drinking purposes. The submersible pump shall be 2 HP and all control as per standard has to be provided.
14.31 EARTHING:

Earth Grid should not be more than TWO meters square. This should be done by using 75x10 mm GI flats. Earth risers should be 50x6 mm GI flats. All equipments & metal parts of the Sub-Station should be connected with main earth grid by using 50x6 GI flats at two different places. The main earth grid should be laid not less than 600 mm below the finished ground level. The lap welding should not less than 100 mm. The welding of joints should be done after removal of Zinc by using Blow lamps. Welding should be done in all four sides and should be double layer continuous. Before taking up the second layer welding the deposited flux should be removed. During welding the two flats should be tightened properly by using ‘C’ clamps. Immediately after welding two layers of anti-corrosive paints should be painted over the welded portion along with two coats of Black bituminous paints. Before back filling of earth trenches the welded portion should be covered by wrapping with bituminous tape properly and also jointing portion should be covered with PCC (1:2:4) mix. The backfilling of earth pits and trenches should be done with powered loam soil mixed with Benton ate powder (10:1) mix.

All equipments, steel structures etc should be connected with Main earth mat at two rows separately. All LAs, PTs, Columns having spikes should individually connected with individual Pipe electrodes and again should be connected with main earth grid at two separate places. The Neutral of Power Transformer should be connected with two separate pipe electrodes and again connected with main earth electrodes at two separate places. The separation distance between each pipe electrodes should not be less than 2 mts. The back filling of pipe electrodes should be done in layer of Charcoal, Salt & loam soil mixed with Benton ate powder.

There should be a closely spaced earth grid (1.5 mts square having .5 mts spacing) below the mechanism boxes of each Isolators & AB switches. In Sub-station the diameter of pipe electrode should not be less than 50 mm. The Flange (50x6) mm GI flat should be welded in all sides with Pipe electrode. In each face of Flange there should be two nos 17.5 mm hole to accommodate 16 mm GI Bolt nut with 1 no spring washer.
The fencing of sub-station should not directly connected with main earth grid. There should be a separate earth grid (75x10) mm GI flat 2 mts away from fence and should be connected rigidly with the fence at an interval of 5 mts. There should be one 50x6 mm earth flat run over the cable rack and should be connected with main earth grid at an interval of 5 mts. The jointing portion of earth flats over the ground should be painted with two coats of Anti-corrosive paints and two coats of good quality of Aluminium paints (Berger/Asian paints).

The water hydrant system should be provided in the areas where earth resistivity more and soil is laterite and sandy in nature (Areas like BBSR, Khurda, Puri etc) as per the direction of Engineer in charge. Each handles of Isolators/AB switches etc should be connected with earth grid by using flexible Tinned Copper earth bonds. In each earth switches TWO nos flexible earth bonds should be provided. Each earth pits having pipe electrodes should be provided 250 mm Brick wall chambers with RCC cover Slab.

14.31 (A) G.I. Flat (75x 10 mm) & G.I. Flat (50 x 6 mm)

The specification covers manufacture, testing and supply of Galvanized Steel flat for Earthing arrangements.

I. APPLICABLE STANDARDS:

Materials shall conform to the latest applicable Indian standards. In case bidders offer steel section and supports conforming to any other international specifications which shall be equivalent or better than IS, the same is also acceptable.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Standard No.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IS: 2062 Grade ‘A’ Quality</td>
<td>Specification for M.S. Channel and M.S. Flat</td>
</tr>
<tr>
<td>2</td>
<td>IS: 2062</td>
<td>Chemical and Physical Composition of material</td>
</tr>
</tbody>
</table>
II. RAW MATERIAL:

The steel section shall be re-rolled from the BILLETs/INGOTS of tested quality as per latest version of IS: 2830 or to any equivalent International standard and shall be arranged by the bidder from their own sources. The chemical composition and physical properties of the finished materials shall be as per the relevant standards.

III. TEST

Steel sections shall be tested in IS approved laboratory or standard laboratory of the Bidder country having all facilities available for conducting all the tests as prescribed in relevant IS or IEC or to any equivalent International laboratory or Institutions.

The Bidders are required to specifically indicate that:

They hold valid IS (or equivalent IEC) License. Steel Section offered are bearing requisite IS certification or equivalent IEC marks.

The Bidders are required to submit a copy of the valid IS (or equivalent IEC) License clearly indicating size and range of product against respective ISS or any equivalent International Standards along with their offer.

IV. PHYSICAL & CHEMICAL PROPERTIES

Length

The GS Flat to be supplied shall be in 5.5 meters to 13 meters lengths.

Weighment

The weighment of GS Flat shall be witnessed by the consignee at the time of taking delivery. The weight recorded in the material receipt certificate issued by the consignees shall be final.

Chemical composition and physical properties of M.S.Channels and M.S.Flat conforming to IS: 2062/84L composition.
Chemical Composition

<table>
<thead>
<tr>
<th></th>
<th>For Fe 410 WA Grade</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>C - 0.23% MAX.</td>
</tr>
<tr>
<td>2</td>
<td>Mn - 1.5% MAX.</td>
</tr>
<tr>
<td>3</td>
<td>S - 0.050% MAX.</td>
</tr>
<tr>
<td>4</td>
<td>P - 0.050% MAX.</td>
</tr>
<tr>
<td>5</td>
<td>Si - 0.40% MAX.</td>
</tr>
<tr>
<td>6</td>
<td>CE - 0.42% MAX.</td>
</tr>
</tbody>
</table>

(Carbon Equivalent)

V. Mechanical Properties

1. Tensile strength Kgf/mm² - 410
2. Yield stress Min. for thickness/diameter
   <20 mm - 26 Kgf/mm² OR 250N/mm²
   20-40 mm - 24Kgf/mm² OR 240N/mm²
   40 mm - 23Kgf/mm² OR 230N/mm²
3. Elongation % - 23%
4. Bend Test (Internal Dia) - Min-3t (this the thickness of the material)

VI. MARKING

It is desirable that the Bidders should put his identification marks on the finished materials. The mark shall be in “legible English letters”

VII. INSPECTION AND TEST CERTIFICATE

The materials to be supplied will be subject to inspection and approval by the purchaser’s representative before dispatch and / or on arrival at the destination. Inspection before dispatch shall not, however, relieve the bidders of his responsibility to supply the steel section strictly in accordance with the specification.
The bidders shall abide by all the statutory provisions, acts such as the Indian Electricity Act, Indian factory Act, Indian Boiler Act etc., and corresponding rules and regulations as may be applicable and as amended from time to time.

The purchaser’s representative shall be entitled at all reasonable time during manufacture to inspect, examine and test at the bidder’s premises the materials and workmanship of the steel section to be supplied. As soon as the steel section are ready for testing, the bidder’s shall intimate the purchaser well in advance, so that action may be taken for getting the material inspected. The material shall not be dispatched unless waiver of inspection is obtained or inspected by the purchaser’s authorized representative. The test certificate shall be in accordance with the latest version of the relevant Indian Standard or any equivalent International standards.

The acceptance of any batch /lot shall in no way relieve the bidder of any of his responsibilities for meeting all the requirements of the specification and shall not prevent subsequent rejection of any item if the same later found defective.

All conductors burred in earth and concrete and above ground level shall be galvanized steel. Galvanized steel shall be subject to four one minute dips in copper sulphate solution as per IS: 2633/1922.

### VIII. METHOD OF GALVANISING:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Tests</th>
<th>For GI Flat</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dip test</td>
<td>6 dips of 1 min each</td>
</tr>
<tr>
<td>2</td>
<td>Mass of Zinc coating</td>
<td>610 gram/sq.m minimum</td>
</tr>
</tbody>
</table>

Pre dispatch inspection shall be performed to witness following tests:

Freedom from defects,
Verification of dimensions
Galvanization tests
Mechanical tests
Chemical composition tests
These tests are to be performed and certified at Govt. recognized laboratory

MS flat shall conform to IS 2062 & its latest amendments for steel & Galvanization as per IS 4759 & its Latest amendments.

The flat shall be coated with Zn 98 Zinc grade.

The minimum Zinc coating shall be 610 gm/sqm for thickness more than 5 mm and 460 gm/sqm for item thickness less than 5 mm.

IX. Inspection & Rejection:

The representative of Purchaser shall pick up samples at random from the GI Flats offered for carrying out routine tests as per specified IS.
The representative shall make visual inspection on each & every GI flats.
The purchaser reserves the right to reject on inspection after the same is received at destination.

14.31 (B) G.I. Flat (75 x 10 mm) & G.I. Flat (50x 6 mm)
(To be submitted along with Offer)

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Particulars</th>
<th>Bidders’ Offer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Location of Factory or Place of Manufacture</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Maker’s Name, Address &amp; Country</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Size of G.I. Flat</td>
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<td>---</td>
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<tr>
<td>4</td>
<td>Standard Length</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Galvanization Process</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Galvanization thickness</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Galvanization tests to be conducted</td>
<td></td>
</tr>
</tbody>
</table>

14.31 (C) Earth Electrode (50/40 NB 3.0 Mtr Length)

I. Qualification Criteria of sub vendor / Manufacturer:-

The prospective bidder may source Earth Electrode from sub vendors / manufacturers who must qualify all the following requirements:

a) The sub vendor /manufacturer must have successfully carried out Type Test of similar item from any NABL Accredited Laboratory within the last 5 years, prior to the date of submission of the bid.

II. Scope:-

This specification provides for design, manufacturing, testing before dispatch, supply & delivery of Earthing Device (Heavy Duty) (for use in line (40x3000) mm & SS (50x3000 mm), as per enclosed Drawing.

III. APPLICABLE STANDARDS:-

The Earthing Device must be made out of 50 mm for S/S,40 mm for line (Heavy Gauge- No minus Tolerance allowed) Wall thickness Hot Dip G.I. Pipe (as per IS :- 1239,m Part-1, 1990 of reputed Make(TATA/Jindal) & 3.0 mtrs length tapered finished smooth at one end for a length of 75 mm & Clamp at the other end.

Staggered drills hole of 12 mm Dia of interval of 150mm shall be made before galvanization.

The GI Earthing Clamp/ Strip (C- Clamp Type) is to be of 50mm width, 6mm thickness & flange length of 65 mm in each side. This should be suitable for termination of 4 nos of GI Flat earth electrodes. The Clamp/ Strip & Earthing pipe after fabrication will be hot dip galvanized confirming to
IS: 2629/85 with latest amendments. The clamp shall have two holes in both sides suitable for 16 mm GI Bolts & Nuts.

14.31. (D) Earth Electrode (50 NB 3.0 Mtr Length)

**Guaranteed Technical Particulars**

(To be submitted along with Offer)

<table>
<thead>
<tr>
<th>Sl. No.</th>
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<td>3</td>
<td>Size of</td>
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<tr>
<td></td>
<td>a) Pipe</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) Earthing Strips</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Length</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Thickness of Pipe</td>
<td></td>
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<tr>
<td>6</td>
<td>Galvanization Process</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Galvanization thickness</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) For Earthing device</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) For Connecting Flat</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Galvanization tests to be conducted as per ISS</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Any other Particulars (like details of Clamp/ G.I. Bolts)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Details of Drawings submitted</td>
<td></td>
</tr>
</tbody>
</table>

Metal parts of all equipment other than those forming part of an electrical circuit shall be connected directly to the main earth system via two separate conductors of adequate capacity at two different points.

All main members of structural steelworks shall be earthed by galvanized iron flat connections bonded by welding or bolting to the steelworks.

Connections to apparatus and structures shall be made clear of ground level, preferably to a vertical face and protected as appropriate against electrolytic corrosion. They shall be made between clean surfaces and of sufficient size and pressure to carry the rated short circuit current without damage.

