



# TENDER DOCUMENT

SOUTHERN ELECTRICITY SUPPLY COMPANY OF ODISHA LTD  
CORPORATE OFFICE SOUTHCO, BERHAMPUR

**TENDER NOTICE NO: Tech/ RLTA 2013-14/08/2014-15**

**FOR  
TURNKEY CONTRACTS (SUPPLY & ERECTION)**

**For Installation of additional 1x1.6MVA, 33/11KV Power Transformer and  
33Bay Extension along with associated works at 33/11KV Dangasarada S/S  
under Rayagada District under RLTA scheme 2013-14**

The last date and time of receipt of tender- dt. 23.07.2014 upto 13.00Hrs

Date and time of opening of Technical Bid- dt. 23.07.2014 at 15.30Hrs

Ref No.-Tech/RLTAP / 8518<sup>(31)</sup>

Date- 08.07.2014

**Tender Notice No-Tech/ RLTAP 2013-14/ 08 /2014-15 dt.08.07.2014**

Southern Electricity Supply Company of Orissa Ltd. (SOUTHCO) invites sealed bids in duplicate on two part bidding system from experienced, qualified and eligible bidders having valid HT Electrical License and Civil license from Govt of Odisha who comply with the terms and conditions for the following work on turnkey basis.

Sl No	Description of work	Estimated cost (in Rs)	EMD (in Rs)	Non refundable cost of bid documents incl. VAT 5% (in Rs)
1	For Installation of additional 1x1.6MVA, 33/11KV power transformer and 33KV Bay extension along with associated works at 33/11KV Dangasarada S/S under Rayagada District RLTAP Scheme 2013-14.	35,19,258/-	35,192/-	6,300/-

The tender documents will be available from the office of the undersigned during office hours on working days on payment of Rs 6,300/- in shape of cash / Bank Draft in favour of **Southco, Berhampur**, payable at Berhampur (Non-Refundable).

1. Sale of bid documents will be from-**dt.09.07.2014**
2. Last date / time of submission of bids dt. **23.07.2014 upto 13.00Hrs**
3. Date & time for opening of Technical bids dt.**23.07.2014 at 15.30Hrs.**

SOUTHCO reserves the right to alter the tendered quantity and reject / accept any or all tenders or split the tender among tenderers without assigning any reason thereof.

Dy. General Manager  
(Tech, Proj & MRT)  
Southco, Berhampur.

Cc to-

1. IT in charge CSO Bhubaneswar for information and he is requested to upload the same in Southco website.
2. Collector cum District Magistrate Rayagada for kind information
3. All EEs under Distribution and Construction Divisions under Southco. They are requested to display it on their notice board for wide circulation.
4. GMs / DGMs / SEs in charge of Electrical circles under Southco. They are requested to display it on their notice board for wide circulation.
5. GM (Fin) Southco.
6. Sr GM / AVP (MAC, Com) Southco.
7. MD Southco for kind information.
8. Notice board of this office.

**Section – I**

**INVITATION FOR BIDS (IFB)**

**Tender Notification: Tech/ RL TAP 2013-14/08/2014-15**

**Dy. General Manager (Tech, Proj & MRT) Southco, Berhampur**

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 its licensed area. The bidder must fulfill all the qualification requirements as specified in clause 2.0 stated below. The sealed envelopes shall be duly super scribed as “**TENDER NOTICE No: Tech/ RL TAP 2013-14/08 /2014-15 Dt 08.07.2014**”

2.0 **Due date of opening- 23.07.2014 at 15.30Hrs**

SI No	Brief Description of Works	Estimated Cost (Rupees In Lacs)	Earnest Money Deposit (Rs)	Last date /time for submission of bids	Date and time of opening of bid	Non refundable Cost of Bid Document (Incl. VAT)
1	For Installation of additional 1x1.6MVA, 33/11KV power transformer and 33KV Bay extension along with associated works at 33/11KV Dangasarada S/S under Rayagada District RL TAP Scheme 2013-14.	35,19,258/-	35,192/-	23.07.14 upto 13.00Hrs	23.07.14 upto 15.30Hrs	Rs. 6300/-

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

(a) Bidder must quote for the entire quantum of works.

(b) The minimum Average Annual Turnover of the bidder in any three financial year out of the last five financial years should not be less than the estimated value. Bidder must enclose copies of the relevant work orders, electrical inspection report issued by electrical inspector and copy of tax invoices in proof of having executed the desired quantum of works during the last three financial years.

(c) In addition to above the bidder should submit the following documents in **Part-I** bid as qualifying terms.

- i. Valid electrical (HT) license for electrical works.
- ii. EPF registration
- iii. ESI registration
- iv. Service Tax registration
- v. VAT Clearance Certificate
- vi. PAN & TIN No.
- vii. Existing Labour license.
- viii. Registration under Building and Other Construction Workers Welfare Cess.
- ix. Last 3Years audited balance sheet & profit loss account.

(d) The bidders who have earlier failed to execute the works order(s) of the **Owner** shall not be eligible to participate in this tender.

(e) **Owner 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. 6,300/-** towards non-refundable cost of bid documents (Including VAT) through cash / Bank DD drawn in favour of **Southco, Berhampur** payable at **Berhampur** (Non-refundable) during office hours from **10.30AM to 4.30PM. till dt.22.07.2014**

4.0 The tender documents can also be downloaded from Southco websites [www.Southcoodisha.com](http://www.Southcoodisha.com). In case tender papers are downloaded from these websites, then the bidder has to enclose a Demand Draft, drawn on any schedule bank, 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: “Tech/RLTAP 2013-14/ 08/2014-15 Dtd: 08.07.2014”**”. The envelope should accompany the Bid Documents.

5.0 Price shall be inclusive of all taxes & duties.

6.0 Project Completion Schedules:-

<b>Description</b>	<b>Date</b>
Issue of Tender Document	09.07.2014
Submission of Bids	23.07.2014 upto 13.00Hrs
Opening of Bids (Technical Bid)	23.07.2014 upto 15.30Hrs
Opening of Bids (Price Bid)	Will be intimated
Completion period	To be completed within <b>90 days</b> from the date of issue of Work Order.

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

Dy. General Manager (Tech, Proj & MRT), Corporate Office, Southco, Berhampur.

Dy. General Manager  
(Tech, Proj & MRT)  
Southco, Berhampur

**Section – II**

**INSTRUCTION TO BIDDERS (ITB)**

**Tender Notification: Tech/RLTAP 2013-14/08/2014-15**

**A. GENERAL:-**

**1.0** SOUTHCO, hereinafter referred to as the “Owner” is desirous of implementing the various works at their respective licensed area in the state of Orissa. The Owner has now floated this tender For Installation of additional 1x1.6MVA, 33/11KV power transformer and 33KV Bay extension along with associated works at 33/11KV Dangasarada S/S under Rayagada District RLTA Scheme 2013-14.

**2.0 SCOPE OF WORKS:-**

**2.0** The scope shall include For Installation of additional 1x1.6MVA, 33/11KV power transformer and 33KV Bay extension along with associated works at 33/11KV Dangasarada S/S under Rayagada District RLTA Scheme 2013-14 area, conforming to the REC Technical Specifications & CEA guidelines.

**3.0 DISCLAIMER:-**

3.01 This Document includes statements, which reflect various assumptions, which may or may not be correct. Each Bidder 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.

3.02 Neither the Owner nor its employees will have any liability what so ever to any Bidder or any other person under the law or contract, the principles 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 Document, any matter deemed to form part of this Document, provision of Services and any other information supplied by or on behalf of Owner or its employees, or otherwise arising in any way from the selection process for the Supply & Construction.

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

3.04 This Document and the information contained herein are strictly confidential and are for the use of only the person(s) to whom it is issued. It may not be copied or distributed by the recipient to third parties (other than in confidence to the recipient’s professional advisors).

**4.0 COST OF BIDDING:-**

The Bidder shall bear all costs associated with the preparation and submission of its Bid and Owner will in no case be responsible or liable for those costs.

**B. BIDDING DOCUMENTS:-**

**5.0 BIDDING DOCUMENTS:-**

5.01 The Scope of Works, Bidding Procedures and Contract Terms are described in the Bidding Documents. In addition to the covering letter accompanying Bidding Documents, the Bidding Documents include:

- (a) Invitation for BIDs (IFB)
- (b) Instructions to Bidders (ITB)
- (c) General Conditions of Contract (GCC)

- (d) General Technical Specification (GTS)
- (e) Bid Forms and Formats
- (f) Price Bid

5.02 The Bidder is expected to examine the Bidding Documents, including all Instructions, Forms, Terms and Specifications. Failure to furnish all information required by the Bidding Documents or submission of a Bid not substantially responsive to the Bidding Documents in every respect may result in the rejection of the Bid.

#### **6.0 AMENDMENT OF BIDDING DOCUMENTS:-**

- 6.01 At any time prior to the deadline for submission of Bids, the Owner may, for any reasons, whether at its own initiative or in response to a clarification requested by a prospective Bidder, modify the Bidding Documents by Amendment.
- 6.02 The Amendment shall be part of the Bidding Documents, pursuant to Clause 5.01, and it will be notified in writing by Fax / E-mail to all the Bidders who have received the Bidding Documents and confirmed their participation to Bid, and will be binding on them.
- 6.03 In order to afford prospective Bidders reasonable time in which to take the Amendment into account in preparing their Bids, the Owner may, at its discretion, extend the deadline for the submission of Bids.

#### **C. PREPARATION OF BIDS:-**

##### **7.0 LANGUAGE OF BID:-**

The Bid prepared by the Bidder, and all correspondence and documents relating to the Bid exchanged by the Bidder and the Owner, shall be written in the English Language. Any printed literature furnished by the Bidder may be written in another Language, provided that this literature is accompanied by an English translation, in which case, for purposes of interpretation of the Bid, the English translation shall govern.

##### **8.0 DOCUMENTS COMPRISING THE BID:-**

The Bid prepared and submitted by the Bidder shall comprise the following components:

- (a) Bid Form, Price BID & other Schedules (STRICTLY AS PER FORMAT).
- (b) All the Bids must be accompanied with the required EMD.
- (c) Power of Attorney indicating that the person(s) signing the Bid have the authority to sign the Bid and thus that the Bid is binding upon the Bidder during the full period of its validity, in accordance with clause 12.0.

##### **9.0 BID FORM:-**

9.01 The Bidder shall complete an 'Original' and another one 'Copy' of the Bid Form and the appropriate Price & Other Schedules.

##### **9.02 Bid Security**

The bidder shall furnish, as part of its bid, a bid security as already specified in the tender document. The bid security is required to protect the Owner against the risk of Bidder's conduct, which would warrant the security's forfeiture.

The bid security shall be denominated in the currency of the bid, and shall be in the following form:



(a) Bank Draft in favor of **Southco, Berhampur** payable at **Berhampur**. Unsuccessful bidders' bid security will be discharged or returned as promptly as possible but not later than **thirty (30)** days after the expiration of the period of bid validity. The successful bidder's bid security will be discharged upon furnishing the performance security.

The bid security may 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 sign & accept the Contract, or
  - (ii) to furnish the required Composite performance Bank Guarantee within the stipulated period.

**10.0 BID PRICES:-**

- 10.01 Bidders shall quote with a break-up of prices for individual items. The total Bid Price shall also cover all the Supplier's obligations mentioned in or reasonably to be inferred from the Bidding Documents in respect of design, Supply, Transportation to site, all in accordance with the requirement of Bidding Documents. The Bidder shall complete the appropriate Price Schedules included herein, stating the Unit Price for each item & total Price.
- 10.02 The prices offered shall be inclusive of all costs as well as Duties, Taxes and Levies paid or payable during execution of the supply works, break up of price constituents, should be there.
- 10.03 Prices quoted by the Bidder shall be "Firm" and not subject to any price adjustment during the performance of the Contract. A Bid submitted with an adjustable price quotation will be treated as non-responsive and rejected.

**11.0 BID CURRENCIES:-**

Prices shall be quoted in Indian Rupees Only.