Earth bars installed directly into the ground should normally be laid bare and the trench backfilled with a fine top soil. Where the soil is of a hostile nature, special precautions must be
taken to protect the earth bar. Wherever required to achieve the required resistance betonies powder to be mixed in loam/ black cotton crushed soil in 1:10 proportion is permissible, the method used being subject to the agreement of the Engg. In charge. In the event of betonies powder being adopted, water supply through conduit to the area must be supplemented and regulated to keep the surface/mat moisture absorbent.

Joints in earth bars+ shall be welded and then coated with a suitable anti-corrosion protection treatment.

Facilities shall be provided on the earth bar run between equipment and the base of structures, comprising a looped strip, so as to permit the attachment of portable earth connections for maintenance purposes.

The cross sectional area of the earth bar and connections shall be such that the current density is not greater than 100 A/mm$^2$ for a 3 second fault duration.

### 14.32 Welding and welders qualifications

#### 14.32.1 General

All welding shall be carried out by qualified welders only.

All welding shall be in accordance with the corresponding standards of the American Welding Society or the American Society of Mechanical Engineers.

Other standards to determine the quality of welding process and qualifications of welders may be considered, provided that sufficient information is first submitted for the approval of the Engg. Incharge.

Prior to the start of fabrication, the Contractor shall submit to the Engg. In charge for approval, a description of each of the welding procedures which he proposes to adopt, together with certified copies of reports of the results from tests made in accordance with these procedures.

The Contractor shall be responsible for the quality of the work performed by his welding organization. All welding operators, to be assigned work, including repair of casting, shall pass the required tests for qualification of welding procedures and operators. The Engg. In
charge reserves the right to witness the qualification tests for welding procedures and operators and the mechanical tests at the samples.

The Contractor shall bear all his own expenses in connection with the qualification tests. If the work of any operator at any time appears questionable, such operator will be required to pass appropriate pre-qualification tests as specified by the Inspector and at the expense of the Contractor.

Welding carried out in ambient temperature of 5°C or below shall be heat treated.
A spacer wire of proper diameter may be used for weld root opening but must be removed after tack welding and before applying root run.

On completion of each run craters, weld irregularities, slag etc. shall be removed by grinding or chipping.

During the process of welding, all movements, shocks, vibration or stresses shall be carefully avoided in order to prevent weld cracks.

Fillet welds shall be made by shielded metal arc process regardless of thickness and class of piping. Electrode size shall not exceed 10 SWG. (3.25 mm). At least two runs shall be made on socket weld joints.

14.32 WIRING, CABLING AND CABLE INSTALLATION

14.33.1 Cubicle wiring

Panels shall be complete with interconnecting wiring between all electrical devices in the panels. External connections shall be achieved through terminal blocks. Where panels are required to be located adjacent to each other all inter panel wiring and connections between the panels shall be carried out internally. The Contractor shall furnish a detailed drawing of such inter panel wiring. The Contractor shall ensure the completeness and correctness of the internal wiring and the proper functioning of the connected equipment.

All wiring shall be carried out with 1.1 kV grade, PVC insulated, single core, stranded copper wires. The PVC shall have oxygen index not less than ‘29’ and Temperature index not less
than 250°C. The wires shall have annealed copper conductors of adequate size comprise not less than three strands.

The minimum cross sectional area of the stranded copper conductor used for internal wiring shall be as follows:

a) All circuits excepting CT circuits and energy metering circuit of VT 2.5 sq.mm

b) All CT circuits and metering circuit of VT 2.5 sq. mm

All internal wiring shall be supported, neatly arranged, readily accessible and connected to equipment terminals and terminal blocks. Wiring gutters and troughs shall be used for this purpose.

Cubicle connections shall be insulated with PVC to IEC 227. Wires shall not be jointed or teed between terminal points.

Bus wires shall be fully insulated and run separately from one another. Auxiliary bus wiring for AC and DC supplies, voltage transformer circuits, annunciation circuits and other common services shall be provided near the top of the panels running throughout the entire length of the panel suite. Longitudinal troughs extending throughout the full length of panel shall be preferred for inter panel wiring.

All inter connecting wires between adjacent panels shall be brought to a separate set of terminal blocks located near the slots of holes meant for the passage of the interconnecting wires. Interconnection of adjacent panels on site shall be straightforward and simple. The bus wires for these purposes shall be bunched properly inside each panel.

Wire termination shall be made with solderless crimping type and tinned copper lugs which firmly grip the conductor. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wire and shall not fall off when the wire is disconnected from terminal blocks. Numbers 6 and 9 shall not be included for ferrules purposes unless the ferrules have numbers underscored to enable differentiation. (i.e. 6 and 9).
Fuses and links shall be provided to enable all circuits in a cubicle, except a lighting circuit, to be isolated from the bus wires.

The DC trip and AC voltage supplies and wiring to main protective gear shall be segregated from those for back-up protection and also from protective apparatus for special purposes. Each such group shall be fed through separate fuses from the bus wires. There shall not be more than one set of supplies to the apparatus comprising each group. All wires associated with the tripping circuits shall be provided with red ferrules marked “Trip”.

It shall be possible to work on small wiring for maintenance or test purposes without making a switchboard dead.

The insulation material shall be suitably coloured in order to distinguish between the relevant phases of the circuit.

When connections rated at 380 volt and above are taken through junction boxes they shall be adequately screened and “DANGER” notices shall be affixed to the outsides of junction boxes or marshalling kiosk.

Where connections to other equipment and supervisory equipment are required the connections shall be grouped together.

14.33.2 LV power cabling

LVAC cable terminals shall be provided with adequately sized, hot pressed, cast or crimp type lugs. Where sweating sockets are provided they shall be without additional clamping or pinch bolts. Where crimp type lugs are provided they shall be applied with the correct tool and the crimping tool shall be checked regularly for correct calibration. Bi-metallic joints between the terminals and lugs shall be provided where necessary.

Terminals shall be marked with the phase colour in a clear and permanent manner.

A removable gland plate shall be provided by the Contractor. The Contractor shall be responsible for drilling the cable gland plate.
Armoured cables shall be provided with suitable glands for terminating the cable armour and shall be provided with an earthing ring and lug to facilitate connection of the gland to the earth bar.

14.33.3 Multi-core cables and conduit wiring

External multi-core cabling between items of main and ancillary equipment shall form part of the Contract Works and shall consist of un-armoured multi-core cable with stranded copper conductors PVC insulated and PVC over sheathed complying with the requirements of IEC 227 and 228 as applicable.

Multi-core cable for instrumentation and control purposes shall be supplied with 2.5 mm\(^2\) stranded copper cores. Multi-core cables for CT and VT circuits shall be supplied with two by 2.5 mm\(^2\) stranded copper cores and the cores shall be identified by the phase colour.

Where conduit is used the runs shall be laid with suitable falls and the lowest parts of the run shall be external to the equipment. All conduit runs shall be adequately drained and ventilated. Conduits shall not be run at or below ground level.

Multi-core cable tails shall be so bound that each wire may be traced to its cable without difficulty. All multi-core cables shall be provided with 20 \% spare cores and the spare cores shall be numbered and terminated at a terminal block in the cubicle. Where cables are terminated in a junction box and the connections to a relay or control cubicle are continued in conduit, the spare cores shall be taken through the conduit and terminated in the cubicle. The dc trip and ac voltage circuits shall be segregated from each other as shall the circuits to main protective gear be segregated from those for back-up protection.

The screens of screened pairs of multi-core cables shall be earthed at one end of the cable only. The position of the earthing connections shall be shown clearly on the diagram.

All wires on panels and all multi-core cable cores shall be crimped with the correct size of crimp and crimping tool and will have ferrules which bear the same number at both ends. At those points of interconnection between the wiring carried out by separate contractors where a change of number cannot be avoided double ferrules shall be provided on each wire. The
change of numbering shall be shown on the appropriate diagram of the equipment. The same ferrule number shall not be used on wires in different circuits on the same panels.

The Contractor shall provide a two (2) meter loop of spare cable at both ends of all multi-core cable runs and shall leave sufficient lengths of tails at each end of the multi-core cables to connect up to the terminal boards. The Contractor shall also strip, insulate, ring through and tag the tails and shall also seal the cable boxes. The Contractor shall be responsible for re-checking the individual cores and for the final connecting up and fitting of numbered ferrules within all equipment provided on this contract.

The drilling of gland plates, supply and fitting of compression glands and connecting up of power cables included in the Contract scope of work shall be carried out under this contract.

14.34 Laying and installing of cables

14.34.1 General

For cable laying the following shall apply:

a) Switchyard area

In concrete cable troughs (cable trench having cable racks with cable trays)

b) Control Room

On cable racks consisting of slotted type and ladder type cable trays

c) Buildings

Conduits

Directly buried cables shall be used wherever necessary with the approval of Engg. In charge.

14.34.2 Laying of cable

Cables shall be laid in concrete troughs provided under this contract or drawn into pipes or ducts or on cable racks or directly buried as may be required by the Engg. In charge. Concrete troughs shall be designed so that the cables are supported on cable support systems and the supports shall be arranged so as to allow the segregation of power, control (including CT and VT circuits) and communications cables onto different layers of cable supports. All cable
supports shall be earthed in accordance with IS 3043. The minimum vertical separation between layers of cable tray shall be not less than 300 mm.

The cable support system shall be designed and constructed to carry the required cables without undue crowding of the supports and without overloading the supports. The maximum number of layers of cable that shall be permitted on a single cable support shall be three. The width of the cable supports shall be selected to ensure that the supports are not crowded, the cable supports are not overloaded and that sufficient space is provided in the cable trough to allow for personnel access during and after cable installation. The width of cable supports should not exceed 750 mm.

Cables shall be laid direct in the ground only at the discretion of the Engg. In charge. All cables laid direct in the ground outside buildings shall be laid in a trench and protected by reinforced concrete slabs or cable tiles. For auxiliary cables the top of the slab or tile shall be at a depth not less than 300 mm below the surface of the ground and there shall be a layer of fine well packed riddled earth 75 mm thick in between the cable and the bottom of the trench and between the top of the cable and the underside of the slab.

The Contractor shall be responsible for the proper laying of all cables in the ground. Where cables in the same trench are laid over each other, they shall be separated by not less than 75 mm of riddled earth. The riddled earth used for this purpose shall have been passed through a screen having a 12 mm square mesh. Where cables pass under roadways they shall be laid in pipes at a depth not less than 800 mm below the surface.

The Contractor shall be responsible for the excavation of trenches which shall include all pumping and baling required and the provision of all necessary labour, plant, tools, water, additional soil, fuel or motor power for such purposes.

Cables in trenches will be inspected by the Engg. In charge before the trenches are backfilled.
The running of communications and power cables along the same route shall be avoided as far as possible. Where this is not possible they shall be segregated, the one group from the other. Power and communication cables shall be laid in separate tiers. For other than directly buried cables the order of laying of various cables shall be as follows:

a) Power cables on top tiers.

b) Control/ instrumentation and other service cables in bottom tiers.

14.34.3 Cable tags and markers

Each cable and conduit run shall be tagged with numbers that appear in the cable and conduit schedule.

The tag shall be of aluminum with the number punched on it and securely attached to the cable conduit by not less than two turns of 20 SWG GI wire conforming to IS 280. Cable tags shall be of rectangular shape for power cables and of circular shape for control cables.

Location of cables laid directly in the ground shall be clearly indicated with cable marker made of galvanized iron plate.

Location of buried cable joints shall be indicated with a cable marker having an additional inscription "Cable joint".

Cable markers shall project 150 mm above ground and shall be spaced at an interval of 30 meters and at every change in direction. They shall be located on both sides of road and drain crossings.