**12.0 PERIOD OF VALIDITY OF BIDS:-**

- 12.01 Bids shall remain valid for **180** days from the date of opening of the Bid.
- 12.02 Notwithstanding Clause 12.01 above, the Owner may solicit the Bidder's consent to an extension of the Period of Bid Validity. The request and the responses thereto shall be made in writing by Fax / E-mail.

**13.0 ALTERNATIVE BIDS:-**

Bidders shall submit Bids, which comply with the Bidding Documents. Alternative Bids will not be considered. The attention of Bidders is drawn to the provisions of Clause 22.03 & 22.04 regarding the rejection of Bids, which are not substantially responsive to the requirements of the Bidding Documents.

**14.0 FORMAT AND SIGNING OF BID:-**

- 14.01 The original Bid Form and accompanying documents (as specified in Clause 9.0), clearly marked "Original Bid", plus one copy must be received by the Owner at the date, time and place specified pursuant to Clauses 15.0 and 16.0. In the event of any discrepancy between the original and the copies, the original shall govern.

- 14.02 The original and copy of the Bid shall be typed or written in indelible ink and shall be signed by the Bidder or a person or persons duly authorized to sign on behalf of the Bidder. Such authorization shall be indicated by written Power-of-Attorney accompanying the Bid.
- 14.03 The Bid shall contain no interlineations, erasures or overwriting except as necessary to correct errors made by the Bidder, in which case such corrections shall be initialed by the person or persons signing the Bid.

**15.0 SUBMISSION OF BID: -**

- 15.01 Sealed tenders in Two parts each in duplicate, each complete in all respects in the manner herein after specified are to be submitted at Dy. General Manager (Tech, Proj & MRT) Corporate office Southco, Berhampur on or before the date and time specified in the notice inviting the tenders. 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.
- 15.02 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.
- 15.03 Fax and Telegraphic tenders shall not be accepted.
- 15.04 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.

**16.0 DEADLINE FOR SUBMISSION OF BIDS:-**

- 16.01 The original Bid, together with the required copies, must be received by the Owner at the address specified not later than **13.00 Hrs on dt. 23.07.2014**
- 16.02 The Owner may, at its discretion, extend the deadline for the submission of Bids, in which case all rights and obligations of the Owner and Bidders previously subject to the deadline will thereafter be subject to the deadline as extended.

**17.0 ONE BID PER BIDDER:-**

Each Bidder shall submit only one Bid either by itself, or as a partner in a Joint Venture. A Bidder who submits or participates in more than one Bid will cause all those Bids to be rejected.

**18.0 LATE BIDS:-**

Any Bid received by the Owner after the deadline for submission of Bids prescribed by the Owner, pursuant to Clause 16.0, will be declared "Late" and rejected and returned unopened to the Bidder.

**19.0 MODIFICATIONS AND WITHDRAWAL OF BIDS:-**

- 19.01 The Bidder is not allowed to modify or withdraw its Bid after submission of the Bid.
- 19.02 No Bid may be modified to the deadline for Bids.

**E. EVALUATION OF BID:-**

**20.0 PROCESS TO BE CONFIDENTIAL:-**

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.

**21.0 CLARIFICATION OF BIDS:-**

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.

**22.0 PRELIMINARY EXAMINATION OF BIDS / RESPONSIVENESS:-**

22.01 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.

22.02 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.

22.03 Prior to the detailed evaluation, Owner will determine the substantial responsiveness of each Bid to the Bidding Documents including 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.

22.04 A Bid determined as not substantially responsive will be rejected by the Owner and may not subsequently be made responsive by the Bidder by correction of the non-conformity.

**23.0 EVALUATION AND COMPARISON OF BIDS:-**

23.01 The evaluation of Bids shall be done based on the delivered cost competitiveness basis.

23.02 The evaluation of the Bids shall be a stage-wise procedure. The following stages are identified for evaluation purposes:

In the first stage, the Bids would be subjected to a responsiveness check. The Technical Proposals and the Conditional ties of the Bidders would be evaluated.

Subsequently, the Financial Proposals along with Supplementary Financial Proposals, if any, of Bidders with Techno-commercially Acceptable Bids shall be considered for final evaluation.

23.03 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

Bidders shall base their Bid price on the terms and conditions specified in Bidding Documents.

The cost of all quantifiable deviations and omissions from the specification, terms and conditions specified in Bidding Documents shall be evaluated. The Owner will make its own assessment of the cost of any deviation for the purpose of ensuring fair comparison of Bids.

- 23.04 Any adjustments in price, which result from the above procedures, shall be added or subtracted for the purposes of comparative evaluation only to arrive at an "Evaluated Bid Price". Bid Prices quoted by Bidders shall remain unaltered.

**24.0 CONTACTING THE OWNER:-**

- 24.01 From the time of Bid opening to the time of contract award, if any Bidder wishes to contact the Owner on any matter related to the Bid, it should do so in writing.
- 24.02 Any effort by a Bidder to influence the Owner and / or in the Owner's decisions in respect of Bid evaluation, Bid comparison or Contract Award, will result in the rejection of the Bidder's Bid.

**25.0 THE OWNER'S RIGHT TO ACCEPT ANY BID AND TO REJECT ANY OR ALL BIDS:-**

The Owner reserves the right to accept or reject any Bid and to annul the Bidding process and reject all Bids at any time prior to award of Contract, without thereby incurring any liability to the affected Bidder or Bidders or any obligation to inform the affected Bidder or Bidders of the grounds for the Owner's action.

**26.0 AWARD OF CONTRACT:-**

The Owner will award the Contract to the successful Bidder whose Bid has been determined to be the lowest - evaluated responsive Bid, provided further that the Bidder has been determined to be qualified to satisfactorily perform the Contract. Owner reserves the right to award order other bidders in the tender, provided it is required for progress of project & provided he agree to come to the lowest rate.

**27.0 THE OWNER'S RIGHT TO VARY QUANTITIES:-**

The Owner reserves the right to vary the quantity i.e. increase or decrease the quantities without any change in terms and conditions during the execution of the Order.

**28.0 LETTER OF INTENT/ NOTIFICATION OF AWARD:-**

The letter of intent / Notification of Award shall be issued to the successful Bidder whose bids have been considered responsive, techno-commercially acceptable and evaluated to be the Lowest (L1). The successful Bidder shall be required to furnish a letter of acceptance within 7 days of issue of the letter of intent / Notification of Award by Owner.

**29.0 CORRUPT OR FRAUDULENT PRACTICES:-**

- 29.01 The Owner requires that the Bidders observe the highest standard of ethics during the execution of the Project. In pursuance of this policy, the Owner:  
Defines, for the purposes of this provision, the terms set forth below as follows:

- i. "Corrupt practice" means behavior on the part of officials in the public or private sectors by which they improperly and unlawfully enrich themselves and/or those close to them, or induce others to do so, by misusing the position in which they are placed, and it includes the offering, giving, receiving, or soliciting of anything of value to influence the action of any such official in the contract execution; and
  - ii. "Fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Owner, and includes collusive practice among Bidders (prior to or after Bid submission) designed to establish Bid prices at artificial non-competitive levels and to deprive the Owner of the benefits of free and open competition.
    - (a) Will reject a proposal for award if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question;
    - (b) Will declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded an contract if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for, or in executing, an contract.
- 29.02 Furthermore, Bidders shall be aware of the provision stated in the General Conditions of Contract.

Dy. General Manager  
(Tech, Proj & MRT)  
Southco, Berhampur.

**Section – III**  
**GENERAL CONDITIONS OF CONTRACT**  
**(GCC)**  
**Tender Notification: Tech/ RL TAP 2013-14/08 /2014-15**

**GENERAL CONDITION OF CONTRACT (GCC):-**

**1.0 GENERAL: -**

Southco herein after referred to as the “**Owner**” is desirous of implementing the various works at its licensed area in the state of Odisha on Total Turnkey Basis under deposit head. The “**Owner**” has now floated this tender For Installation of additional 1x1.6MVA, 33/11KV power transformer and 33KV Bay extension along with associated works at 33/11KV Dangasarada S/S under Rayagada District RLTA Scheme 2013-14.

**2.0 SCOPE OF WORKS : -**

“For Installation of additional 1x1.6MVA, 33/11KV power transformer and 33KV Bay extension along with associated works at 33/11KV Dangasarada S/S under Rayagada District RLTA Scheme 2013-14.”

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

2.02 The detail work involves:

- A. Installation of additional 1x1.6MVA, 33/11KV power transformer = 1No
- B. 33KV Bay extension with 4-pole structure and installation of 33KV VCB.
- C. Installation of 11KV DP with AB switch & 11KV VCB.
- D. Construction of Plinth of Power transformer and 33KV & 11KV VCB.

**2.03** The detailed scope of the works shall include;

- i. Detailed survey of substation, line and preparation of SLD / BOQ to be done by the bidder.
- ii. Complete supply of materials from the approved vendor or from authorized dealers.
- iii. Packing and transportation from the manufacturer’s works to the site.
- iv. Receipt, storage, preservation and conservation of materials at the site.
- v. Reliability tests and performance and guarantee tests on completion of commissioning;
- vi. Erection of lines of specified voltage.
- vii. Testing, Commissioning of substations and lines / installations
- viii. Storing before erection.
- ix. Getting the substations & lines inspected by Electrical Inspector after completion of Works.

**3.0 DEFINITION OF TERMS**

(i) The ‘**Contract** ’means acceptance of the work order by the contractor or 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 Berhampur** 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) **‘Engineer in Charge / Project Manager’** shall mean the officer / officers appointed in writing by the Owner to act as Engineer from time to time for the purpose of the Contract.
- (v) **‘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.
- (vi) **‘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.
- (vii) **‘Inspector’** shall mean the Owner 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.
- (viii) **‘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.
- (ix) **‘Date of Contract’** shall mean the date on which work order has been issued.
- (x) **‘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.
- (xi) 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.
- (xii) **‘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.
- (xiii) Words imparting ‘Person’ shall include firms, companies, corporations and associations or bodies of individuals, whether incorporated or not.
- (xiv) 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.
- (xv) 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.**
  - c) **‘Contract Performance Guarantee’** shall also mean **‘Contract Performance Security’**.

#### **4.0 RECEIPT AND OPENING OF THE BID: -**

4.01 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.

4.02 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.

4.03 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.

4.04 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.

#### **5.0 EVALUATION OF BIDS & AWARD OF CONTRACT:-**

**5.01** 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.

**5.02** 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.

**5.03** 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.

**5.04** Prior to the detailed evaluation, Owner will determine the substantial responsiveness of each Bid to the Bidding Documents including 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.

**5.05** 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) Works Schedule

(b) Deviations from Bidding Documents

**5.06** 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 bidder is not ready and/or capable to undertake the entire works 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.

**5.07** 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.

**6.0 EARNEST MONEY DEPOSIT (EMD):-**

6.01 The Tender must be accompanied by Earnest Money Deposit in shape of Demand Draft in favour of **Southco, Berhampur** and payable at **Berhampur**, EMD shall be for **Rs. 35,192/-** Bids without Earnest Money deposit will be rejected out rightly.

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

6.03 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 sign the Contract, or

(ii) To furnish the required Contract Performance Bank Guarantee.

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

**7.0 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 upto 20% of the tender quantity without any change in price or other terms and conditions.

**8.0 INSPECTION AND TESTING:-**

A) All the major materials ( i.e, Power transformer and 33KV & 11KV VCB ) shall be inspected by the Owner / any authorized representative of the Owner or Jointly by the Owner / Owners authorized representative with the Third Party Inspection Evaluation Agency (TPIEA) (If any) as per relevant IS at the manufacturer site. The contractor shall provide unhindered clearance, giving full rights to the Owner/ Engineer in-charge to inspect, examine and test the materials. 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 Owner advance notice in writing of the date and place at least 15days before the schedule date on which the materials will be ready for testing.

B) Engineer-in-charge shall be entitled at all reasonable times during erection / installation to inspect examine and test the materials at the contractor's premises / erection site about quality &

Workmanship of the materials to be supplied under this contract. The Owner may also at its discretion get any of the materials tested in any approved laboratory at contractor's cost.