Cable tags shall be provided on all cables at each end (just before entering the equipment enclosure), on both sides of a wall or floor crossing, on each duct, conduit entry and at every twenty meters (20 m) in cable tray/trench runs. Cable tags shall be provided inside switchgear, motor control centers, control and relay panels etc. and wherever required for cable identification when a number of cables enter together through a gland plate.
The price of cable tags and markers shall be included in the installation rates for cables/conduits quoted by the Bidder.

14.34.4 Cable supports and cable tray mounting arrangements in control room

The control room will normally be provided with embedded steel inserts on concrete floors/walls for the purpose of cabling in the control room. The supports shall be secured by welding to these inserts or available building steel structures. However, in cases where no such embedded steel inserts are available, the same shall have to secure to the supports on walls or floors by suitable anchoring.

14.34.5 Cable support structure in switchyard cable trenches

The contractor shall fabricate and install cable support structures in cable trenches. These supports shall be provided at 750 mm spacing along the run of cable trenches.

Cable supports and cable racks shall be fabricated from standard structural steel members, channels, angles and flats of required size. The fabrication, welding and erection of these structures shall conform to the relevant clauses of this Specification, in addition to the specification given herein.

14.34.6 Termination of cables and wires

Where cables leave the apparatus in an upward direction the cable boxes shall be provided with a barrier joint to prevent leakage of cable oil or compound into the apparatus. Where cable cores are liable to contact with oil or oil vapour the insulation shall be unaffected by oil.

PVC sheathed cables shall be terminated by compression glands complying with BS 6121 (or equivalent).

Auxiliary PVC insulated cables shall be terminated with compression type glands, clamps or armour clamps complete with all the necessary fittings.

Colours shall be marked on the cable box, cable tail ends and single core cables at all connecting points and/or any positions the Engg. In charge (Divisional Engr.) may determine.
Cable boxes shall be provided with suitable labels indicating the purpose of the supply where such supply is not obvious or where the Engg. In charge (Divisional Engr.) may determine.

All cables shall be identified and shall have phase colours marked at their termination.
All incoming and outgoing connections shall be terminated at a terminal block. Direct termination into auxiliary switches will not be accepted.

14.35 Supply voltage

The auxiliary supply voltages on site shall be as follows:

<table>
<thead>
<tr>
<th>Nominal Voltage V</th>
<th>Variation</th>
<th>Frequency Hz or DC</th>
<th>Phase</th>
<th>Wires</th>
<th>Neutral Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>430</td>
<td>10%</td>
<td>5%&lt;sup&gt;±&lt;/sup&gt; 50</td>
<td>3</td>
<td>4</td>
<td>Solidly earthed</td>
</tr>
<tr>
<td>240</td>
<td>10%</td>
<td>5%&lt;sup&gt;±&lt;/sup&gt; 50</td>
<td>1</td>
<td>2</td>
<td>Solidly earthed</td>
</tr>
<tr>
<td>45V - 55V</td>
<td>DC</td>
<td>DC</td>
<td>2</td>
<td></td>
<td>+ve earthed</td>
</tr>
</tbody>
</table>

14.48 Erection of Distribution Transformers

14.48.1 General

As a part of this scheme, there is a provision to install distribution transformers on 11 kV line. The contractor shall transport the transformer along with the distribution board (OSM) from the store, install, test and commission the DT of 100 KVA capacity.

a. The contractor’s scope is to install distribution transformers on DP structures up to 100 KVA and on plinth foundation beyond 100 KVA capacity including all support structures, channels, clamps, nut & bolts etc for DT and all other accessories. On 11 kV side, the accessories would be LA, A.B. Switch & HG fuse as specified. The construction of foundation is in the scope of contractor as per the approved drawings. Any other item, not specifically mentioned but necessary for safe operation of the distribution transformer is deemed to be included in the scope of the contractor.

14.48.2 Erection of Distribution Transformers
All distribution transformers shall be installed on 11 kV line DP structures. Bimetallic connectors shall be provided on HT side of DT. The connectors shall be as per REC specifications.

The HT side connections shall be made with AAA conductor. LT side connections from transformer bushing to MCCB of LTDB shall be made by providing single core Al. un-armoured XLPE LT cable of suitable size and support. The outgoings from MCCB of LTDB to the overhead line are also to be made by providing single core Al. un-armoured XLPE LT cable of suitable size. In both the cases suitable clamping (made from 50x6mm GI Flats with GI Bolts & nuts) arrangement (3nos. at transformer side & 4 nos. at line side) with cushioning, cable gland and end termination kit at both ends shall be provided. The outgoing cable of LTDB has to be connected to the overhead LT line by providing minimum 2 nos. of 3-bolted (M-12) type PG clamps. Required layers of ampere tape and PVC tape are to be wrapped as per requirement.

In case of AB cables directly emanating from the LTDB to LT lines, suitable clamping arrangement with the pole as mentioned above shall be made. Necessary tension clamps, dead end clamps etc. shall be provided on the pole for holding the AB cable properly so that the load of the cable shall not be transferred to LTBD. The contractor shall provide all such clamps, nuts & bolts at no extra cost to the owner.

The contractor shall provide and install a Sign Board of 1ft x 1 ft size at each DT location. The sign board shall be mounted on the pole with suitable clamps. The board shall be of 1.6 mm (min) thick GI sheet and epoxy painted (minimum paint thickness 75 micron) the layout & the content to be written on the board shall be decided during detailed engineering. The boards shall be prepared through screen printing or better technology. The cost of providing and installing the board shall be included in the quoted rates for DT erection.

All materials required for completion of job in all respect beyond owner supply has to be approved by the owner prior to procurement. During procurement, contractor supply items should also be inspected and tested including third party unless otherwise waived out.

14.48.4 Earthing of Distribution Sub-stations
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Five nos. 50mm dia, 3 mtr. Long, heavy gauge Pipe (Jindal / Tata) earthing shall be provided for the distribution Sub-station complying with relevant IS. Adequate quantity of charcoal and salt shall be used to keep the earth resistance low. Two connections from transformer neutral, two nos. from HV side LAs, one from handle of AB switch, transformer body & DP structure shall be provided to the pipe earths. All the five pits shall be connected to an earth grid with 24mtr. long 50x10mm size GI Flats at a depth of 600mm below the ground level for plinth mounted S/s and for DP mounted the same is of 14 mtr. long. The earth risers should be with 50x6 mm GI Flats requiring 34mtrs in both type of S/s.

Note:- Drawing enclosed are indicative only. The detail drawings & design has to be submitted as per the actual soil parameters for approval.

CONTROL ROOM

For Urban Sub-Station (In-Door 11 kV VCB Panels) = 15 mtr x 8 mtr
For Urban Sub-Station (Out-Door 11Kv &33 kV VCB) = 12 mtr x 8 mtr
For Rural Sub-Station (In-Door 11 kV VCB Panels) = 12 mtr x 6 mtr
For Rural Sub-Station (Out-Door 11Kv &33 kV VCB) = 10 mtr x 6 mtr
BREAKER FOUNDATION DESIGN

\[\begin{align*}
\text{BREAKER} & \quad \text{(Diagram)} \\
& \quad \text{Dimensions:} 300 \times 500 \times 150 \times 1310 \times 1400 \\
\end{align*}\]
**Breaker Rod Details**

### Rod Binding Schedule

<table>
<thead>
<tr>
<th>(A)</th>
<th>1800</th>
</tr>
</thead>
<tbody>
<tr>
<td>(B)</td>
<td>1500</td>
</tr>
<tr>
<td>(C)</td>
<td>1100</td>
</tr>
<tr>
<td>(D)</td>
<td>300</td>
</tr>
</tbody>
</table>

### Requirement of Rods

<table>
<thead>
<tr>
<th>SIZE</th>
<th>VCB</th>
<th>Total Mtr</th>
<th>Kg./Mtr</th>
<th>TOTAL in Kg.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. 10 tor</td>
<td>2<em>8</em>1.8</td>
<td>28.8</td>
<td>0.630</td>
<td>18.144</td>
</tr>
<tr>
<td>B. 10 tor</td>
<td>2<em>13</em>1.1</td>
<td>28.6</td>
<td>0.630</td>
<td>18.018</td>
</tr>
<tr>
<td>C. 12 tor</td>
<td>2<em>10</em>1.8</td>
<td>36</td>
<td>0.888</td>
<td>31.968</td>
</tr>
<tr>
<td>D. 6 tor</td>
<td>2<em>7</em>1.38</td>
<td>19.32</td>
<td>0.222</td>
<td>4.289</td>
</tr>
</tbody>
</table>

**EXCAVATION:**
- 2.15*1.4*1.2 = 3.612 Cum. 12.481
- 2.15*1.4*0.075 = 0.226 Cum. 0.462

---

**EXCAVATION:**
- Hard Soil
- Wet Soil

---

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RCC: 1:2:4

1.2\times1.915\times0.2 = 0.4596 \text{ Cum.}

2\times(1.0\times0.5\times1.4) = 1.4 \text{ Cum.}

1.8596 \text{ Cum.} 2.421

**Foundation for 11 KV KIOSK**

EXCAVATION: 2.5 \times 1.2 \times 1.0 = 3 \text{ cum.}

PCC: 1:4:8 2.5 \times 1.2 \times 0.075 = 0.225 \text{ cum.}

Brick 0.25 = 2.11 \text{ cum.}

Sand 2 \times 0.7 \times 1.3 = 1.82 \text{ cum.}

RCC i) 2.5 \times 1.2 \times 0.15 = 0.45 \text{ cum.}

ii) (0.2 \times 0.2 \times 1.3) \times 4 = 0.21 \text{ cum.}

Rod 10 tor = 60 \text{ Kg.}
Single Isolator Foundation Design

CIVIL WORKS
Ex-2.1 x 0.9 x 1.250 x 2 = 4.725
PCC (1 : 4 : 8)-2.1 x 0.9 x 0.075 x 2 = 0.283

LIST OF FOUNDATION BOILTS
2.5 mm x 700 mm foundation bolts-8 Nos.
2.730 Kg x 8 = 21.840 Kg
RCC-(a) $1.9 \times 0.7 \times 0.250 \times 2 = 0.665$ Plate $75 \times 12...8$ Nos. $= 4.240$ Kg.
(b) $1.25 \times 0.7 \times 1.25 \times 2 = 2.188$
Total $= 2.853$ Nut Bolt washers $13.632$ Kg.
Total Wt. of members $= 268.813$ Kg
Total $= 308.525$ Kg.