C) All the materials (except those mentioned at 8.0(A)) shall be inspected by the Owner/ Engineer in-charge as per relevant IS at the contractor's worksite. The contractor shall give the Owner advance notice in writing about the place at least 3 days before the schedule date on which the material will be ready for inspection

**9.0 COMPLETION AND COMPLETENESS OF THE EQUIPMENT:-**

9.01 Time being the essence of the contract; the works shall be completed within **90 days** from the date of issue of works order.

9.02 The works shall be treated as complete item wise when one item shall be complete in all respect 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.

9.03 All similar components and/or parts of similar equipment supplied shall be interchangeable with one another. Various equipments supplied under this contract shall be subject to Owner's approval.

9.04 Owner however reserves the right to re-schedule the completion period, if required.

**10.0 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 (Technical Specification), Owner shall reject such materials / services and ask the contractor in writing to replace / rectify the defects. The contractor on receipt of such notification shall either rectify or replace the defective materials and / or re-install the works already executed, free of cost to the Owner. If the contractor fails to do so, the Owner 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 materials which deviate from the Owners specification at reduced price considered acceptable under the circumstances.

D) Forfeit the Contract Performance Bank Guarantee.

**11.0 EXPERIENCE OF BIDDERS: -**

The bidders are required to furnish information regarding their experience on the following aspects.

i. Description of similar type of works executed during the last three years **with same or higher voltage level** with the name(s) of the party(s) to whom / where supplies / erection were made.

ii. Works orders details (P.O / W.O No. and date only) executed (construction works) during the last three years along with Electrical inspection report copies and copies of user's performance certificates. Bids may not be considered if the past performance is found to be un-satisfactory.

**12.0 DEVIATION FROM SPECIFICATION: -**

The bidders are requested to study the specification thoroughly before tendering so that if they make any deviations, the same are prominently brought on a separate sheet under the headings "Deviations". 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, not withstanding any deviations mentioned elsewhere in the Bid. However the acceptance of deviation is not binding on the Owner.

**13.0 CONTRACTOR TO INFORM HIMSELF FULLY: -**

The contractor shall examine the instructions, general conditions of the contract, specifications and the schedule of quantity and work completion 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.

**14.0 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.

**15.0 GUARANTEE PERIOD: -**

15.01 The Power Transformer and VCBs supplied by the contractor shall be guaranteed for **60 (Sixty)** Months from the date of Handing Over for satisfactory performance of the materials. In the event of any defect in the materials/equipments arising out of faulty design, inferior quality of raw material used or bad workmanship within the guarantee period, the contractor shall guarantee to replace/repair to the satisfaction of the owner the defective equipment free of cost. If the contractor fails to do so within a reasonable time, the owner reserves the right to recover the amount from the contractor either from the bills pending or may recover from the Performance Guarantee submitted by the contractor.

15.02 The bidder shall guarantee for the workmanship for a minimum period of **24 (Twenty four) months** from the date of completion of commissioning. The contractor shall guarantee to repair to the satisfaction of the Owner the defective parts at site free of cost within the above period. However, if the bidder fails to do so within a reasonable time, the Owner reserves the right to effect repair and recover such charges from the contractor.

15.03 If during the defect liability period any services performed found to be defective, these shall be promptly rectified by contractor on its own cost (including the cost of dismantling and reinstallation) on the instruction of Owner. The above guarantee certificate shall be furnished in triplicate to the Owner for his approval.

15.04 The materials (Except Power transformer & VCBs) to be supplied by the contractor shall be guaranteed for satisfactory operation against defects in design and workmanship for a period of **24 (Twenty four) months** from the date of handing over the completed installations. Any defect 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 Owner.

**16.0 PENALTY FOR DELAY IN COMPLETION OF CONTRACT: -**

16.01 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. **The Penalty / Liquidated damage as written above will be levied if any deviation to the schedule on any item of works due to the fault of the contractor is observed.**

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

16.03 Extension of completion of work period could be with / without levy of penalty with the discretion of Owner.

**17.0 RIGHT OF WAY:-**

Right of way issues, if any, arising during execution of the works shall be sorted out by the Contractor with the help of *District Administration and Concerned Executive Engineer*. Reasonable cost for settling ROW issues shall be borne by the Owner. But no such expenditure shall be incurred by the contractor without prior written approval from the Owner.

**18.0 CONTRACTOR'S DEFAULT:-**

18.01 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 connection with the works or contravenes the provisions or the contract, the Owner may give notice in writing to the Contractor to make good the failure, neglect or contravention complained of. Should the Contractor fail to comply with the notice within thirty (30) days from the date of serving the notice, the Owner 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 thinks fit, without prejudice to any other right, he may have under the Contract to take the works 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 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 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.

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

18.03 Such action by the Owner 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.

**19.0 TERMINATION OF CONTRACT ON OWNER'S INITIATIVE:-**

19.01 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.

19.02 The Contractor upon receipt of such notice shall discontinue the works 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 works terminated and terms satisfactory or the Owner, stop all further sub-contracting or purchasing activity related to the works terminated and assist Owner in maintenance, protection, and disposition of the works acquired under the Contract by the Owner. 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 works but to carry out the left over works through other agencies.**

19.03 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 in completed 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.

**20.0 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 in writing of the cause of delay. The **Owner** shall verify the facts and grant extension as facts justify.

**21.0 EXTENSION OF TIME: -**

If the delivery of the equipments / materials is delayed due to reasons beyond the control of the Contractor, the Contractor shall immediately **within 3 days** inform the Owner in writing of his claim for an extension of time. The Owner 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.

**22.0 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.

**23.0 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.

**24.0 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 Owner and is accepted by the authorized representative of the Owner in writing. Contractor shall also arrange adequate cover for his employees / laborers 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.

**25.0 ENGINEER IN CHARGE / PROJECT MANAGER:-**

The Owner shall appoint authorized engineer as Engineer in charge / Project manager for the Project.

**26.0 CONTRACT PERFORMANCE BANK GUARANTEE:-**

26.01 Within 15 days of issue of the Works Order or Letter of Award, whichever is earlier, the Contractor shall submit two separate Contract Performance Bank Guarantee issued by a scheduled Bank, in favour of the Owner, covering



- i. 10% of the total value of the contract (Excluding the cost of power transformer and VCB).
- ii. 10% of the total value of power transformer and VCBs.

**26.02** The said Bank Guarantee shall be prepared in the prescribed Performa as attached in Section V, Annexure -II. 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.

**26.03** The Contract Performance Bank Guarantee mentioned in clause **26.01 (i)** above 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. ( i.e, at least for a period of **30Months** from the date of issue of the work order) and contract performance bank guarantee mention in clause **26.01 (ii)** above shall remain valid for a period not less than 90days over and above the guarantee period of Power transformer & VCB (i.e, at least for a period of **66Months** from the date of issue of the work order) towards security and acceptance thereof, failing which the works orders (W.O) will be liable for cancellation without any further notice with forfeiture of E.M.D. However, if the due date of completion of the project is delayed, the BG shall extended, accordingly.

**26.04** No interest shall be allowed by the Owner on the above Performance Security Deposit submitted by the Bidder except in case of demand draft or cash deposit.

**27.0 TERMS OF PAYMENT:-**

27.01 80% (Eighty percent) of contract price on pro-rata basis along with taxes and duties shall be paid progressively for each completed items of works certified by the Engineer in charge / Project manager against each calendar month by 1st week of succeeding month along with utilization certificate. No payment shall be released if the accounts for utilization of materials follow with proper certification by the Engineers In Charge / Project manager on the basis of check points involved in such items of works.

27.02 Balance 20% (twenty percent) of contract price shall be paid after completion of all works, envisaged including any additions and alterations, testing & commissioning, return of dismantled materials, taking over certificate and entire stretch is fully ready for commercial operation.

**28.0 PAYING OFFICER:-**

**Owner** shall notify the paying officer for the project.

**29.0 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.

**30.0 DISPUTE RESOLUTION AND JURISDICTION:-**

(i) Any dispute arising out of this contract shall be referred to the Managing Director, SOUTHCO, Berhampur who shall decide the case, which shall be final.



(ii) 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.

**31.0 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.

**32.0 SUBMITTALS REQUIRED AFTER AWARD OF CONTRACT:-**

32.01 Within 15 days of the effective date of contract the contractor shall provide three copies of an outline program of inspection & erection.

32.02 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.

**33.0 APPROVAL PROCEDURE OF SUB VENDORS & DRAWINGS OF BOUGHT OUT MATERIALS OF ALL MAJOR MATERIALS**

33.01 The contractor shall submit all drawings, documents and test reports, QAP, Name of Sub vendor, samples (as applicable) etc, to the engineer in charge within 15 days of award of LOA 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.

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

33.03 If the drawings will be as per the technical specifications, the competent authority of the Owner. Will return the drawings & documents to the contractor marked with "Approved" stamp

**34.0 TAKING OVER:-**

34.01 Upon successful completion of all the tests to be performed at site on equipment / materials supplied, and erected and commissioned by the contractor, the supply engineer 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 unreasonably 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 failing which department 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.

34.02 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.

**35.0 EMBOSSING / PUNCHING / CASTING / PAINTING**

The all equipments and materials supplied / erected under the RLTA Program shall bear distinct mark of “**Name of the Owner, GoO, RLTA Program, PO Order No. & Date**” by a way of embossing / punching / casting / painting etc. This should be clearly visible to naked eye.

Dy, General Manager  
(Tech, Proj & MRT)  
Southco, Berhampur

**SECTION - IV**  
**GENERAL TECHNICAL SPECIFICATION**  
**(GTS)**

**Tender Notification-Tech/RLTAP2013-14/08/2014-15**

**1. GENERAL:-**

**1.1 Scope of works**

**i. Contractor's scope:**

**A. Supply**

All the materials are required to complete the work is supplied by the Contractor's.

**B. Construction:-**

The detail work involves:

- A. Installation of additional 1x1.6MVA, 33/11KV power transformer = 1No
- B. 33KV Bay extension with 4-pole structure and installation of 33KV VCB.
- C. Installation of 11KV DP with AB switch & 11KV VCB.
- D. Construction of Plinth of Power transformer and 33KV & 11KV VCB

Prior to the commencement of the supply / works all relevant drawings, designs must be got approved by the Owner / Engineer-in-charge.

**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 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 lines & substation.

**• Limit of contract:**

The scope of works shall also include all works 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 Owner 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 Owner shall also be at liberty to delete Any Items from the Contractor's scope at any time before commencement of works under the detailed scope of works.

**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.

Sl. No.	Description of Technical Parameter	Unit	Data	
			11 KV	33KV
1	Nominal system voltage	KVrms	11 KV	33KV
2	Maximum system voltage	KVrms	12.KV	36KV
3	Power frequency with stand voltage	KVrms	28KV	70KV
4	Lightning impulse withstand voltage a) Line to earth b) Across isolating gap	KVp	75KVp 85KVp	170KVp 195KVp
5	One minute power frequency withstand value Dry Wet	KVrms KVrms	35 35	95 75
6	System frequency	Hz	50	
7	Variation in frequency	%	2.5	
8	Continuous current rating (Out door equipment)	Amp	1250	1250
9	Symmetrical short circuit current	kA	25	
10	Duration of short circuit fault current	Sec	3	
11	Dynamic short circuit current rating	kAp	62.5kA	
12	Design ambient temperatures	°C	50	
13	Pollution level as per IEC-815 and 71		III	
14	Maximum fault clearing time	Ms	not exceeding 150 ms	
15	Safety clearances 1. Section clearance 2. Ground clearances( between ground and bottom most part of energized object) i. Along a street ii. Across a street 3. Horizontal clearance between the fence / building, structure and energized object	Meters Meters Meters	3 5.791 6.096 3.64	4 5.791 6.06

### 1.3.2 Layout arrangement

The Contractor shall finalize the layout arrangements for new HT/ LT OH lines & 11/0.4KV substations in line with this Specification with the approval of the Engineer- In-charge which shall be meeting at least the basic minimum electrical clearances as specified in the schedules.

#### a) Location and site description

The details of the line & sub-substation locations, their approach, geography and topography etc are to be collected from the concerned Executive Engineer of Southco to the extent possible. The Bidder shall make necessary visit to the site of line & substation and fully appraise himself before bidding. Deviations on account of inadequate data for line & substation works shall not be acceptable and the Bid may not be considered for evaluation in such cases.

#### b) 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 visit roots and fully satisfy himself regarding site conditions in all respects, and shall be fully responsible for the complete design and engineering of the line & substations.

**1.4 GUARANTEES TECHNICAL PARTICULARS:-**

*The Contractor shall comply with the guaranteed technical particulars specified in the respective BIS/IEC/REC. The contractor has to submit the GTP of the materials with all relevant drawings & test report. The contractor has to get the GTP & drawings approved from the owner prior to starting of the work .The contractor has to get the vendors approved from the owner from whom the materials are to be procured.*

The successful Contractor shall the supply the equipment from manufacturers complying with the stipulated requirements under SOUTHCO's approval .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 materials & equipments 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 specifications (TS) quantities of various items as specified in the bid proposal sheet shall be considered for quoting. However the works shall be executed as specified in the technical specification. Only brief description is given in the BPS & the works shall be executed in line with the requirement given in the TS.

**1.6 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 of materials or other tools, lighting and testing purposes. All such installations shall comply with all appropriate statutory regulations.

**1.7 SUPERVISION AND CHECKING OF WORKS ON SITE:-**

All works on site included in the contractor's scope of works shall be supervised by sufficient number of qualified representatives of the Contractor. The Contractor shall give in writing to the Engineer In charge the period of notice as specified in the General Conditions of Contract, when the plant or apparatus is ready for inspection or energisation.

**1.8 RESPONSIBILITY FOR THE WORK COMPLETION 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, under construction, or in use for the Owner's service.

**1.9 COMPLIANCE WITH REGULATIONS:-**

All apparatus and material supplied, and all works 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 Owner as are applicable to the Contract Works and with any other applicable regulations to which the Owner is subjected to oblige.

**1.10 MAINTENANCE AND CLEARING OF SITE:-**

The placing of materials 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 and erection area of the Contract Works reasonably clean and shall remove all waste material as it accumulates and as directed by the Engineer In-charge from time to time.

**1.11 WORKS AND SAFETY REGULATIONS:-**

The Contractor shall ensure safety of all the workmen, material, 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 Engineers-In charge.

**1.12 INSURANCE:-**

**1.12.1 General**

In addition to the conditions covered in the General Conditions of Contract, the following provisions will also apply to the works to be done by the contractor

**1.12.2 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 and 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 sub-contractors or from riots, strikes and civil commotion. The hazards to be covered will pertain to all works and

areas where the Contractor, its sub-contractors, agents and employees have to perform works pursuant to the Contracts.

**1.1 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 Engineer In-charge.

**1.2 QUALITY ASSURANCE:-**

**1.2.1 General**

To ensure that the supply and services under the scope of this Contract, whether manufactured or performed within the Contractor's works or at Site or at any other place of works are in accordance with the Specification, with the Regulations and with relevant Indian or otherwise Authorized Standards the Contractor shall adopt suitable Quality Assurance Programmes and Procedures to ensure that all activities are being controlled as necessary. The quality assurance arrangements shall conform to the relevant requirements of ISO 9001 or ISO 9002 as appropriate.

**1.2.2 Non-conforming product**

The Contractor shall retain responsibility for the disposition of non-conforming items.

**1.3 STANDARDS:-**

1. 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.

- (a) Unless otherwise specified, all materials covered under this specification shall be designed, manufactured, tested and installed in conformity with the latest Indian Standard.



- (b) Specifications. In case such Indian Standard Specifications are not published equivalent British Standard Specifications shall be followed. All equipments shall conform to latest Indian Electricity Rules, CEA Regulations, PWD and Local/State laws or byelaws as regards to safety, earthing and other essential provisions specified therein.
- (c) All the materials supplied by the contractor according to the contract conditions will be subject to inspection and approval by the Owner / Engineer-in-charge or their authorized representative from time to time. The contractor shall extend all required facilities for such inspection free of cost. At the time of inspection, the inspecting officer shall have full liberty to reject any such material, which does not confirm to specifications or the requirements. The Owner shall not entertain any claim for the rejected materials. The contractor shall remove all rejected materials from the site at his own cost.
- (d) The Owner shall not accept any surplus material procured by the contractor.
- (e) The contractor will be responsible to get electrical installations inspected by the Electrical Inspector of the State Government and to obtain the statutory clearance for energisation. The concerned Executive Engineer of Southco will deposit the necessary inspection fees.
- (f) The contractor should possess valid electrical contract license and labour license issued by the appropriate statutory authority of the State Government during the execution of the contract.
- (g) The contractor shall be registered with Provident Fund Department for engagement of Labours / Employees.

#### **1.4 SUBMITTALS:-**

##### **1.4.1 Submittals required with the bid**

The following shall be required in duplicate:

- completed technical data schedule;
- Descriptive literature giving full technical details of goods offered;
- Test certificates, where available, and sample routine test reports;
- Details of manufacturer's quality assurance standards and programme and ISO 9000 series or equivalent national certification where available.
- Deviations from this specification. Only deviations approved in writing before award of contract shall be accepted;

##### **1.5 Survey & scope of works:**

1.5.1 Survey shall be carried out by the contractor for the new line.

1.5.2 Aligning / erection of poles in the route of line along with strengthening of its foundation is in the scope of bidder.

1.5.3 Before undertaking the construction works in the given line the bidder shall make assessment of quantity of the required materials in consultation with Engineer in charge.

Accordingly, the BOQ of the works may be prepared and get it approved from Engineer In charge.

1.5.4 Any other works not mentioned above exclusively but required for accomplishing desired works will be in the scope of the bidder.

1.5.5 For all above activities shutdown shall be arranged by the subject to advanced notice in writing by the contractor.

1.5.6 While placing the equipment, if any equipment gets damaged due to negligent handling of the contractor, the same shall be back charged to the contractor at penal rate.

**2.0 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:

a) 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 bidder shall select the height of the poles in order to achieve the prescribed electrical clearances.

**3.0 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.

b) **Earthing of Poles**

In 11 kV line, each poles shall be earthed with coil earthing as per REC construction standard J-1.

**4.0 Danger Boards**

The vendor shall provide & install danger plates on 11 KV DP structures. The danger plates shall conform to REC specification No. 57/1993

**5.0 Anti-climbing Devices**

The vendor shall provide and install anti-climbing device on 11 KV DP structures. This shall be done with G.I. Barbed wire. The barbed wire shall conform to IS-278 (Grade A1).The barbed wires shall be given chromating dip as per procedure laid down in IS: 1340.

## **A) TECHNICAL SPECIFICATION FOR 33/11KV 1.6 MVA ON/AN POWER TRANSFORMERS**

### **1. SCOPE**

1.1 This Specification provides for design, engineering, manufacturing, assembly, stage inspection, final inspection and testing before dispatch, packing and delivery at destination sub-station by road transport, transit insurance, unloading at site/stores of **1.6MVA, 33/11 KV Power Transformer(s)**, complete with all fittings, accessories, associated equipments/spares, 10% extra Transformer Oil, required for its satisfactory operation in any of the sub-stations of the owner.

1.2 The core shall be constructed from either from high grade, non-aging Cold Rolled Grain Oriented (CRGO) silicon steel laminations confirming to grade M4 or better like M3 or HIB or laser grade (Quoted grade and type shall be used).The maximum flux density in

any part of the cores and yoke at normal voltage and frequency shall not be more than **1.6Tesla**.The bidder shall provide saturation curve of the core material, proposed to be used. Laminations of different grade(s) and different thickness(s) are not allowed to be used in any manner or under any circumstances.

1.3 The scope of supply includes the provision of type test. The owner reserves the right to waive type tests as indicated in the section on Quality Assurance, Inspection and Testing in this specification.

1.4 1) The Power Transformer 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 owner shall have the power to reject any work or material, which in his judgment, is not in full accordance therewith. The Transformer(s) offered, shall be complete with all components, necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of supply, irrespective of whether those are specifically brought out in this specification and / or the commercial order or not.

The owner reserves the right to reject the transformers if on testing the losses exceed the declared losses beyond tolerance limit as per IS or the temperature rise in oil and / or winding exceeds the value, specified in technical particular or impedance value differ from the guaranteed value including tolerance as per this specification and if any of the test results do not match with the values, given in the guaranteed technical particulars and as per technical specification. The Owner reserves the right to retain the rejected Transformer and take into service until the supplier replaces it at no extra cost to the owner by a new transformer

Alternately, the supplier shall repair or replace the Transformer within a reasonable period as decided by the owner to owner’s satisfaction at no extra cost to the owner.

<b>2</b>	<b>SPECIFIC TECHNICAL REQUIREMENTS</b>		
1	<b>Rated MVA (ON/AN rating)</b>		<b>1.6 MVA</b>
2	No. of phases		3
3	Type of installation		Outdoor
4	Frequency		50 Hz (± 5% )
5	Cooling medium		Insulating Oil (ONAN)
6	Type of mounting		On Wheels, Mounted on rails.
7	Rated voltage		
	a)	High voltage winding	33KV
	b)	Low voltage winding	11KV
8	Highest continuous system voltage		
	a)	Maximum system voltage ratio (HV / LV )	36KV / 12 KV
	b)	Rated voltage ratio (HV / LV )	33KV /11 KV
9	No. of windings		Two winding Transformers
10	Type of cooling		ON/AN ( Oil natural / Air natural )
11	MVA Rating corresponding to ONAN cooling system		100%
12	Method of connection:		



	b)	LV winding		12 KV porcelain type of bushing (Antifog type)
29		Insulation level of bushing		<u>HV</u> <u>LV</u>
	a)	Lightning Impulse withstand (KVP)		170                      75
	b)	1 Minute Power Frequency withstand voltage (KV –rms )		70                      28
	c)	Creepage distance (mm) (minimum)		900                      500
30		Material of HV & LV Conductor		Electrolytic Copper
31		Maximum current density for HV and LV winding for rated current		2.4 A/ mm <sup>2</sup>
32		Polarisation index i.e ratio of megger values at 600 sec. to 60 sec for HV to earth, L.V to earth and HV to LV.		Shall be greater than or equal to 1.5, but less than or equal to '5'.
33		<b>Core Assembly</b>		<b>Boltless type</b>
34		Temperature Indicator		
	a)	Oil		One number
	b)	Winding		One number
35		Permissible no load loss at rated voltage and rated frequency (Max.) 1.6MVA 3.15MVA		2.5KW 3.0 KW
36		Permissible load loss at rated current and at 75 <sup>0</sup> C (Max) 1.6MVA 3.15MVA		13.0 KW 17.0KW

**2.1 MARSHALLING BOX**

A metal enclosed, weather, vermin and dust proof marshalling box fitted with required glands, locks, glass door, terminal Board, heater with switch, illumination lamp with switch etc. shall be provided with each transformer to accommodate temperature indicators, terminal blocks etc. It shall have degree of protection of IP 55 or better as per IS: 2147 (Refer Clause 3.12).

**2.2 PERFORMANCE**

- i) Transformer shall be capable of withstanding for TWO seconds without damage to any external short circuit, with the short circuit MVA available at the terminals.
- ii) The maximum flux density in any part of the core and yoke at rated MVA, rated Voltage and system frequency of 50 Hz shall be 1.6 Tesla (maximum).
- iii) Transformer shall under exceptional circumstances due to sudden disconnection of the load, be capable of operating at the voltage approximately 25% above normal rated voltage for a period of not exceeding one minute and 40% above normal for a period of 5 seconds.
- iv) The transformer may be operated continuously without danger on any particular tapping at the rated MVA ± 12.5% of the voltage corresponding to the tapping.
- v) The thermal ability to withstand short circuit shall be demonstrated by calculation.
- vi) Transformer shall be capable of withstanding thermal and mechanical stress caused by any symmetrical and asymmetrical faults on any winding.