**RETAINING WALL WHERE EARTH FILLING 1 MTR.**

![Diagram of retaining wall]

**Civil Works for 100 mtr**

1. Excavation $0.9 \times 1.1 \times 100 = 99$

RRHG

2. (i) $0.4 \times 2.2 \times 100 = 88$

(ii) $\frac{1}{2} (0.4 \times 2.2 \times 100) = 44$
3 (i) PCC 1:4:8 0.20 x 1.1 x 100 = 22
(ii) PCC 1:2:4 0.05 x 0.4 x 100 = 2

DRAIN

<table>
<thead>
<tr>
<th></th>
<th>Drain per mtr</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Excavation</td>
</tr>
<tr>
<td>2</td>
<td>PCC (1:4:8)</td>
</tr>
<tr>
<td>3</td>
<td>PCC (1:2:4)</td>
</tr>
<tr>
<td>4</td>
<td>Brick Masonary</td>
</tr>
<tr>
<td></td>
<td>1)</td>
</tr>
<tr>
<td></td>
<td>2) 0.25<em>1.0</em>0.7</td>
</tr>
<tr>
<td>---</td>
<td>-----------------</td>
</tr>
<tr>
<td></td>
<td>Plastering (1:6)</td>
</tr>
<tr>
<td>5</td>
<td>Top 0.275<em>1.0</em>2</td>
</tr>
<tr>
<td></td>
<td>Outside 1 0.93*1.0</td>
</tr>
<tr>
<td></td>
<td>Inside 1 1.0*1.0</td>
</tr>
<tr>
<td></td>
<td>Outside 2 1.0*0.7</td>
</tr>
<tr>
<td></td>
<td>Inside 2 1.0*0.7</td>
</tr>
</tbody>
</table>

### RETAINING WALL WHERE EARTH FILLING IS LESS THAN 1 MTR.

<table>
<thead>
<tr>
<th></th>
<th>Excavation 1<em>1</em>0.8</th>
<th>0.8</th>
<th>4</th>
<th>RRHG</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>PCC (1:4:8) 1<em>1</em>0.2</td>
<td>0.2</td>
<td></td>
<td>a) 0.6<em>0.6</em>1 0.36</td>
</tr>
<tr>
<td>3</td>
<td>PCC (1:2:4) 1<em>0.4</em>0.05</td>
<td>0.02</td>
<td></td>
<td>b) 0.4<em>1</em>1 0.40</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>c) 1/2<em>0.2</em>1 0.10</td>
</tr>
</tbody>
</table>

|   | 3.88 Sq. mm. |      |    |
CONTROL CABLE TRENCH

8 tor 150 mm C / C

2250 mm

250 mm

G.I. Flat

50 mm RCC 1:2:4

RCC (1:2:4) 75 mm

PCC (1:4:8) 75 mm

150 mm C / C
Abstract for Cable Trench

For 10 Mtrs.  

Brick
Sand 300 mm
Sand 100 mm
Brick
Sand 100 mm

For 10 mtr
For 1 Mtr
1. **Excavation**
   - Size: 0.870*2.0*10
   - Volume: 17.4 cum.
   - Extra: 1.74 cum.

2. **PCC**
   - Size: 0.075*2.0*10
   - Volume: 1.5 cum.
   - Extra: 0.15 cum.

3. **RCC (1:2:4)**
   - (a) **Base**
     - Size: 1.8*0.1*10
     - Volume: 1.8 cum.
   - (b) **Pillar**
     - Size: 4*(0.25*1.02*0.25)
     - Volume: 0.255 cum.
   - (c) **Over Brick work (top)**
     - Size: 0.25*0.075*10
     - Volume: 0.1875 cum.
   - (d) **Over Brick work (top) on Pillar side**
     - Size: 0.25*0.075*9
     - Volume: 0.1688 cum.
     - Extra: 0.241 cum.

4. **Brick Masonary (1:5)**
   - (a) **No pillar side**
     - Size: 0.25*0.94*10
     - Volume: 2.35 cum.
   - (b) **Pillar side**
     - Size: 0.25*0.94*9
     - Volume: 2.115 cum.
     - Extra: 0.447 cum.

5. **Plastering (1:6)**
   - **Inside**
     - Size: 2*10*1.02
     - Volume: 20.4 cum.
   - **Outside**
     - Size: 2*10*0.5
     - Volume: 10 cum.
     - Extra: 3.04 cum.

6. **G.I. Flat 50 x 6**
   - Size: 0.2*2*4
   - Volume: 1.6 *2.4kg
   - Extra: 0.384 Kg.

**Abstract of ROD**

<table>
<thead>
<tr>
<th>Wt.</th>
<th>10% Extra</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 tor</td>
<td>19.68 mtr</td>
</tr>
<tr>
<td>8 tor</td>
<td>245 mtr</td>
</tr>
<tr>
<td>6 tor</td>
<td>29.2 mtr</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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ROAD INSIDE SUB STATION

Per Mtr

1. Excavation : 0.550m x 1.0m x 3.5m = 1.925 Cub.
2. Boulder Packing : 0.5m x 1.0m x 3.5m = 1.750 Cub.
3. W. Base course:
   i) 0.075 m x 1.0m x 3.5m = 0.2625
   ii) 0.075 m x 1.0m x 3.5m = 0.2625 (0.525 cum)
4. PCC (1:2:4) : 0.1m x 1.0m x 3.5m = 0.35 Cub.
5. Brick work:
   i) 0.25 m x 0.25m x 1.0m = 0.0625
   ii) 0.30 m x 0.25/2 m x 1.0m = 0.0375 (0.1 cum)
COMPOUND WALL FOUNDATION

- PCC (1:2:4) = 2.43
- PCC \(0.25 \times 0.075 \times 130\) = 5.38
- Brick \(0.68 \times 0.68 \times 0.3 \times 117\) = 16.23
- Brick \(0.53 \times 0.53 \times 0.15 \times 117\) = 4.93
- \(0.38 \times 0.38 \times 0.15 \times 117\) = 2.53
- \(0.23 \times 0.23 \times 1.850 \times 117\) = 11.45
- \(= 35.14\)
PILLAR FOR COMPOUND WALL
WITH FOUNDATION

PCC (1:2:4) 0.32 x 0.32 x 0.75 x 41
Excavation of Earth 0.85 x 0.525 x 130 = 58.01
PCC 0.85 x 0.075 x 130 = 8.287
Brick masonry 0.75 x 0.75 x 0.03 x 41 = 0.691
Brick = 0.6 x 0.6 x 0.15 x 41 = 0.221
0.45 x 0.45 x 0.15 x 41 = 0.012
0.3 x 0.3 x 1.85 x 41 = 6.826
= 7.750

300 mm
1850 mm
150
150
300
75
75
75
G.L
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
DESIGN OF SPIKES

1. G.I. Plate 325 mm x 325 mm x 6 mm (Wt. in Kg.= 5 kg.)

2. (i) Wt. of 2 No. plate = 2 x 5 Kg = 10 Kg.

   (ii) Wt. of 40 mm x 4 mm thickness x 3 mtr length GI Pile = 85 Kg.

   (iii) Wt of support pipe 50 mm x 4.5 mm x 100 mm = 5 Kg.

   __________
   Total = 100 Kg
CONCRETING OF PSC POLES

PSC POLE

500 x 500 x 10 mm MS Plate

1:2:4

1:4:8

75/200 mm PCC

1000

1500 mm

500 x 500

1000 x 1000
TRANSFORMER FOUNDATION

![Diagram of Transformer Foundation]

1. Rail Pole: 100 mm
2. G.I. Plate: 15 mm
3. Angle: 12 mm
4. Torque: 100 mm
5. 75 mm P.C.C.
6. 600 mm
7. 150 mm C to C
8. 10 mm
9. 8 Tor: 200 / 250 RCC
10. 75 mm P.C.C.
11. 3000 mm
12. (RCC)
13. (C)
14. 500 to 1000 mm
15. 75 mm P.C.C.

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FOUNDATION DETAIL FOR POWER TRANSFORMER

1. EXCAVATION:
   3m x 3 x 1.1 m = 9.9 Cum.
   in Hard Soil

2. Stone Grating by using RRHG Boulder of 250 mm size maximum
   3m x 3 m x 0.5m = 4.5 Cum.

3. PCC: 1:4:8
   3m x 3 m x 0.075m = 0.675 Cum.
   (Above RRGH)

4. RCC: 1:2:4
   i) 3m x 3 m x 0.2m = 1.8 Cum.
   ii) 2*(2.7 x 0.6 x 0.925 m) = 2.997 Cum.
   Lengh x width x height
   iii) Side Wall
        0.075 m x [2.8 m +2.8 m +2.8 m+ {3-(0.1+0.1+0.6+0.6)}m]x 0.625
        Thickness side1 x side2xside3
        0.075 x 0.625 x 10.0 = 0.4688 Cum.
        Total RCC (i+ii+iii) = 5.26 Cum.

ROD
   a) 12 tor 2.9m x 20 x4 = 232 @ 0.888 Kg. = 206.016 Kg.
   b) 10 tor 0.9 x 70 = 63 @ 0.617 = 38.871 Kg.
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100 C/C  
c)  10 tor  1.28 x 5  =  6.4  @  0.617  =  3.9488  Kg.  
d)  8 tor  10 x 6  =  60  @  0.395  =  23.7  Kg.  

Beam  
a)  16 tor  2 x (26x2+10)x1.775  =  220.1  @  1.58  =  347.758  Kg.  
b)  8 tor  2x(8x6.4)m  =  102.4  @  0.395  =  40.448  Kg.  
\[ \text{Total} = 660.742 \text{ Kg.} \]

**STEEL:**

500 x 500 x 10 mm G.I. Base Plate - 6 No.  
65 x 65 x 6 mm MS Angle - 2 No. x 2.7 m = 5.4 mtr.  
70 lb Rail Pole - 2 No. x 2.7 = 5.4 mtr.
**Foundation for T1.........T5 Columns**

1. **Excavation**: 2.15m x 2.15 m x 1.825 m = 8.436 cum
2. **PCC (1:4:8)**: 2.15m x 2.15 m x 0.075 m = 0.3467 cum
3. **RCC (1:2:4)**: (2 m x 2 m x 0.25 m) + = 2.376 cum
(0.8 m x 0.8 m x 2.15 m)

4 Base Plate 620 x 620 12 mm GI- 36 Kg. welded to column.

5 Foundation Bolts- GI) 32 mm x 1400 mm = 8.834 kg

6 ROD
- 12 Tor : 2.4 m x 12 No.=28.8 m x 0.888 kg. = 25.57 Kg. 91.76
- 10 Tor : 2.0 m x 44 No= 88 m x 0.63 = 55.44 Kg. = 90 kg.
- 6 mm : 2.42 m x 20 no. = 48.4m x 0.222 kg. = 10.74 Kg.

Repair of damaged joist

N.B:-
(1) After welding of channel and angles, the mass concreting has to be done with minimum coverage of 75 mm.
(2) Concreting should be 1 : 2 : 4 (mix).
(3) Height of cooping above the ground should be 750 mm in cultivated land.

**AB Cable Accessories**

![Diagram of AB Cable Accessories]

**EYE HOOK DETAILS OF (A)**

![Diagram of Eye Hook Details]

(One bolt in case of Dead End clamp & two bolts for fitting stay)

**DEAD END BACK CLAMP**
Suspension Back Clamp
Approx. wt. of 4.5 Kg.

Transformer Foundation for 250 KVA and above

ELEVATION
PLAN

750

750

250mm
SOUTHERN ELECTRICITY SUPPLY COMPANY OF ORISSA LIMITED

Construction of new 33/11KV s/s at Machkund with 2*3.15MVA and 33KV linking line from Lamtaput (Tusuba) proposed 33/11KV s/s (under RGGVY) to Machkund : 25kms

Name of District: Koraput
Name of the Circle: Electrical Circle, Jeypore
Name of the Division: Jeypore Electrical Division, Jeypore
Name of the Sub-Division: Jeypore-I
Name of the Section: Section-I
Scope of Work:
A 33KV DP Structure for I/C and Metering arrangement
B 8-pole structure including VCB arrangement
C Installation of 2x 3.15 MVA power transformer on plinth mounted
D Errection of 11 KV I/C DP with AB switch arrangement & 11KV I/C VCB (2 Nos.)
E Errection of 11 KV Busbar and 4 Nos bay (using 2x8 pole structure) and feeder VCB
F 25 KVA 33/0.4 KV Station Transformer
G 11KV DP for O/G feeder with Metering arrangement (4 nos.)
H Construction of 3ph 3 wire 33 KV line of 100 MM2 AAA Conductor with 10 Mtr Long 300 KG PSC pole:25 Km.