**2.3 DRAWINGS/ DOCUMENTS INCORPORATING THE FOLLOWING PARTICULARS SHALL BE SUBMITTED WITH THE BID**

- a) General outline drawing showing shipping dimensions and overall dimensions, net weights and shipping weights, quality of insulating oil, spacing of wheels in either direction of motion, location of coolers, marshalling box and tap changers etc.
- b) Assembly drawings of core, windings etc. and weights of main components / parts.
- c) Height of center line on HV and LV connectors of transformers from the rail top level.
- d) Dimensions of the largest part to be transported.
- e) GA drawings / details of various types of bushing
- f) Tap changing and Name Plate diagram
- g) Type test certificates of similar transformers.
- h) Illustrative & descriptive literature of the Transformer.
- i) Maintenance and Operating Instructions.

**2.4 MISCELLANEOUS**

- i) Padlocks along with duplicate keys as asked for various valves, marshalling box etc. shall be supplied by the contractor, wherever locking arrangement is provided.
- ii) Foundation bolts for wheel locking devices of Transformer shall be supplied by the Contractor.

**2.5 DELIVERY**

The full quantity of the equipments shall be delivered as per the delivery schedule appended to this specification.

**2.6 SCHEDULES**

All Schedules annexed to the specification shall be duly filled by the bidder separately.

**2.7 ALTITUDE FACTOR**

If the equipment is to be installed in the hilly area, necessary correction factors as given in the Indian Standard for oil temperature rise, insulation level etc. shall be applied to the Standard Technical Parameters given above.

**2.8 NAME PLATE**

Transformer rating plate shall contain the information as given in clause 15 of IS-2026 (part-I). The details on rating plate shall be finalized during the detailed engineering. Further, each transformer shall have inscription of owner's name. The name plate shall also include (i) The short circuit rating, (ii) Measured no load current and no load losses at rated voltage and rated frequency, (iii) measured load losses at 75<sup>0</sup> C ( normal tap only ), (iv) D.C resistance of each winding at 75<sup>0</sup> C.

**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 5° C

◆	maximum temperature attainable by an object exposed to the sun	60 ° C
◆	maximum yearly weighted average ambient temperature	32° C
◆	maximum relative humidity	100%
◆	average number of thunderstorm days per annum (isokeraunic level)	70
◆	average number of rainy days per annum	120
◆	average annual rainfall	1500 mm
◆	maximum wind pressure	260Kg / m <sup>2</sup>

Environmentally, the region where the equipment will be installed 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, tropical and humid coastal atmosphere.

#### 4 **SYSTEM CONDITIONS**

The equipment shall be suitable for installation in supply systems of the following characteristics.

◆	Frequency		50 Hz± 5%
◆	Nominal system voltages		33 KV 11 KV
◆	Maximum system voltages	33KV System 11 KV System	36 KV 12 KV
◆	Nominal short circuit level ( Basing on apparent power )	33 KV System 11 KV System	1.1 KA 3.3KA
◆	Insulation levels : 1.2/50 μ sec impulse withstand voltage	33 KV System 11 KV System	170 KV(peak) 75 KV (peak)
◆	Power frequency one minute withstand (wet and dry) voltage	33 KV System 11 KV System	70 KV(rms) 28 KV (rms)
◆	Neutral earthing arrangements :	11 KV System	Solidly earthed

#### 5 **CODES & STANDARDS**

5.1 The design, material, fabrication, manufacture, inspection, testing before dispatch and performance of power transformers at site shall comply with all currently applicable statutory regulations and safety codes in the locality where the equipment will be installed. The equipment shall also conform to the latest applicable standards and codes of practice. Nothing in this specification shall be construed to relieve the contractor of this responsibility.

5.2 The equipment and materials covered by this specification shall conform to the latest applicable provision of the following standards.

IS:5	:	Colour for ready mixed paints
IS:325	:	Three Phase Induction Motors
IS:335	:	New insulating oil for transformers, switch gears
IS:1271	:	Classification of insulating materials for electrical machinery and apparatus in relation to their stability in services
IS:2026(Part I to IV)	:	Power Transformer
IS:2071	:	Method of high voltage testing
IS:2099	:	High voltage porcelain bushings
IS:2147	:	Degree of protection
IS:2705	:	Current Transformers
IS:3202	:	Code of practice for climate proofing of electrical equipment
IS:3347	:	Dimensions for porcelain Transformer Bushings
IS:3637	:	Gas operated relays
IS:3639	:	Fittings and accessories for power Transformers
IS:5561	:	Electric Power Connectors
IS:6600/BS:CP' 10:0	:	Guide for loading of oil immersed Transformers
IS:10028	:	Code of practice for selection, installation and maintenance of transformers, Part I. II and III
C.B.I.P. Publication	:	Manual on Transformers

If the standard is not quoted for any item, it shall be presumed that the latest version of Indian Standard shall be applicable to that item.

The equipment complying other internationally accepted standards, may also be considered if they ensure performance superior to the Indian Standards.

### 5.3 **DRAWINGS**

- a) The contractor shall furnish, within fifteen days after issuing of Letter of Award. Six copies each of the following drawings/documents incorporating the transformer rating for approval.
  - i) Detailed overall general arrangement drawing showing front and side elevations and plan of the transformer and all accessories including radiators and external features with details of dimensions, spacing of wheels in either direction of motion, net weights and shipping weights, crane lift for un-tanking, size of lugs and eyes, bushing lifting dimensions, clearances between HV and L.V terminals and ground, quantity of insulating oil etc.
  - ii) Assembly drawings of core and winging and weights of main components / parts
  - iii) Foundation plan showing loading on each wheel land jacking points with respect to centre line of transformer.
  - iv) GA drawings details of bushing and terminal connectors.
  - v) Name plate drawing with terminal marking and connection diagrams.
  - vi) Wheel locking arrangement drawing.
  - vii) Transportation dimensions drawings.



- Viii) Magnetization characteristic curves of PS class neutral and phase side current transformers, if applicable.
  - ix) Interconnection diagrams.
  - x) Over fluxing withstand time characteristic of transformer.
  - xi) GA drawing of marshalling box.
  - xii) Control scheme/wiring diagram of marshalling box.
  - xiii) Technical leaflets of major components and fittings.
  - xiiiv) As built drawings of schematics, wiring diagram etc.
  - xv) Setting of oil temperature indicator, winding temperature indicator.
  - xvi) Completed technical data sheets.
  - xvii) Details including write-up of tap changing gear.
  - xviii) HV conductor bushing.
  - xix) Bushing Assembly.
  - xx) Bi-metallic connector suitable for connection to 100 mm<sup>2</sup> up to 232 mm<sup>2</sup> AAAC Conductor.
  - xxi) GA of LV cable Box.
  - xxii) Radiator type assembly.
- b) All drawings, documents, technical data sheets and test certificates, results calculations shall be furnished.

5.4 Any approval given to the detailed drawings by the owner shall not relieve the contractor of the responsibility for correctness of the drawing and in the manufacture of the equipment. The approval given by the owner shall be general with overall responsibility with contractor.

## **6. GENERAL CONSTRUCTIONAL FEATURES**

- 6.1 All material used shall be of best quality and of the class most suitable for working under the conditions specified and shall withstand the variations of temperature and atmospheric conditions without distortion or deterioration or the setting up of undue stresses which may impair suitability of the various parts for the work which they have to perform.
- 6.2 Similar parts particularly removable ones shall be interchangeable.
- 6.3 Pipes and pipe fittings, screws, studs, nuts and bolts used for external connections shall be as per the relevant standards. Steel bolts and nuts exposed to atmosphere shall be galvanized.
- 6.4 Nuts, bolts and pins used inside the transformers and tap changer compartments shall be provided with lock washer or locknuts.
- 6.5 Exposed parts shall not have pockets where water can collect.
- 6.6 Internal design of transformer shall ensure that air is not trapped in any location.
- 6.7 Material in contact with oil shall be such as not to contribute to the formation of acid in oil. Surface in contact with oil shall not be galvanized or cadmium plated.
- 6.8 Labels, indelibly marked, shall be provided for all identifiable accessories like Relays, switches current transformers etc. All label plates shall be of in corrodible material.

- 6.9 All internal connections and fastenings shall be capable of operating under overloads and over-excitation, allowed as per specified stands without injury.
- 6.10 Transformer and accessories shall be designed to facilitate proper operation, inspection, maintenance and repairs.
- 6.11 No patching, plugging, shimming or other such means of overcoming defects, discrepancies or errors will be accepted.
- 6.12 Schematic Drawing of the wiring, including external cables shall be put under the prospane sheet on the inside door of the transformer marshalling box.
- 6.13 **Painting**
- 6.13.1 All paints shall be applied in accordance with the paint manufacturer's recommendations. Particular attention shall be paid to the following:
- a) Proper storage to avoid exposure as well as extremes of temperature.
  - b) Surface preparation prior to painting.
  - c) Mixing and thinning
  - d) Application of paints and the recommended limit on time intervals between coats.
  - e) Shelf life for storage.
- 6.13.1.1 All paints, when applied in normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects.
- 6.13.1.2 All primers shall be well marked into the surface, particularly in areas where painting is evident, and the first priming coat shall be applied as soon as possible after cleaning. The paint shall be applied by airless spray according to the manufacturer's recommendations. However, wherever airless spray is not possible, conventional spray be used with prior approval of owner.
- 6.13.1.3 The supplier shall, prior to painting protect nameplates, lettering gauges, sight glasses, light fittings and similar such items.
- 6.13.2 **Cleaning and Surface Preparation**
- 6.13.2.1 After all machining, forming and welding has been completed, all steel work surfaces shall be thoroughly cleaned of rust, scale, welding slag or spatter and other contamination prior to any painting.
- 6.13.2.2 Steel surfaces shall be prepared by Sand/Shot blast cleaning or Chemical cleaning by Seven tank process including Phosphating to the appropriate quality.
- 6.13.2.3 The pressure and Volume of the compressed air supply for the blast cleaning shall meet the work requirements and shall be sufficiently free from all water contamination prior to any painting.
- 6.13.2.4 Chipping, scraping and steel wire brushing using manual or power driven tools cannot remove firmly adherent mill-scale and shall only be used where blast cleaning is impractical.
- 6.13.3 **Protective Coating**
- As soon as all items have been cleaned and within four hours of the subsequent drying, they shall be given suitable anticorrosion protection.
- 6.13.4 **Paint Material**

Followings are the type of paints that may be suitably used for the items to be painted at shop and supply of matching paint to site:

- i) Heat resistant paint (Hot oil proof) for inside surface.
- ii) For external surfaces one coat of Thermo Setting Paint or 2 coats of Zinc chromate followed by 2 coats of **Polyurethane paint**. The color of the finishing coats shall be dark admiral grey conforming to No.632 or IS 5:1961.

**6.13.5 Painting Procedure**

6.13.5.1 All painting shall be carried out in conformity with both specifications and with the paint manufacture's recommendations. All paints in any one particular system. Whether shop or site applied, shall originate from one paint manufacturer.

6.13.5.2 Particular attention shall be paid to the manufacturer's instructions on storage, mixing, thinning and pot life. The paint shall only be applied in the manner detailed by the manufacturer e.g. brush, roller, conventional or airless spray and shall be applied under the manufacturer's recommended conditions. Minimum and maximum time intervals between coats shall be closely followed.

6.13.5.3 All prepared steel surfaces should be primed before visible re-rusting occurs or within 4 hours whichever is sooner. Chemical treated steel surfaces shall be primed as soon as the surface is dry and while the surface is warm.

6.13.5.4 Where the quality of film is impaired by excess film thickness,(wrinkling, mud cracking or general softness) the supplier shall remove the unsatisfactory paint coatings and apply another. As a general rule, dry film thickness should not exceed the specified minimum dry film thickness by more than 25% . In all instances, where two or more coats of the same paints are specified, such coatings may or may not be of contrasting colors.

6.13.5.5 Paint applied to items that are not be painted, shall be removed at supplier's expense, leaving the surface clean, un-stained and undamaged.

**6.13.6 Damages to Paints Work**

6.13.6.1 Any damage occurring to any part of the painting scheme shall be made good to the same standard of corrosion protection and appearance as that originally employed.