Head of Accounts: RLTAP Scheme (13-14)

ESTIMATE

<table>
<thead>
<tr>
<th>Sl. no</th>
<th>Description of materials</th>
<th>Unit</th>
<th>Qnty</th>
<th>Rate (13-14)</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>33KV DP Structure for I/C and Metering arrangement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>150x150 mm 11Mtr RS Joist Pole-2 Nos</td>
<td>Kg</td>
<td>761.2</td>
<td>55.00</td>
<td>41866.00</td>
</tr>
<tr>
<td>2</td>
<td>Base plate</td>
<td>No</td>
<td>2</td>
<td>255.23</td>
<td>510.46</td>
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<td>Fixing of stay set with 0.5 Cum cement concrete foundation 1:3:6 size (900mmx600mmx900mm) using 40mm BHG metal with all labour and material except stay set, stay wire, stay insulator.</td>
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<td>Concreting of support C.C - 1:4:8 using 40mm BHG metal size - 5'x2'x2' = 20CFT = 0.570Cum Padding 900x600x150mm = 0.081/0.651Cum @2925= 1904.17each</td>
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**B 8-pole structure including VCB arrangement**

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Page 326 of 355
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<td>Concreting of support C.C - 1:4:8 using 40mm BHG metal size - 5′x2′x2′ = 20CFT = 0.570Cum</td>
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<td>Material for masonary work for earth pit charcoal, salt for earthing</td>
<td>No</td>
<td>3</td>
<td>4000.00</td>
<td>12000.00</td>
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<tr>
<td>107</td>
<td>33KV Lighting Arrestor</td>
<td>No</td>
<td>3.00</td>
<td>10000.00</td>
<td>30000.00</td>
</tr>
<tr>
<td>108</td>
<td>33 kv A.B Switch</td>
<td>Set</td>
<td>1.00</td>
<td>18000.00</td>
<td>18000.00</td>
</tr>
<tr>
<td>109</td>
<td>33KV HG fuse</td>
<td>Set</td>
<td>1.00</td>
<td>13200.00</td>
<td>13200.00</td>
</tr>
<tr>
<td>110</td>
<td>33 kv G.I Pin</td>
<td>No</td>
<td>3.00</td>
<td>260.00</td>
<td>780.00</td>
</tr>
<tr>
<td>111</td>
<td>33 kv Disc Insulator( B&amp;S)</td>
<td>No</td>
<td>9.00</td>
<td>350.00</td>
<td>3150.00</td>
</tr>
<tr>
<td>112</td>
<td>33 kv HW Fitting ( B&amp;S)</td>
<td>Each</td>
<td>3.00</td>
<td>350.00</td>
<td>1050.00</td>
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<tr>
<td>113</td>
<td>33 kv Pin Insulator</td>
<td>No</td>
<td>3.00</td>
<td>310.00</td>
<td>930.00</td>
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<tr>
<td>114</td>
<td>MS Nut -Blot-Washer</td>
<td>Kg</td>
<td>25</td>
<td>75.00</td>
<td>1875.00</td>
</tr>
<tr>
<td>115</td>
<td>Earthing Coil for support</td>
<td>Each</td>
<td>40</td>
<td>156.00</td>
<td>6240.00</td>
</tr>
<tr>
<td>116</td>
<td>Concreting of support C.C - 1:4:8 using 40mm BHG metal size - 5’x2’x2’ = 20CFT = 0.570Cum Padding 900x600x150mm = 0.081 0.651Cum @2925= 1904.17each</td>
<td>No</td>
<td>2</td>
<td>1904.17</td>
<td>3808.34</td>
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</table>

G 11KV DP for O/G feeder with Metering arrangement (4 nos.)

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Unit</th>
<th>Quantity</th>
<th>Rate</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>117</td>
<td>150x150 mm 10mtr RS Joist Pole-8 nos</td>
<td>Kg</td>
<td>736</td>
<td>55.00</td>
<td>40480.00</td>
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<tr>
<td>118</td>
<td>Base plate</td>
<td>No</td>
<td>8</td>
<td>242.55</td>
<td>1940.40</td>
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<td>Sl. No.</td>
<td>Description of materials</td>
<td>Unit</td>
<td>Qty.</td>
<td>Rate (13-14)</td>
<td>Amount in Rs.</td>
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<tr>
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<td>------</td>
<td>------</td>
<td>--------------</td>
<td>---------------</td>
</tr>
<tr>
<td>1</td>
<td>100sqm AAA conductor</td>
<td>KM</td>
<td>77.25</td>
<td>56000.00</td>
<td>4,326,000</td>
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</tbody>
</table>

**Office of the Executive Engineer (Elect) Construction Division Jeypore**

Construction of 3ph 3 wire 33 KV line of 100 MM2 AAA Conductor with 10 Mtr Long 300 KG PSC pole :25 KM (2 cut point for each KM) (Avg span length is 50 Mtr)
<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Unit</th>
<th>Quantity</th>
<th>Rate</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>10 Mtrs 300Kg PSC Pole</td>
<td>No</td>
<td>525</td>
<td>4000.00</td>
<td>2,100,000</td>
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<tr>
<td>3</td>
<td>33KV 'V' Cross arm</td>
<td>No</td>
<td>523</td>
<td>1260.00</td>
<td>658,980</td>
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<tr>
<td>4</td>
<td>Back clamp for 'V' crossarm</td>
<td>No</td>
<td>523</td>
<td>150.00</td>
<td>78,450</td>
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<tr>
<td>5</td>
<td>33KV Poletop Bracket</td>
<td>No</td>
<td>523</td>
<td>195.00</td>
<td>101,985</td>
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<tr>
<td>6</td>
<td>33KV Pin Insulator</td>
<td>No</td>
<td>1569</td>
<td>310.00</td>
<td>486,390</td>
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<tr>
<td>7</td>
<td>33KV G I Pin</td>
<td>No</td>
<td>1569</td>
<td>260.00</td>
<td>407,940</td>
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<tr>
<td>8</td>
<td>18mm GI Stay set Complete</td>
<td>Set</td>
<td>100</td>
<td>950.00</td>
<td>95,000</td>
</tr>
<tr>
<td>9</td>
<td>33 KV Stay Insulator</td>
<td>No</td>
<td>100</td>
<td>40.00</td>
<td>4,000</td>
</tr>
<tr>
<td>10</td>
<td>Ht Stay Clamp</td>
<td>Pair</td>
<td>100</td>
<td>262.5</td>
<td>26,250</td>
</tr>
<tr>
<td>11</td>
<td>7/10 G I Stay Wire</td>
<td>Kg</td>
<td>800</td>
<td>75.00</td>
<td>60,000</td>
</tr>
<tr>
<td>12</td>
<td>33KV Disc Insulator(B&amp;S)</td>
<td>No</td>
<td>900</td>
<td>350.00</td>
<td>315,000</td>
</tr>
<tr>
<td>13</td>
<td>33KV Hardware fitting(B&amp;S)</td>
<td>Set</td>
<td>300</td>
<td>425.00</td>
<td>127,500</td>
</tr>
<tr>
<td>14</td>
<td>GI Earthing coil</td>
<td>No</td>
<td>525</td>
<td>156.00</td>
<td>81,900</td>
</tr>
<tr>
<td>15</td>
<td>100x50x6mm M.S.Channel 3.5 Mtr Long (9.2 Kg / Mtr) 24 No.</td>
<td>Kg</td>
<td>6440</td>
<td>60.00</td>
<td>386,400</td>
</tr>
<tr>
<td>16</td>
<td>Concreting of support C.C - 1:4:8 using 40mm BHG metal size - 5'x2'x2' = 20CFT = 0.570CumPadding 900x600x150mm = 0.081 0.651Cum@ 2925= 1904.17 each</td>
<td>Kg</td>
<td>525</td>
<td>1904.17</td>
<td>999,689.25</td>
</tr>
<tr>
<td>17</td>
<td>Nuts&amp;Bolts with Washers</td>
<td>Kg</td>
<td>625</td>
<td>75.00</td>
<td>46,875</td>
</tr>
<tr>
<td>18</td>
<td>Fixing of stay set with 0.5Cum cement concret foundation 1:3:6 size (900mmx600mmx900mm) using 40mm BHG metal with all labour and material except stay set, stay wire, stay insulator.</td>
<td>No.</td>
<td>100</td>
<td>1670.38</td>
<td>167,038.00</td>
</tr>
<tr>
<td>19</td>
<td>Sundries (paint ,DB , clamp connector, Anti-climbing Device, Binding Tape &amp; etc)</td>
<td>LS</td>
<td>25</td>
<td>5000.00</td>
<td>125,000</td>
</tr>
<tr>
<td></td>
<td><strong>Cost of Materials(I)= A+B+C+D+E+F+G+H</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>21034998.79</strong></td>
</tr>
<tr>
<td></td>
<td>Transportation @ 7.5% of I</td>
<td>%</td>
<td></td>
<td></td>
<td><strong>1,577,624.91</strong></td>
</tr>
<tr>
<td></td>
<td>Erection Charges @ 10% of I</td>
<td>%</td>
<td></td>
<td></td>
<td><strong>2,103,499.88</strong></td>
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<tr>
<td></td>
<td><strong>Total J</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>24,716,123.58</strong></td>
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**Civil Work**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Quantity</th>
<th>Rate</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cost of Power Transformer Plinth (30'x8'x5'6&quot; size)</td>
<td>1</td>
<td>120,000.00</td>
<td><strong>120,000.00</strong></td>
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<tr>
<td>2</td>
<td>Cost of the 33KV VCB Plinth @ Rs 25000.00/ plinth)</td>
<td>2</td>
<td>50,000.00</td>
<td><strong>50,000.00</strong></td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Quantity</td>
<td>Amount</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------------------------------------------</td>
<td>----------</td>
<td>------------</td>
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</tr>
<tr>
<td>3</td>
<td>Cost of the 11KV VCB Plinth @ Rs 20000/plinth)</td>
<td></td>
<td>40,000.00</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Layling of the S/s yard with sand and metal spreading</td>
<td></td>
<td>60,000.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total (K)</td>
<td></td>
<td>270,000.00</td>
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<tr>
<td></td>
<td>Grand Total (J+K)</td>
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<td>24,986,124.00</td>
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<tr>
<td></td>
<td>Third Party Inspection Fees(5 % of Gross)</td>
<td></td>
<td>1,249,306.00</td>
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</tr>
</tbody>
</table>
Construction of 33 kv line with 100mm2 AAAC conductor 10 mtr PSC pole:- 30 km 
(from Jayanagar Grid s/s to Lamtaput) and 33 kv line on 132 kv tower:- 10 km
(since the line is passing through Ghat area and deep forest area)

Name of District: Koraput
Name of the Circle: Electrical Circle, Jeypore
Name of the Division: Jeypore Electrical Division, Jeypore
Name of the Sub-Division: Jeypore-I
Name of the Section: Section-II

Scope of Work:
A  Construction of 3ph 3 wire 33 KV line of 100 MM2 AAA Conductor with 10 Mtr Long 
300 KG PSC pole:30 Km.
B  33 kv line on 41 nos. NBLS tower:- 10 km