6.13.6.2 Any damaged paint work shall be made as follows:

a) The damaged area, together with an area extending 25mm around its boundary, shall be cleaned down to bare metal.

b) A priming coat shall immediately applied, followed by a full paint finish equal to that originally applied and extending 50mm around the perimeter of the originally damaged.

6.13.6.3 The repainted surface shall present a smooth surface. This shall be obtained by carefully chamfering the paint edges before & after priming.

**6.13.7 Dry Film Thickness**

6.13.7.1 To the maximum extent practicable, the coats shall be applied as a continuous film of uniform thickness and free of pores. Over-spray, skips, runs, sags and drips should be avoided. The different coats may or may not be same color.

6.13.7.2 Each coat of paint shall allowed to hardened before the next is applied as per manufacture's recommendations.

6.13.7.3 Particular attention must be paid to full film thickness at edges.

6.13.7.4 The requirement for the dry film thickness (DFT) of paint and the material to be used shall be as given below:

Sl. No	Paint Type	Area to be painted	No of Coats	Total Dry film thickness(Min)
1.	Liquid paint			
	a) Zinc Chromate(Primer)	Out side	02	45 micron
	b) Poly Urethene (P.U.) Paint (Finish Coat)	Out side inside	02 01	35 micron 35 micron
	c) Hot Oil paint			

## 7.0 DETAILED DESCRIPTION

### 7.1 Tank

7.1.1 The Transformer tank and cover shall be fabricated from high grade low carbon plate steel of tested quality. The tank and the cover shall be of welded construction.

7.1.2 Tank shall be designed to permit lifting by crane or jacks of the complete transformer assembly filled with oil. Suitable lugs and bossed shall be provided for this purpose.

7.1.3 All beams, flanges, lifting lugs, braces and permanent parts attached to the tank shall be welded and where practicable, they shall be double welded.

7.1.4 The main tank body of the transformer, excluding tap changing compartments and radiators, shall be capable of withstanding pressure of 760mm of Hg.

7.1.5 Inspection hole(s) with welded flange(s) and bolted cover(s) shall be provided on the tank cover. The inspection hole(s) shall be of sufficient size to afford easy access to the lower ends of the bushings, terminals etc.

7.1.6 Gaskets of Nitrile Rubber or equivalent shall be used to ensure perfect oil tightness. All gaskets shall be closed design (without open ends) and shall be of one Piece only. Rubber gaskets used for flange type connection of the various oil compartments shall be laid in grooves or in groove equivalent section on bolt sides of the gaskets, throughout their total length. Care shall be taken to ensure uniformly distributed mechanical strength.

Over the gasket and retains throughout the total length. Gasket of Neopropene and / or any kind of impregnated / bonded core or cork only which can easily be damaged by over passing are not acceptable. Use of hemp as gasket material is also not acceptable.

7.1.7 Suitable guides shall be provided for positioning the various parts during assemble or dismantling. Adequate space shall be provided between the cores and windings and the bottom of the tank for collection of any sediment.

### 7.2 Tank Cover

The transformer top shall be provided with a detachable tank cover with bolted flanged gasket joint. Lifting lugs shall be provided for removing the cover. The surface of the cover shall be suitable sloped from HV to LV side so that it does not retain rain water.

### 7.3 UNDER CARRIAGE

7.3.1 The transformer tank shall be supported on steel structure with detachable plain rollers. Suitable channels for movement of rollers with transformer shall be provided. It shall be possible to swivel the wheels in two directions, at right angle or parallel to the main axis of the transformer by manually changing the axis & rollers.

7.4 **CORE**

- 7.4.1 Stage level inspection for core construction shall be carried out by the owner.
- 7.4.2 Each lamination shall be insulated such that it will not deteriorate due to mechanical pressure and the action of hot transformer oil.

7.4.3 The core shall be constructed from either from high grade, non-aging Cold Rolled Grain Oriented (CRGO) silicon steel laminations confirming to grade M4 or better like M3 or HIB or laser grade (Quoted grade and type shall be used).The maximum flux density in any part of the cores and yoke at normal voltage and frequency shall not be more than **1.6Tesla**. The bidder shall provide saturation curve of the core material, proposed to be used. Laminations of different grade(s) and different thickness(s) are not allowed to be used in any manner or under any circumstances.

7.4.4(A) The bidder should offer the core for inspection **starting from the destination port to enable OWNER for deputing inspecting officers for detail verification as given below** and approval by the owner during the manufacturing stage. Bidder's call notice for the purpose should be accompanied with the following documents as applicable as a proof towards use of prime core material:

**The core coils, if found suitable, are to be sealed with proper seals which shall be opened in presence of the inspecting officers during core-cutting at the manufacturer's or its sub-vendor's premises as per approved design drawing.**

- a) Purchase Order No. & Date.
- b) Invoice of the supplier
- c) Mills test certificate
- d) Packing list
- e) Bill of lading
- f) Bill of entry certificate to customs

Core material shall be directly procured either from the manufacturer or through their accredited marketing organization of repute, but not through any agent.

7.4.4(B) For Transformer Manufacturer™, who has in-house core cutting facility, the packed core coils shall be verified at their works as per followings along with witnessing of core-cutting.

- Purchase Order No. & Date ;
- No. of packed coils with Package nos.
- Gross weight:
- Net weight:
- Port of loading
- Port of Discharge
- Name of the ocean vessel:
- Grade & Thickness of Core Material:
- Any other information as mentioned on the body of packed coils.

7.4.4(C) For those bidders, who have no in-house core cutting facility, they should mention the names of at least three sub-vendors to whom they intend to assign their core cutting. Such sub-vendors should have been approved by other Electricity Board/ Electrical Utilities and accredited by some internationally recognized certification body like ISO-9000 etc. to ensure that a minimum quality parameters & tolerance are maintained. The experience, the details of core cutting facilities finishing & testing facilities etc. as available which such sub-vendors should be clearly out-lined in the bid

7.4.4(D) On award of Contract the TM is to assign the core-cutting to such sub-vendors for which approval is to be given by the Owner.

- 7.4.5 The laminations shall be free of all burrs and sharp projections. Each sheet shall have an insulating coating resistant to the action of hot oil.
- 7.4.6 The insulation structure for the core to bolts and core to clamp plates shall be such as to withstand **2000 V DC voltage for one minute.**
- 7.4.7 The completed core and coil shall be so assembled that the axis and the plane of the outer surface of the core assemble shall not deviate from the vertical plane by more than **25mm.**
- 7.4.8 All steel sections used for supporting the core shall be thoroughly shot or sand blasted, after cutting, drilling and welding.
- 7.4.9 The finally assembled core with all the clamping structures shall be free from deformation and shall not vibrate during operation.
- 7.4.10 The core clamping structure shall be designed to minimize eddy current loss.
- 7.4.11 The framework and clamping arrangements shall be securely earthed.
- 7.4.12 The core shall be carefully assembled and rigidly clamped to ensure adequate mechanical strength.
- 7.4.13 Oil ducts shall be provided, where necessary, to ensure adequate cooling inside the core. The welding structure and major insulation shall not obstruct the free flow of oil through such ducts.
- 7.4.14 The design of magnetic circuit shall be such as to avoid static discharges, development of short circuit paths within itself or to the earth clamping structure and production of flux component at right angle to the plane of the lamination, which may cause local heating. The supporting framework of the cores shall be so designed as to avoid the presence of pockets, which would prevent complete emptying of the tank through the drain valve or cause trapping of air during filling.
- 7.4.15 The construction is to be of boltless core type. The core shall be provided with lugs suitable for lifting the complete core and coil assembly. The core and coil assemble shall be so fixed in the tank that shifting will not occur during transport or short circuits.
- 7.4.16 **The temperature gradient between core & surrounding shall be maintained less than 20deg C. The manufacturer shall demonstrate this either through test (to be mutually agreed) or by calculation.**
- 7.5 **INTERNAL EARTHING**
- 7.5.1 All internal metal parts of the transformer, with the exception of individual laminations and their individual clamping plates shall be earthed.
- 7.5.2 The top clamping structure shall be connected to the tank by a copper strap. The bottom clamping structure shall be earthed by one or more the following methods:
- a) By connection through vertical tie-rods to the top structure.
  - b) By direct metal to metal contact with the tank base.
  - c) By a connection to the structure on the same side of the core as the main earth connection to the tank.
- 7.5.3 The magnetic circuit shall be connected to the clamping structure at one point only and this shall be brought out of the top cover of the transformer tank through a suitably rated insulator. A disconnecting link shall be provided on transformer tank to facilitate disconnections from ground for IR measurement purpose.

- 7.5.4 Coil clamping rings of metal at earth potential shall be connected to the adjacent core clamping structure on the same side as the main earth connections.
- 7.6 **WINDING**
- 7.6.1 Winding shall be subjected to a shrinking and seasoning process, so that no further shrinkage occurs during service. Adjustable devices shall be provided for taking up possible shrinkage in service.
- 7.6.2 All low voltage windings for use in the circular coil concentric winding shall be wound on a performed insulating cylinder for mechanical protection of the winding in handling and placing around the core.
- 7.6.3 Winding shall not contain sharp bends which might damage the insulation or produce high dielectric stresses. No strip conductor wound on edge shall have width exceeding six times the thickness.
- 7.6.4 Materials used in the insulation and assembly of the windings shall be insoluble, non catalytic and chemically inactive in the hot transformer oil and shall not soften or the otherwise affected under the operating conditions.
- 7.6.5 Varnish application on coil windings may be given only for mechanical protection and not for improvement in dielectric properties. In no case varnish or other adhesive be used which will seal the coil and prevent evacuation of air and moisture and impregnation by oil.
- 7.6.6 Winding and connections shall be braced to withstand shocks during transport or short circuit.
- 7.6.7 Permanent current carrying joints in the windings and leads shall be welded or brazed. Clamping bolts for current carrying parts inside oil shall be made of oil resistant material which shall not be affected by acidity in the oil steel bolts, if used, shall be suitably treated.
- 7.6.8 Terminals of all windings shall be brought out of the tank through bushings for external connections.
- 7.6.8.1 The completed core and coil assemble shall be dried in vacuum at not more than 0.5mm of mercury absolute pressure and shall be immediately impregnated with oil after the drying process to ensure the elimination of air and moisture within the insulation. Vacuum may be applied in either vacuum over or in the transformer tank.
- 7.6.8.2 The winding shall be so designed that all coil assemblies of identical voltage ratings shall be interchangeable and field repairs to the winding can be made readily without special equipment. The coils shall have high dielectric strength.
- 7.6.8.3 Coils shall be made of continuous smooth high grade electrolytic copper conductor, shaped and braced to provide for expansion and contraction due to temperature changes.
- 7.6.8.4 Adequate barriers shall be provided between coils and core and between high and low voltage coil. End turn shall have additional protection against abnormal line disturbances.
- 7.6.8.5 The insulation of winding shall be designed to withstand voltage stress arising from surge in transmission lines due to atmospheric or transient conditions caused by switching etc.
- 7.6.8.6 Tapping shall not be brought out from inside the coil or from intermediate turns and shall be so arranged as to preserve as far as possible magnetic balance of transformer at



all voltage ratios.

7.6.8.7 Magnitude of impulse surges transferred from HV to LV windings by electromagnetic induction and capacitance coupling shall be limited to BILL of LV winding.

7.6.8.8 The current density adopt for all winding shall not exceed **2.4 amp/sq. mm**. The total net cross section area of the strip conductor for calculating carrying density for each winding shall be obtained after deducting the copper area lost due to rounding up of the sharp edges at the rectangular conductor.

**7.7 INSULATING OIL**

7.7.1 The insulating oil for the transformer shall be of EHV grade, generally conforming to IS: 335. No inhibitors shall be used in the oil.

7.7.2 The quantity of oil required for the first filling of the transformer and its full specification shall be stated in the bid. **The bidder shall quote the price of transformer complete with all fittings, accessories and new transformer oil required for first filling plus 10% extra oil.** The extra quantity of oil shall be supplied in non-returnable drums along with the oil required for the radiator banks.