Head of Accounts: RLTAP Scheme (13-14)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description of materials</th>
<th>Unit</th>
<th>Qty.</th>
<th>Rate (13-14)</th>
<th>Amount in Rs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100sqmAAA conductor</td>
<td>KM</td>
<td>92.7</td>
<td>56000.00</td>
<td>51,91,200</td>
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<tr>
<td>2</td>
<td>10 Mtrs 300Kg PSC Pole</td>
<td>No</td>
<td>630</td>
<td>4000.00</td>
<td>25,20,000</td>
</tr>
<tr>
<td>3</td>
<td>33KV 'V' Cross arm</td>
<td>No</td>
<td>628</td>
<td>1260.00</td>
<td>7,91,280</td>
</tr>
<tr>
<td>4</td>
<td>Back clamp for 'V' crossarm</td>
<td>No</td>
<td>628</td>
<td>150.00</td>
<td>94,200</td>
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<tr>
<td>5</td>
<td>33KV Poletop Bracket</td>
<td>NO</td>
<td>628</td>
<td>195.00</td>
<td>1,22,460</td>
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<tr>
<td>6</td>
<td>33KV Pin Insulator</td>
<td>No</td>
<td>1884</td>
<td>310.00</td>
<td>5,84,040</td>
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<tr>
<td>7</td>
<td>33KV G I Pin</td>
<td>No</td>
<td>1884</td>
<td>260.00</td>
<td>4,89,840</td>
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<tr>
<td>8</td>
<td>18mm GI Stay set Complete</td>
<td>Set</td>
<td>120</td>
<td>950.00</td>
<td>1,14,000</td>
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<tr>
<td>9</td>
<td>33 KV Stay Insulator</td>
<td>No</td>
<td>120</td>
<td>40.00</td>
<td>4,800</td>
</tr>
<tr>
<td>10</td>
<td>Ht Stay Clamp</td>
<td>Pair</td>
<td>120</td>
<td>262.5</td>
<td>31,500</td>
</tr>
<tr>
<td>11</td>
<td>7/10 G I Stay Wire</td>
<td>Kg</td>
<td>28800</td>
<td>75.00</td>
<td>21,60,000</td>
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<tr>
<td>12</td>
<td>33KV Disc Insulator(B&amp;S)</td>
<td>No</td>
<td>1080</td>
<td>350.00</td>
<td>3,78,000</td>
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<tr>
<td>13</td>
<td>33KV Hardware fitting(B&amp;S)</td>
<td>Set</td>
<td>360</td>
<td>425.00</td>
<td>1,53,000</td>
</tr>
<tr>
<td>14</td>
<td>G I Earthing coil</td>
<td>No</td>
<td>630</td>
<td>156.00</td>
<td>98,280</td>
</tr>
<tr>
<td>15</td>
<td>100x50x6mm M.S.Channel 3.5 Mtr Long (9.2 Kg / Mtr) 24 Nos.</td>
<td>Kg</td>
<td>7728</td>
<td>60.00</td>
<td>4,63,680</td>
</tr>
</tbody>
</table>
| 16      | Concreting of support C.C - 1:4:8 using 40mm BHG metal size - 5'x2'x2' = 20CFT 
Padding 900x600x150mm = 0.081 
0.651Cum 
@2925= 1904.17each | NO   | 630  | 1904.17     | 11,99,627.10  |
| 17      | Nuts&Bolts with Washers  | Kg   | 750  | 75.00        | 56,250        |
### Fixing of stay set with 0.5 Cum cement concrete foundation 1:3:6 size (900mmx600mmx900mm) using 40mm BHG metal with all labour and material except stay set, stay wire, stay insulator.

<table>
<thead>
<tr>
<th>No.</th>
<th>Description of Material</th>
<th>Unit</th>
<th>QNTY.</th>
<th>Rate for 13-14 in Rs</th>
<th>Amount in Rs</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>Fixing of stay set with 0.5 Cum cement concrete foundation 1:3:6 size (900mmx600mmx900mm) using 40mm BHG metal with all labour and material except stay set, stay wire, stay insulator.</td>
<td>No. 120</td>
<td>1670.38</td>
<td>2,00,445.60</td>
<td></td>
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<tr>
<td>19</td>
<td>Sundries (paint, DB, clamp connector, Anti-climbing Device, Binding Tape &amp; etc)</td>
<td>LS 30</td>
<td>5000.00</td>
<td>1,50,000</td>
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</tbody>
</table>

**Total cost of material including storage (A)**

$$1,48,02,602.70$$

### B 33 kv line on NBLS tower: - 10 km

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>DESCRIPTION OF MATERIAL</th>
<th>UNIT</th>
<th>QNTY.</th>
<th>RATE FOR 13-14 IN RS</th>
<th>AMOUNT IN RS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>33KV Single Circuit tower (5MT each) to support 100MM² conductor</td>
<td>MT 205</td>
<td>75000.00</td>
<td>15375000.00</td>
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</tr>
<tr>
<td>2</td>
<td>GI Bolts, Nuts, Washers</td>
<td>Kg 10250</td>
<td>125.00</td>
<td>1281250.00</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>G.I Earthing electrode 40mm dia medium gauge(3.25mm thickness)-2.3 Mtr long</td>
<td>No 41</td>
<td>1400.00</td>
<td>57400.00</td>
<td></td>
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<tr>
<td>4</td>
<td>100MM² AAA Conductor</td>
<td>Km 31.5</td>
<td>56000.00</td>
<td>1764000.00</td>
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<tr>
<td>5</td>
<td>Vibration damper for 100MM² AAA Conductor</td>
<td>No 246</td>
<td>400.00</td>
<td>98400.00</td>
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<tr>
<td>6</td>
<td>Danger Plate</td>
<td>No 41</td>
<td>245.00</td>
<td>10045.00</td>
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<tr>
<td>7</td>
<td>Phase Plate</td>
<td>No 123</td>
<td>105.00</td>
<td>12915.00</td>
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<tr>
<td>8</td>
<td>Anti climbing device</td>
<td>Set 41</td>
<td>4000.00</td>
<td>164000.00</td>
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<tr>
<td>9</td>
<td>Earth wire</td>
<td>Km 4.1</td>
<td>28000.00</td>
<td>114800.00</td>
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<tr>
<td>10</td>
<td>Earth wire tension clamp</td>
<td>NO 41</td>
<td>444.00</td>
<td>18204.00</td>
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</tr>
<tr>
<td>11</td>
<td>Vibration damper for earth wire</td>
<td>Km 41</td>
<td>444.00</td>
<td>18204.00</td>
<td></td>
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<tr>
<td>12</td>
<td>11 KV Disc Insulator B &amp; S type(70 KN)</td>
<td>No 738</td>
<td>350.00</td>
<td>258300.00</td>
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</tr>
<tr>
<td>13</td>
<td>33 KV H/W fitting B &amp; S Type(70KN)</td>
<td>No 246</td>
<td>425.00</td>
<td>104550.00</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Concreting of tower by laying foundation and civil work from foundation to ground level and coupling</td>
<td>No 41</td>
<td>50000.00</td>
<td>20500000.00</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Sundries (Paint, danger board, Clamp Connectors,Anti-climbing device, Binding tape etc)</td>
<td>LS 41</td>
<td>30000.00</td>
<td>1230000.00</td>
<td></td>
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</table>

**Total cost of material including storage (B)**

$$22557068.00$$

**Total Material cost C = (A+B)**

$$3,73,59,670.70$$
<table>
<thead>
<tr>
<th></th>
<th>%</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation @ 7.5% of C</td>
<td>7.50%</td>
<td>28,01,975.30</td>
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<tr>
<td>Erection Charges @ 10% of C</td>
<td>10%</td>
<td>37,35,967.07</td>
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<td><strong>Grand Total</strong></td>
<td></td>
<td><strong>4,38,97,613.00</strong></td>
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<tr>
<td>Third Party Inspection Fees(5 % of Gross)</td>
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<td>21,94,881.00</td>
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</table>
SOUTHERN ELECTRICITY SUPPLY COMPANY OF ORISSA LIMITED

Estimate for Up-rating of 33 KV line conductor from 34mm2 ACSR to 100mm2 AAAC-34Km. (5nos. Intermediate pin point Pole & 1 cut point pole for each km ),with 2 Nos 33KV DP from Umerkote to Raighar

Name of District: Nabarangpur
Name of the Circle: Electrical Circle, Jeypore
Name of the Division: Nabarangpur Electrical Division, Nabarangpur
Name of the Sub-Division: Umerkote
Name of the Section: Raighar
Scope of Work: Up-rating of 3 ph 3 wire 33 KV line conductor from 34mm2 ACSR to 100mm2 AAAC-34Km. (5nos. Intermediate pin point Pole & 1 cut point pole for each km ), with 2 nos. 33KV DP

Head of Accounts: RLTAP Scheme (13-14)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description of materials</th>
<th>Unit</th>
<th>Qty.</th>
<th>Rate (13-14)</th>
<th>Amount in Rs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100 mm sq AAAC Conductor</td>
<td>km</td>
<td>105.06</td>
<td>56000.00</td>
<td>5883360.00</td>
</tr>
<tr>
<td>2</td>
<td>9 mtrs PSC Pole</td>
<td>No</td>
<td>204</td>
<td>3000.00</td>
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<td>158100.00</td>
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<tr>
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<td>9</td>
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<td>No</td>
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<td>350</td>
<td>214200.00</td>
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<tr>
<td>16</td>
<td>Concreting of support C.C - 1:4:8 using 40mm BHG metal size - 5’x2’x2’ = 20CFT = 0.570Cum Padding 900x600x150mm = 0.081 0.651Cum @2925= 1904.17each</td>
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<td>Nut, Bolt &amp; Washers</td>
<td>Kg</td>
<td>510</td>
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<td>18</td>
<td>Fixing of stay set with 0.5Cum cement concrete foundation 1:3:6 size (900mmx600mmx900mm) using 40mm BHG metal with all labour and material except stay set, stay wire, stay insulator</td>
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<td>68</td>
<td>1670.38</td>
<td>113,585.84</td>
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<tr>
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<td>Sundries (paint, DB, clamp connector, Anti-climbing Device, Binding Tape &amp; etc)</td>
<td>LS</td>
<td>34</td>
<td>2000.00</td>
<td>68000.00</td>
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**Total cost of material including storage (A)**

- Transportation (@ 7.5% of A)
  - 7.50%
  - 628,555.31
- Erection Charges @ 10% of A
  - 10%
  - 838,073.75

**Grand Total**

- 9,847,366.59
**SOUTHERN ELECTRICITY SUPPLY COMPANY OF ORISSA LIMITED**

**Estimate for 33 KV Bay extension and construction of 33 KV line of 100 mm2 AAA Conductor using 10 mtr long PSC pole 17 KM from Sunabeda 132/33 KV Grid S/S to OMP Koraput**

Name of District: Koraput  
Name of the Circle: Electrical Circle, Jeypore  
Name of the Division: Koraput Electrical Division, Koraput  
Name of the Sub-Division: Koraput  
Name of the Section:  
Scope of Work: A. Construction of 3ph 3 wire 33 KV line of 100 MM2 AAA Conductor with 10 Mtr Long 300 KG PSC pole : 17 KM(2 cut point & 1 DP for each KM ) (Avg span length is 50 Mtr)  

Head of Accounts: RLTP Scheme (13-14)

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<thead>
<tr>
<th>Sl. No.</th>
<th>Description of materials</th>
<th>Unit</th>
<th>Qty.</th>
<th>Rate (13-14)</th>
<th>Amount in Rs.</th>
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<td>4</td>
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<td>5</td>
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<td>214,200</td>
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<td>16</td>
<td>Concreting of support C.C - 1:4:8 using 40mm BHG metal size - 5'x2'x2' = 20CFT = 0.570Cum Padding 900x600x150mm = 0.081 0.651Cum @2925= 1904.17each</td>
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<td>17</td>
<td>Nuts&amp;Bolts with Washers</td>
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<td>Fixing of stay set with 0.5Cum cement concrete foundation 1:3:6 size (900mmx600mmx900mm) using 40mm BHG metal with all labour and material except stay set, stay wire, stay insulator.</td>
<td>No.</td>
<td>68</td>
<td>1670.38</td>
<td>113,585.84</td>
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<tr>
<td>19</td>
<td>Sundries (paint, DB, clamp connector, Anti-climbing Device, Binding Tape &amp; etc)</td>
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Total cost of material including storage (A)  7,095,988.53

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<td>Erection Charges @ 10% of A</td>
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Grand Total  8,337,787.00
SOUTHERN ELECTRICITY SUPPLY COMPANY OF ORISSA LIMITED

Provision for 1 no. 2X1.6 MVA 33/11 KV S/S at Balipeta under Narayana patna Block with 11Kms of 33 KV line.