7.7.3 The design and materials used in the construction of the transformer shall be such as to reduce the risk of the development of acidity in the oil.

7.7.4 The contractor shall warrant that oil furnished is in accordance with the following specifications.

Sl. No	Characteristic	Requirement	Method of Test
01	Appearance	The oil shall be clear & transparent & free from suspended matter or sediment	A representative sample of oil shall be examined in a 100 mm thick layer at ambient temp.
02	Density at 20 <sup>0</sup> C	0.89 g/cm <sup>3</sup> Max.	IS:1448
03	Kinematic Viscosity at 27 deg. C Max	27 CST	IS:1448
04	Interfacial tension at 27 <sup>0</sup> C Min.	0.03 N/m	IS:6104
05	Flash Point	136 <sup>0</sup> C	IS:1448
06	Pour Point Max.	-6 <sup>0</sup> C	IS:1448
07	Nautralisation Value (Total Acidity) Max.	0.03 mg KOH/gm	IS:335
08	Electric strength Breakdown (voltage) Min.	72.5 KV	IS:6792
09	Dielectric dissipation factor tan delta at 90 <sup>0</sup> C	0.03 Max	IS:6262
10	Min specific resistance(resistively) at 90 <sup>0</sup> C	35X10 <sup>12</sup> ohm cm (min.)	IS:6103
11	Oxidation stability		
12	Neutralization value after oxidation	0.40mg KOH/g	
13	Total sludge after oxidation	0.10% by weight max.	
14	Presence of oxidation Inhibitor	The oil shall not contain anti-oxidant Additives.	IS:335
15	Water content Max:	Less than 25ppm	IS:2362

**7.8 VALVES**



i) Valves shall be of forged carbon steel upto 50mm size and of gun metal or of cast iron bodies with gun metal fittings for sizes above 50mm. They shall be of full way type with screwed ends and shall be opened by turning counter clockwise when facing the hand wheel. There shall be no oil leakage when the valves are in closed position.

ii) Each valve shall be provided with an indicator to show the open and closed positions and shall be provided with facility for padlocking in either open or closed position. All screwed valves shall be furnished with pipe plugs for protection. Padlocks with duplicate keys shall be supplied along with the valves.

iii) All valves except screwed valves shall be provided with flanges having machined faced drilled to suit the applicable requirements, Oil tight blanking plates shall be provided for each connection for use when any radiator is detached and for all valves opening to atmosphere. If any special radiator valve tools are required the contractor shall supply the same.

Each transformer shall be provided with following valves on the tank:

- a) Drain valve so located as to completely drain the tank & to be provided with locking arrangement.
- b) Two filter valves on diagonally opposite corners of 50mm size & to be provided with locking arrangement.
- c) Oil sampling valves not less than 8mm at top and bottom of main tank & to be provided with locking arrangement.
- d) One 15mm air release plug.

Valves between radiators and tank.

Drain and filter valves shall be suitable for applying vacuum as specified in the specifications.

## 7.9 ACCESSORIES

### 7.9.1 Bushing

i) All porcelain used in bushings shall be homogeneous, non-porous, uniformly glazed to brown colour and free from blisters, burns and other defects.

ii) Stress due to expansion and contraction in any part of the bushing shall not lead to deterioration.

iii) Bushing shall be designed and tested to comply with the applicable standards.

iv) Bushing rated for 400A and above shall have non-ferrous flanges and hardware.

v) Fittings made of steel or malleable iron shall be galvanized

vi) Bushing shall be so located on the transformers that full flashover strength will be utilized. Minimum clearances as required for the BIL shall be realized between live parts and live parts to earthed structures.

vii) All applicable routine and type tests certificates of the bushings shall be furnished for approval.

viii) Bushing shall be supplied with bi-metallic terminal connector/ clamp/ washers suitable for fixing to bushing terminal and the OWNER'S specified conductors. The connector/clamp shall be rated to carry the bushing rated current without exceeding a temperature rise of 55<sup>0</sup> C over an ambient of 50<sup>0</sup> C. The connector/clamp shall be designed to be corona free at the maximum rated line to ground voltage.

- ix) Bushing of identical voltage rating shall be interchangeable.
- x) The insulation class of high voltage neutral bushing shall be properly coordinated with the insulation class of the neutral of the low voltage winding.
- xi) Each bushing shall be so coordinated with the transformer insulation that all flashover will occur outside the tank.

#### 7.9.2 **Protection & Measuring Devices**

##### **i) Oil Conservator Tank**

- a) The Conservator tank shall have adequate capacity between highest and lowest visible levels to meet the requirement of expansion of the total cold oil volume in the transformer and cooling equipment.
- b) The conservator tank shall be bolted into position so that it can be remove for cleaning purposes.
- c) The conservator shall be fitted with magnetic oil level gauge with low level electrically insulated alarm contact.
- d) Plain conservator fitted with silica gel breather.

##### **ii) Pressure Relief Device.**

The pressure relief device provided shall be of sufficient size for rapid release of any pressure that may be generated in the tank and which may result in damage of the equipment. The device shall operate at a static pressure of less than the hydraulic test pressure of transformer tank. It shall be mounted direct on the tank. A pair of electrically insulated contract shall be provided for alarm and tripping.

##### **iii) Buchholz Relay**

A double float type Buchholz relay shall be provided. Any gas evolved in the transformer shall collect in this relay. The relay shall be provided with a test cock suitable for a flexible pipe connection for checking its operation. A copper tube shall be connected from the gas collector to a valve located about 1200 mm above ground level to facilitate sampling with the transformer in service. The device shall be provided with two electrically independent potential free contracts, one for alarm on gas accumulation and the other for tripping on sudden rise of pressure.

##### **iv) Temperature Indicator**

###### **a) Oil Temperature Indicator (OTI) :**

The transformers shall be provided with a micro switch contact type thermometer with 150 mm dial for top oil temperature indication. The thermometer shall have adjustable, electrically independent potential free alarm and trip contacts. Maximum reading pointer and resetting device shall be mounted in the local control panel. A temperature sensing element suitably located in a pocket on top oil shall be furnished. This shall be connected to the OTI by means of capillary tubing. Accuracy class of OTI shall be  $\pm 1\%$  or better. Two Nos. electrical contacts capable of operating at 5 A ac at 230 volt supply.

###### **b) Winding Temperature indicator(WTI) :**

A device for measuring the hot spot temperature of the winding shall be provided. It shall comprise the following.

- i) Temperature sensing element.
- ii) Image Coil.
- iii) Micro switch contacts.
- iv) Auxiliary CTS, If required to match the image coil, shall be furnished and mounted in the local control panel.
- v) 150mm dial local indicating instrument with maximum reading pointer mounted in local panel and with adjustable electrically independent ungrounded contacts, besides that required for control of cooling equipment, one for high winding temperature alarm and on for trip.
- vi) Calibration device.
- vii) Two number electrical contact each capable of operating at 5 A ac at 230 Volt supply.

### 7.9.3 **Oil Preservation Equipment**

#### 7.9.3.1 **Oil Sealing**

The oil preservation shall be diaphragm type oil sealing in conservator to prevent oxidation and contamination of oil due to contact with atmospheric moisture.

The conservator shall be fitted with a dehydrating filter breather. It shall be so designed that.

- i) Passage of air is through a dust filter & Silica gel.
- ii) Silica gel is isolate from atmosphere by an oil seal.
- iii) Moisture absorption indicated by a change in colour of the crystals of the silica gel can be easily observed from a distance.
- iv) Breather is mounted not more than 1400 mm above rail top level.

### 7.10 **MARSHALLING BOX**

- i) Sheet steel, weather, vermin and dust proof marshalling box fitted with required glands, locks, glass door, terminal Board, heater with switch, illumination lamp with switch, water-tight hinged and padlocked door of a suitable construction shall be provided with each transformer to accommodate temperature indicators, terminal blocks etc. The box shall have slopping roof and the interior and exterior painting shall be in accordance with the specification. Padlock along with duplicate keys shall be supplied for marshalling box. The degree of protection shall be IP-55 or better.
- ii) The schematic diagram of the circuitry inside the marshalling box be prepared and fixed inside the door under a prospone sheet.
- iii) The marshalling box shall accommodate the following equipment:
  - a) Temperature indicators.
  - b) Space for accommodating Control & Protection equipment in future for the cooling fan (for ONAF type cooling, may be provided in future).
  - c) Terminal blocks and gland plates for incoming and outgoing cables.

All the above equipments except c) shall be mounted on panels and back of panel wiring shall be used for inter-connection. The temperature indicators shall be so mounted that the dials are not more than 1600 mm from the ground level and the door (s) of the compartment(s) shall be provided with glazed window of adequate size. The transformer shall be erected on a plinth which shall be 2.5 feet above ground level.

iii) To prevent internal condensation, a metal clad heater with thermostat shall be provided. The heater shall be controlled by a MCB of suitable rating mounted in the box. The ventilation louvers, suitably padded with felt, shall also be provided. The louvers shall be provided with suitable felt pads to prevent ingress of dust.

iv) All incoming cables shall enter the kiosk from the bottom and the gland plate shall not be less than 450 mm from the base of the box. The gland plate and associated compartment shall be sealed in suitable manner to prevent the ingress of moisture from the cable trench.

v) The control connection, wiring etc. shall be as per Clause 3.15 of this specification.

## **7.11 TAPCHANGER**

### **7.11.1 OFF-LOAD TAP-CHANGERS**

- i The transformers shall be provided with Off-load Taps
- ii The Transformer with off-load tap changing gear shall have taps ranging from +5% to -10% in equal steps of 2.5% each on HV winding for voltage variation
- iii The tap changing switch shall be located in a convenient position so that it can be operated from ground level. The switch handle shall be provided with locking arrangement along with tap position indication, thus enabling the switch to be locked in position

## **7.12 FITTINGS AND ACCESSORIES**

The following fittings and accessories shall be provided on the transformers:

- i) Conservator with isolating valves, oil filling hole with cap and drain valve. The conservator vessel shall be filled with constant oil pressure diaphragm oil sealing system.
- ii) Magnetic type oil level gauge (150 mm dia) with low oil level alarm contacts.
- iii) Prismatic/ toughened glass oil level gauge.
- iv) Silica gel breather with oil seal and connecting pipe complete with first fill of activated silica gel or Alumina mounted at a level of 1300 mm above ground level.
- v) A double float type Buchholz relay with isolating valve. Bleeding pipe and a testing cock, the test cock shall be suitable for a flexible (pipe connection for checking its operation). A 5mm dia. Copper pipe shall be connected from the relay test cock to a valve located at a suitable height above ground level to facilitate sampling of gas with the transformer in service. Interconnection between gas collection box and relay shall also be provided. The device shall be provided with two electrically independent ungrounded contacts, one for alarm on gas accumulation and the other for tripping on sudden oil surge. These contacts shall be wired upto transformer marshalling box. The relay shall be provided with shut off valve on the conservator side as well as on the tank side.

- vi) Pressure relief devices (including pressure relief valve) and necessary air equalizer connection between this and the conservator with necessary alarm and trip contacts.
- vii) Air release plugs in the top cover.
- viii) Inspection cover, access holes with bolted covers for access to inner ends of bushing etc.
- ix) Winding temperature (hot spot) indicating device for local mounting complete in all respects. Winding temperature indicator shall have two set of contacts to operate at different settings :
  - a) To provide winding temperature high alarm
  - b) To provide temperature too high trip
- x) Dial thermometer with pocket for oil temperature indicator with one set of alarm and one set of trip contacts and maximum reading pointer.
- xi) Lifting eyes or lugs for the top cover, core and coils and for the complete transformer.
- xii) Jacking pads
- xiii) Haulage lugs.
- xiv) Protected type mercury / alcohol in glass thermometer and a pocket to house the same.
- xv) Top and bottom filter valves on diagonally opposite ends with pad locking arrangement on both valves.
- xvi) Top and bottom sampling valves.
- xvii) Drain valve with pad locking arrangement
- xviii) Rating and connection diagram plate.
- xix ) Two numbers tank earthing terminals with associated nuts and bolts for connections to owner's grounding strip.
  - xx) Bi-directional flagged rollers with locking and bolting device.
- xxi) Marshalling Box (MB)
- xxii) Shut off valve on both sides of flexible pipe connections between radiator bank and transformer tank.
- xxiii) Cooling Accessories :
  - a) Requisite number of radiators provided with :-
    - One shut off valve on top
    - One shut off valve at bottom
    - Air release device on top
    - Drain and sampling device at bottom
    - Lifting lugs.
  - b) Air release device and oil drain plug on oil pipe connectors :
- xxiv) Terminal marking plates for Current Transformer and Main Transformer
- xxv) Off- Load Tap Changer

xxvi) Oil Preservation Equipment

xxvii) Oil Temperature indicator

- Note :**
- (i) The fittings listed above are indicative and any other fittings which are generally required for satisfactory operation of the transformer are deemed to be included in the quoted price of the transformer.
  - (ii) The contacts of various devices required for alarm and trip shall be potential free and shall be adequately rated for continuous, making and breaking current duties as specified.