Name of District: Koraput
Name of the Circle: Electrical Circle, Jeypore
Name of the Division: Koraput Electrical Division, Koraput
Name of the Sub-Division: Laxmipur
Name of the Section: Bandhugaon
Scope of Work:
A 33KV DP Structure for I/C and Metering arrangement
B 8-pole structure including VCB arrangement
C Installation of 2x 1.6 MVA power transformer on plinth mounted
D Errection of 11 KV I/C DP with AB switch arrangement & 11KV I/C VCB (2 Nos.)
E Errection of 11 KV Busbar and 4 Nos bay (using 2x8 pole structure)
F 25 KVA 33/0.4 KV Station Transformer
G 11KV DP for O/G feeder with Metering arrangement (4 nos.)
H Construction of 3ph 3 wire 33 KV line of 100 MM2 AAA Conductor with 10 Mtr Long 300 KG PSC pole: 11 Km.

Head of Accounts: RLTAP Scheme (14-15)

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<th>Sl. no</th>
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<th>Amount</th>
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<td>3</td>
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<tr>
<td>4</td>
<td>Bracing 50x50x6 MM MS Angle (3.8mtr-2nos.&amp; 5mtr- 2 nos.)</td>
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<td>6300.00</td>
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<td>2580.00</td>
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<td>8000.00</td>
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<td>75.00</td>
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<td>Fixing of stay set with 0.5Cum cement concrect foundation 1:3:6 size</td>
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<td>4</td>
<td>1670.38</td>
<td>6681.52</td>
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<td>(900mmx600mmx900mm) using 40mm BHG metal with all labour and material except stay set , stay wire , stay insulator.</td>
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<td>19</td>
<td>Concreting of support C.C - 1:4:8 using 40mm BHG metal size - 5'x2'x2' = 20CFT = 0.570Cum</td>
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<td>750.00</td>
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### B 8-pole structure including VCB arrangement

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<td>90000.00</td>
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<td>35</td>
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<td>32000.00</td>
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<td>43</td>
<td>Concreting of support C.C - 1:4:8 using 40mm BHG metal size - 5'x2'x2' = 20CFT = 0.570Cum Padding 900x600x150mm = 0.081 0.651Cum @2925= 1904.17 each</td>
<td>No</td>
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<td>1904.17</td>
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### Office of the Executive Engineer (Elect)  Construction Division  Jeypore

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#### 116
Concreting of support C.C - 1:4:8 using 40mm BHG metal size - 5'x2'x2' = 20CFT  = 0.570Cum
Padding 900x600x150mm = \( \frac{0.081}{0.651} \)Cum
@2925= 1904.17each

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#### G
**11KV DP for O/G feeder with Metering arrangement (4 nos.)**

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<td>Fixing of stay set with 0.5Cum cement concrete foundation 1:3:6 size (900mmx600mmx900mm) using 40mm BHG metal with all labour and material except stay set, stay wire, stay insulator.</td>
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| 134 | Concreting of support C.C - 1:4:8 using 40mm BHG metal size - 5'x2'x2' = 20CFT  = 0.570Cum
Padding 900x600x150mm = \( \frac{0.081}{0.651} \)Cum
@2925= 1904.17each | No | 8 | 1904.17 | 15233.36 |

#### Other accessories

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### Office of the Executive Engineer (Elect)  Construction Division  Jeypore

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<td>26,400</td>
</tr>
<tr>
<td>12</td>
<td>33KV Disc Insulator(B&amp;S)</td>
<td>No</td>
<td>396</td>
<td>350.00</td>
<td>138,600</td>
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<tr>
<td>13</td>
<td>33KV Hardware fitting(B&amp;S)</td>
<td>Set</td>
<td>132</td>
<td>425.00</td>
<td>56,100</td>
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<tr>
<td>14</td>
<td>G I Earthing coil</td>
<td>No</td>
<td>231</td>
<td>156.00</td>
<td>36,036</td>
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<tr>
<td>15</td>
<td>100x50x6mm M.S.Channel 3.5 Mtr Long (9.2 Kg / Mtr) 24 Nos.</td>
<td>Kg</td>
<td>2833.6</td>
<td>60.00</td>
<td>170,016</td>
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<tr>
<td>16</td>
<td>Concreting of support C.C - 1:4:8 using 40mm BHG metal size - 5’x2’x2’ = 20CFT = 0.570Cum Padding 900x600x150mm = 0.081 0.651Cum @2925= 1904.17each</td>
<td>NO</td>
<td>231</td>
<td>1904.17</td>
<td>439,863.27</td>
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<tr>
<td>17</td>
<td>Nuts&amp;Bolts with Washers</td>
<td>Kg</td>
<td>275</td>
<td>75.00</td>
<td>20,625</td>
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<tr>
<td>18</td>
<td>Fixing of stay set with 0.5Cum cement concreton foundation 1:3:6 size (900mmx600mmx900mm) using 40mm BHG metal with all labour and material except stay set, stay wire , stay insulator</td>
<td>No.</td>
<td>44</td>
<td>1670.38</td>
<td>73,496.72</td>
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<tr>
<td>19</td>
<td>Sundries (paint ,DB , clamp connector, Anti-climbing Device, Binding Tape &amp; etc)</td>
<td>LS</td>
<td>11</td>
<td>5000.00</td>
<td>55,000</td>
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**Cost of Materials(I) = A+B+C+D+E+F+G+H**

| Material cost (I) for FY 2014-15 | 11986297.41 |

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<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Rate</th>
<th>Amount</th>
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<tbody>
<tr>
<td>Transportation @ 7.5% of I</td>
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<td>7.50%</td>
<td>898,972.31</td>
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<td>Erection Charges @ 10% of I</td>
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<td>10%</td>
<td>1,198,629.74</td>
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<td><strong>Total J</strong></td>
<td></td>
<td></td>
<td><strong>14,083,899.46</strong></td>
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<td><strong>Civil Work</strong></td>
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<tr>
<td>1  Cost of Power Transformer Plinth (30'x8'x5'6&quot; size)</td>
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<td></td>
<td>120,000.00</td>
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<tr>
<td>2  Cost of the 33KV VCB Plinth @ Rs 25000.00/plinth)</td>
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<td></td>
<td>25,000.00</td>
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<td>3  Cost of the 11KV VCB Plinth @ Rs 20000/plinth)</td>
<td>2</td>
<td></td>
<td>40,000.00</td>
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<td>4  Layling of the S/s yard with sand and metal spreading</td>
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<td></td>
<td>60,000.00</td>
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<tr>
<td><strong>Total (K)</strong></td>
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<td><strong>245,000.00</strong></td>
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<td><strong>Grand Total (J+K)</strong></td>
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<td></td>
<td><strong>14,328,899.00</strong></td>
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</table>
SOUTHERN ELECTRICITY SUPPLY COMPANY OF ORISSA LIMITED

33 KV line uprating from 55 mm2 to 100 MM2 from Laxmipur to Narayanapatana.-25 KM

Name of District: Koraput
Name of the Circle: Electrical Circle, Jeypore
Name of the Division: Koraput Electrical Division, Koraput
Name of the Sub-Division: Laxmipur
Name of the Section: Bandhugaon
Scope of Work: Up-rating of 33 KV line conductor from 50mm2 ACSR to 100mm2 AAAC-25 Km.

Head of Accounts: RLTAP Scheme (14-15)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description of materials</th>
<th>Unit</th>
<th>Qty.</th>
<th>Rate (13-14)</th>
<th>Amount in Rs.</th>
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<td>77.25</td>
<td>56000.00</td>
<td>4326000.00</td>
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<td>9 mtrs PSC Pole</td>
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<td>150</td>
<td>3000.00</td>
<td>450000.00</td>
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<tr>
<td>3</td>
<td>33 KV 'V' Cross Arm</td>
<td>No</td>
<td>125</td>
<td>1260.00</td>
<td>157500.00</td>
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<td>4</td>
<td>Back Clamp for 'V' Cross Arm</td>
<td>No</td>
<td>125</td>
<td>150.00</td>
<td>18750.00</td>
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<tr>
<td>5</td>
<td>33KV Poletop Bracket</td>
<td>NO</td>
<td>125</td>
<td>195.00</td>
<td>24375.00</td>
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<td>6</td>
<td>33 KV Pin Insulator</td>
<td>No</td>
<td>375</td>
<td>310</td>
<td>116250.00</td>
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<td>7</td>
<td>33 KV G.I. Pin</td>
<td>No</td>
<td>375</td>
<td>260</td>
<td>97500.00</td>
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<td>8</td>
<td>H.T.Stay Set (Complete)</td>
<td>Set</td>
<td>50</td>
<td>950</td>
<td>47500.00</td>
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<td>9</td>
<td>HT Stay Insulator</td>
<td>No</td>
<td>50</td>
<td>40.00</td>
<td>2000.00</td>
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<td>HT Stay Clamp</td>
<td>Pair</td>
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<td>146.25</td>
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<td>400</td>
<td>75.00</td>
<td>30000.00</td>
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<td>12</td>
<td>33 KV Disc Insulator (B&amp;S) 70 KN</td>
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<td>350</td>
<td>157500.00</td>
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<tr>
<td>13</td>
<td>33KV Hard ware fitting (B&amp;S)</td>
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<td>63750.00</td>
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<td>14</td>
<td>Earthing support GI coil type</td>
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<td>156.00</td>
<td>23400.00</td>
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<td></td>
<td>Description</td>
<td>Kg</td>
<td>60.00</td>
<td>Amount</td>
<td></td>
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<tr>
<td>15</td>
<td>100x50x6mm M.S.Channel 3.5 Mtr Long (9.2 Kg / Mtr) 4 Nos.</td>
<td></td>
<td>3220</td>
<td>193200.00</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Concreting of support C.C - 1:4:8 using 40mm BHG metal size - 5’x2’x2’ = 20CFT = 0.570Cum Padding 900x600x150mm = 0.081 0.651Cum @2925= 1904.17each</td>
<td>NO</td>
<td>150</td>
<td>1904.17</td>
<td>285,625.50</td>
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<tr>
<td>17</td>
<td>Nut, Bolt &amp; Washers</td>
<td></td>
<td>375</td>
<td>28125.00</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Fixing of stay set with 0.5Cum cement concret foundation 1:3:6 size ( 900mmx600mmx900mm) using 40mm BHG metal with all labour and material except stay set, stay wire, stay insulator</td>
<td>No.</td>
<td>50</td>
<td>1670.38</td>
<td>83,519.00</td>
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<tr>
<td>19</td>
<td>Sundries (paint ,DB , clamp connector, Anti-climbing Device, Binding Tape &amp; etc)</td>
<td>LS</td>
<td>25</td>
<td>2000.00</td>
<td>50000.00</td>
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**Total cost of material including storage** 6,162,307.00

**Total cost of material (A) for FY 2014-15** 6,655,291.56

<p>| | |</p>
<table>
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<tr>
<td>Transportation ( @ 7.5% of A)</td>
<td>7.50%</td>
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<td>499,146.87</td>
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<tr>
<td>Erection Charges @ 10% of A</td>
<td>10%</td>
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<td>665,529.16</td>
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**Grand Total** 7,819,968.00
**SOUTHERN ELECTRICITY SUPPLY COMPANY OF ORISSA LIMITED**

Replacement of AB cable 3x55+1x35 mm sq :- 15 Km with Intermediate pole (8 mtr):- 100 nos

Name of District: Koraput
Name of the Circle: Electrical Circle, Jeypore
Name of the Division: Jeypore Electrical Division, Jeypore
Name of the Sub-Division: Jeypore-I
Name of the Section: Jeypore-II
Scope of Work: Replacement of AB cable 3x55+1x35 mm sq :- 15 Km
Head of Accounts: RLTAP Scheme (14-15)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description of Materials</th>
<th>Unit</th>
<th>Quantity</th>
<th>Rate (2013-14)</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8 Mtr. long 200 Kg. PSC Pole</td>
<td>No.</td>
<td>100</td>
<td>2000.00</td>
<td>2,00,000.00</td>
</tr>
<tr>
<td>2</td>
<td>Concrete slab for base place size 2ftx2ftx2&quot; thickness for each PSC pole</td>
<td>No.</td>
<td>100</td>
<td>350.00</td>
<td>35,000.00</td>
</tr>
<tr>
<td>3</td>
<td>LT Stay set Complete</td>
<td>Set</td>
<td>30</td>
<td>483.74</td>
<td>14,512.20</td>
</tr>
<tr>
<td>4</td>
<td>7/12 SWG Stay Wire</td>
<td>K.g.</td>
<td>300</td>
<td>75.00</td>
<td>22,500.00</td>
</tr>
<tr>
<td>5</td>
<td>LT Stay clamp (1.4 K.g./ Pair )</td>
<td>pair</td>
<td>30</td>
<td>105.00</td>
<td>3,150.00</td>
</tr>
<tr>
<td>6</td>
<td>LT Stay Insulator</td>
<td>No.</td>
<td>30</td>
<td>25.00</td>
<td>750.00</td>
</tr>
<tr>
<td>7</td>
<td>Fixing and concereating of stay set with 0.5Cum cement concret foundation 1:3:6 size (900mmx600mmx900mm) using 40mm BHG metal with all labour and material except stay set, stay wire, stay insulator.</td>
<td>No.</td>
<td>30</td>
<td>1670.38</td>
<td>50,111.40</td>
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<tr>
<td>8</td>
<td>Dead end clamp</td>
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<td>313.92</td>
<td>37,670.40</td>
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<tr>
<td>9</td>
<td>Suspension clamp with I-Hook</td>
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<td>10</td>
<td>Strain fittings</td>
<td>No.</td>
<td>90</td>
<td>42.21</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Unit(s)</td>
<td>Quantity</td>
<td>Rate</td>
<td>Amount</td>
</tr>
<tr>
<td>---</td>
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<td>---------</td>
<td>----------</td>
<td>-------</td>
<td>------------</td>
</tr>
<tr>
<td>11</td>
<td>Guy grip Dead end</td>
<td>No.</td>
<td>90</td>
<td>40.21</td>
<td>3,618.90</td>
</tr>
<tr>
<td>12</td>
<td>Nuts and Bolts</td>
<td>Kg</td>
<td>270</td>
<td>75.00</td>
<td>20,250.00</td>
</tr>
<tr>
<td>13</td>
<td>Earthing Coil each pole to earth</td>
<td>No.</td>
<td>30</td>
<td>174.57</td>
<td>5,237.10</td>
</tr>
<tr>
<td>14</td>
<td>AB Cable( 3 x50 + 1x35mm² )</td>
<td>K.m.</td>
<td>15.45</td>
<td>125000.00</td>
<td>19,31,250.00</td>
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<td>Sundries for survey, tree cutting, insulated tape etc.</td>
<td>LS</td>
<td>15</td>
<td>1000.00</td>
<td>15,000.00</td>
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**Total cost of material including storage (A)** 24,69,046.90

**Material Cost (A) for FY 2014-15** 26,66,570.65

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<tr>
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<tr>
<td>Transportation @ 7.5% of A</td>
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<td>Erection Charges @ 10% of A</td>
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<td>10%</td>
<td>2,66,657.07</td>
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**Grand Total** 31,33,221.00

Third Party Inspection Fees(5 % of Gross) 1,56,661.00
SOUTHERN ELECTRICITY SUPPLY COMPANY OF ORISSA LIMITED
Replacement of AB cable 3x55+1x35 mm sq - 8 Km with Intermediate pole (8 mtr):- 60 nos

Name of District: Koraput
Name of the Circle: Electrical Circle, Jeypore
Name of the Division: Jeypore Electrical Division, Jeypore
Name of the Sub-Division: Jeypore-I
Name of the Section: Jeypore-II
Scope of Work: Replacement of AB cable 3x55+1x35 mm sq - 8 Km
Head of Accounts: RLTAP Scheme (14-15)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description of Materials</th>
<th>Unit</th>
<th>Quantity</th>
<th>Rate(2013-14)</th>
<th>Amount</th>
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<tbody>
<tr>
<td>1</td>
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<td>No.</td>
<td>60</td>
<td>2000.00</td>
<td>1,20,000.00</td>
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<td>2</td>
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<td>No.</td>
<td>60</td>
<td>350.00</td>
<td>21,000.00</td>
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<td>3</td>
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<td>Set</td>
<td>16</td>
<td>483.74</td>
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<tr>
<td>4</td>
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<td>75.00</td>
<td>12,000.00</td>
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<tr>
<td>5</td>
<td>LT Stay clamp (1.4 K.g./ Pair )</td>
<td>pair</td>
<td>16</td>
<td>105.00</td>
<td>1,680.00</td>
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<tr>
<td>6</td>
<td>LT Stay Insulator</td>
<td>No.</td>
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<td>25.00</td>
<td>400.00</td>
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<tr>
<td>7</td>
<td>Fixing and concereating of stay set with 0.5Cum cement concret foundation 1:3:6 size (900mmx600mmx900mm) using 40mm BHG metal with all labour and material except stay set, stay wire, stay insulator.</td>
<td>No.</td>
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<tr>
<td>8</td>
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<tr>
<td>9</td>
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<td>2,026.08</td>
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<td></td>
<td>Description</td>
<td>Unit</td>
<td>Quantity</td>
<td>Rate</td>
<td>Amount</td>
</tr>
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<td>------</td>
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<td>-------</td>
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</tr>
<tr>
<td>11</td>
<td>Guy grip Dead end</td>
<td>No.</td>
<td>48</td>
<td>40.21</td>
<td>1,930.08</td>
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<tr>
<td>12</td>
<td>Nuts and Bolts</td>
<td>Kg</td>
<td>144</td>
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<td>10,800.00</td>
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<td>13</td>
<td>Earthing Coil each pole to earth</td>
<td>No.</td>
<td>16</td>
<td>174.57</td>
<td>2,793.12</td>
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<td>K.m.</td>
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<td>LS</td>
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<td>1000.00</td>
<td>8,000.00</td>
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**Total cost of material including storage (A)** 13,32,491.68

**Material Cost (A) for FY 2014-15** 14,39,091.01

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<tr>
<th>Description</th>
<th>Rate</th>
<th>Amount</th>
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<td>Transportation (@ 7.5% of A)</td>
<td>7.50%</td>
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<tr>
<td>Erection Charges @ 10% of A</td>
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<td>1,43,909.10</td>
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**Grand Total** 16,90,932.00

**Third Party Inspection Fees(5 % of Gross)** 84,547.00
SOUTHERN ELECTRICITY SUPPLY COMPANY OF ORISSA LIMITED
Replacement of AB cable 3x55+1x35 mm sq :- 13.5 Km with Intermediate pole (8 mtr):- 80 nos

Name of District: Koraput  
Name of the Circle: Electrical Circle, Jeypore  
Name of the Division: Jeypore Electrical Division, Jeypore  
Name of the Sub-Division: Jeypore-I  
Name of the Section: Jeypore-II  
Scope of Work: Replacement of AB cable 3x55+1x35 mm sq :- 13.5 Km  
Head of Accounts: RLTAP Scheme (14-15)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description of Materials</th>
<th>Unit</th>
<th>Quantity</th>
<th>Rate(2013-14)</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8 Mtr. long 200 Kg. PSC Pole</td>
<td>No.</td>
<td>80</td>
<td>2000.00</td>
<td>1,60,000.00</td>
</tr>
<tr>
<td>2</td>
<td>Concrete slab for base place size 2ftx2ftx2&quot; thickness for each PSC pole</td>
<td>No.</td>
<td>80</td>
<td>350.00</td>
<td>28,000.00</td>
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<tr>
<td>3</td>
<td>LT Stay set Complete</td>
<td>Set</td>
<td>27</td>
<td>483.74</td>
<td>13,060.98</td>
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<tr>
<td>4</td>
<td>7/12 SWG Stay Wire</td>
<td>K.g.</td>
<td>270</td>
<td>75.00</td>
<td>20,250.00</td>
</tr>
<tr>
<td>5</td>
<td>LT Stay clamp (1.4 K.g./ Pair)</td>
<td>pair</td>
<td>27</td>
<td>105.00</td>
<td>2,835.00</td>
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<tr>
<td>6</td>
<td>LT Stay Insulator</td>
<td>No.</td>
<td>27</td>
<td>25.00</td>
<td>675.00</td>
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<tr>
<td>7</td>
<td>Fixing and concreating of stay set with 0.5Cum cement concrect foundation 1:3:6 size (900mmx600mmx900mm) using 40mm BHG metal with all labour and material except stay set, stay wire, stay insulator.</td>
<td>No.</td>
<td>27</td>
<td>1670.38</td>
<td>45,100.26</td>
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<td>8</td>
<td>Dead end clamp</td>
<td>No.</td>
<td>108</td>
<td>313.92</td>
<td>33,903.36</td>
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<tr>
<td>9</td>
<td>Suspension clamp with I-Hook</td>
<td>No.</td>
<td>324</td>
<td>350.55</td>
<td>1,13,578.20</td>
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<td>10</td>
<td>Strain fittings</td>
<td>No.</td>
<td>81</td>
<td>42.21</td>
<td>3,419.01</td>
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<tr>
<td>11</td>
<td>Guy grip Dead end</td>
<td>No.</td>
<td>81</td>
<td>40.21</td>
<td></td>
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<tr>
<td>No.</td>
<td>Description</td>
<td>Unit</td>
<td>Quantity</td>
<td>Unit Rate</td>
<td>Amount</td>
</tr>
<tr>
<td>-----</td>
<td>------------------------------------------------</td>
<td>------</td>
<td>----------</td>
<td>-----------</td>
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<tr>
<td>12</td>
<td>Nuts and Bolts</td>
<td>Kg</td>
<td>243</td>
<td>75.00</td>
<td>18,225.00</td>
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<tr>
<td>13</td>
<td>Earthing Coil each pole to earth</td>
<td>No.</td>
<td>27</td>
<td>174.57</td>
<td>4,713.39</td>
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<tr>
<td>14</td>
<td>AB Cable (3 x50 + 1 x35 mm²)</td>
<td>K.m.</td>
<td>13.91</td>
<td>125000.00</td>
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<td>15</td>
<td>Sundries for survey, tree cutting, insulated tape etc.</td>
<td>LS</td>
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<td>1000.00</td>
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**Total cost of material including storage (A)** 21,99,142.21

**Material Cost (A) for FY 2014-15** 23,75,073.59

<table>
<thead>
<tr>
<th>Description</th>
<th>Percentage</th>
<th>Amount</th>
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</thead>
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<tr>
<td>Transportation (@ 7.5% of A)</td>
<td>7.50%</td>
<td>1,78,130.52</td>
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<tr>
<td>Erection Charges @ 10% of A</td>
<td>10%</td>
<td>2,37,507.36</td>
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**Grand Total** 27,90,711.00

**Third Party Inspection Fees (5% of Gross)** 1,39,536.00