**7.13 CONTROL CONNECTIONS AND INSTRUMENT AND WIRING TERMINAL BOARD AND FUSES**

- i) Normally no fuses shall be used anywhere instead of fuses MCB's (both in AC & DC circuits) shall be used. Only in cases where a MCB cannot replace a fuse due to system requirements, a HRC fuse can be accepted.
- ii) All wiring connections, terminal boards, fuses MCB's and links shall be suitable for tropical atmosphere. Any wiring liable to be in contact with oil shall have oil resisting insulation and the bare ends of stranded wire shall be sweated together to prevent seepage of oil along the wire.
- iii) Panel connections shall be neatly and squarely fixed to the panel. All instruments and panel wiring shall be run in PVC or non-rusting metal cleats of the compression type. All wiring to a panel shall be taken from suitable terminal boards.
- iv) Where conduits are used, the runs shall be laid with suitable falls, and the lowest parts of the run shall be external to the boxes. All conduit runs shall be adequately drained and ventilated. Conduits shall not be run at or below ground level.
- v) When 400 volt connections are taken through junction boxes or marshalling boxes, they shall be adequately screened and 400 volts Danger Notice must be affixed to the outside of the junction boxes or marshalling box. Proper colour code for Red, Yellow, Blue wires shall be followed.
- vi) All box wiring shall be in accordance with relevant ISS. All wiring shall be of stranded copper (48 strands ) of 1100 Volt grade and size not less than 2.5 sq.mm
- vii) All wires on panels and all multi-core cables shall have ferrules, for easy identifications, which bear the same number at both ends, as indicated in the relevant drawing.
- viii) At those points of interconnection between the wiring carried out by separate contractors, where a change of number can not be avoided double ferrules shall be provided on each wire. The change of numbering shall be shown on the appropriate diagram of the equipment.
- ix) The same ferrule number shall not be used on wires in different circuits on the same panels.
- x) Ferrules shall be of white insulating material and shall be provided with glossy finish to prevent the adhesion of dirt. They shall be clearly and durably marked in black and shall not be affected by dampness or oil.
- xi) Stranded wires shall be terminated with tinned Ross Courtney terminals, claw washers or crimped tubular lugs. Separate washers shall be suited to the size of the wire terminated. Wiring shall, in general, be accommodated on the sides of the box and the wires for each circuit shall be separately grouped. Back of panel wiring shall be

arranged so that access to the connecting items of relays and other apparatus is not impeded.

- xii) All circuits in which the voltage exceeds 125 volts, shall be kept physically separated from the remaining wiring. The function of each circuit shall be marked on the associated terminal boards.
- xiii) Where apparatus is mounted on panels, all metal cases shall be separately earthed by means of stranded (48 No.) copper wire of strip having a cross section of not less than 2 sq. mm where strip is used, the joints shall be sweated. The copper wire shall have green coloured insulation for earth connections.
- xiv) All wiring diagram for control and relay panel shall preferably be drawn as viewed from the back and shall show the terminal boards arranged as in services.
- xv) Terminal block rows should be spaced adequately not less than 100 mm apart to permit convenient access to external cables and terminations.
- xvi) Terminal blocks shall be placed with respect to the cable gland ( at a minimum distance of 200 mm) as to permit satisfactory arrangement of multicore cable tails .
- xvii) Terminal blocks shall have pairs of terminals for incoming and outgoing wires. Insulating barriers shall be provided between adjacent connections. The height of the barriers and the spacing between terminals shall be such as to give adequate protection while allowing easy access to terminals. The terminals shall be adequately protected with insulating dust proof covers. No live metal shall be exposed at the back of the terminal boards. CT terminals shall have shorting facilities. The terminals for CTs should have provision to insert banana plugs and with isolating links.
- xviii) All interconnecting wiring, as per the final approved scheme between accessories of transformer and marshalling box is included in the scope of this specification and shall be done by the Transformer supplier.
- xix) The schematic diagram shall be drawn and fixed under a transparent prospane sheet on the inner side of the marshalling box cover.
- xx) To avoid condensation in the Marshalling Box, a space heater shall be provided with an MCB and thermostat.
- xxi) Suitable MV, CFL light shall be provided in the Marshalling Box for lightning purpose.

#### 7.14 **RADIO INTERFERENCE AND NOISE LEVEL**

Transformers shall be designed with particular care to suppress at least the third and fifth harmonic voltages so as to minimize interference with communication circuits. Transformer noise level when energized at normal voltage and frequency shall be as per NEMA stipulations.

#### 8 **INSPECTION AND TESTING**

- (i) The Contractor shall carry out a comprehensive inspection and testing Programme during manufacture of the transformer. This is, however, not intended to form a comprehensive Programme as it is contractor's responsibility to draw up and carry out such a Programme duly approved by the owner.
- (ii) The contractor shall carry out type tests and routine tests on the transformers.
- (il) The pre-shipment checks shall also be carried out by the contractor.
- (v) The requirements on site tests are as listed in the specifications.

- (vi) Certified test report and oscillograms shall be furnished to the Owner Consultants for evaluation as per the schedule of distribution of documents. The Contractor shall also evaluate the test results and rectify the defects in the equipment based on his and the Owner's evaluations of the tests without any extra charges to the Owner. Manufacturer's Test Certificates in respect of all associated auxiliary and ancillary equipment shall be furnished.
- (vii) The bidder shall state in his proposal the testing facilities available at his works. In case full testing facilities are not available, the bidder shall state the method proposed to be adopted so as to ascertain the transformer characteristics corresponding to full capacity.

## 8.1 **INSPECTION**

### i) **Tank and Conservator**

- a) Inspection of major weld.
- b) Crack detection of major strength weld seams by dye penetration test.
- c) Check correct dimensions between wheels, demonstrate turning of wheels, through 90<sup>0</sup> and further dimensional check.
- d) Leakage test of the conservator.

### ii) **Core**

- a) Sample testing of core materials for checking specific loss, properties, magnetization characteristics and thickness.
- b) Check on the quality of varnish if used on the stampings.
- c) Check on the amount of burrs.
- d) Visual and dimensional check during assembly stage.
- e) Check on completed core for measurement of iron loss, determination of maximum flux density,
- f) Visual and dimensional checks for straightness and roundness of core, thickness of limbs and suitability of clamps.
- g) High voltages DC test (2 KV for one minute) between core and clamps.

### iii) **Insulating Material**

- a) Sample check for physical properties of materials.
- b) Check for dielectric strength
- c) Check for the reaction of hot oil on insulating materials.

### iv) **Winding**

- a) Sample check on winding conductor for mechanical and electrical conductivity.
- b) Visual and dimensional checks on conductor for scratches, dent mark etc.
- c) Sample check on insulating paper for PH value, electric strength.
- d) Check for the bonding of the insulating paper with conductor.
- e) Check and ensure that physical condition of all materials taken for windings is satisfactory and free of dust.
- f) Check for absence of short circuit between parallel strands.

### v) **Checks Before Drying Process**

- a) Check condition of insulation on the conductor and between the windings.
- b) Check insulation distance between high voltage connections, between high voltage connection cables and earth and other live parts.
- c) Check insulating distances between low voltage connections and earth and other parts.
- d) Insulating test for core earthing.



- vi) **Check During Drying Process**
  - a) Measurement and recording of temperature and drying time during vacuum treatment.
  - b) Check for completeness of drying
  
- vii) **Assembled Transformer**
  - a) Check completed transformer against approved outline drawing, provision for all fittings, finish level etc.
  - b) Jacking test on the assembled Transformer.
  
- viii) **Oil**

All standard tests in accordance with IS: 335 shall be carried out on Transformer oil sample before filling in the transformer.
  
- ix) **Test Report for bought out items**

The contractor shall submit the test reports for all bought out / sub contracted items for approval.

  - a) Buchholz relay
  - b) Sudden pressure rise relay on Main Tank
  - c) Winding temperature indicators (for TX capacity >10 MVA )
  - d) Oil temperature indicators
  - e) Bushings
  - f) Bushing current transformers in neutral (If Provided)
  - g) Marshalling box
  - h) Off Load Tap changer
  - i) Any other item required to complete the works.
  - j) Porcelain, bushings, bushing current transformers, wherever provided, winding coolers, control devices, insulating oil and other associated equipment shall be tested by the contractor in accordance with relevant IS . If such requirement is purchased by the contractor on a sub-contract, he shall have them tested to comply with these requirements.

## 8.2 **FACTORY TESTS**

- i) All standards routine tests in accordance IS: 2026 with dielectric tests corresponding as per latest amendments to IS: 2026 shall be carried out.
- ii) All auxiliary equipment shall be tested as per the relevant IS. Test certificates shall be submitted for bought out items.
- iii) High voltage withstand test shall be performed on auxiliary equipment and wiring after complete assembly.
- iv) Following additional routine tests shall also be carried out on each transformer:
  - a) Magnetic Circuit Test:  
Each core shall be tested for 1 minute at 2000 Volt DC
  - b) Oil leakage test on transformer

### 8.2.1 **Type Test**

The offered transformer should be type tested particularly for Temperature rise, Short circuit and Impulse withstand tests at CPRI/ NABL Accredited Laboratory. The test result should be within the loss & impedance mentioned in the tender.

**8.2.2 STAGE INSPECTION**

The supplier shall offer the core, windings and tank of each transformer for inspection by the owner's representative(s). During stage Inspection, all the measurements like diameter, window height, leg centre, stack width, stack thickness, thickness of laminations etc. for core assembly, conductor size, Insulation thickness, I.D., O.D, winding height, major and minor insulations for both H.V and L.V windings, length, breadth, height and thickness of plates of Transformer tank, the quality of fittings and accessories will be taken / determined. The supplier can offer for final inspection of the transformers subject to clearance of the stage Inspection report by the owner.

**8.2.3 Routine Tests**

Transformer routine tests shall include tests stated in latest issue of IS: 2026 (Part –1). These tests shall also include but shall not be limited to the following :

- (i) Measurement of winding DC resistance.
- (ii) Voltage ratio on each tapping and check of voltage vector relationship.
- (iii) Impedance voltage at all tappings.
- (iv) Magnetic circuit test as per relevant ISS or CBIP manual or latest standard being followed.
- (v) Measurement of Load losses at normal tap and extreme taps.
- (vi) No load losses and no load current at rated voltage and rated frequency, also at 25% to 125 % of rated voltage in steps.
- (vii) Absorption index i.e. insulation resistance for 15 seconds and 60 seconds ( R 60/ R 15 ) and polarization index i.e. Insulation Resistance for 10 minutes and one minute (R 10 mt / R 1 mt).
- (viii) Induced over voltage withstand test.
- (ix) Separate source voltage withstand test.
- (x) Tan delta measurement and capacitance of each winding to earth (with all other windings earthed) & between all windings connected together to earth.
- (xi) Measurement of zero sequence impedance.
- (xii) Tests on off- load tap changer (fully assembled on transformer) as per IEC: 214/ 1976 and BS: 4571/ 1970.
- (xii) Auxiliary circuit tests.
- (xiv) Oil BDV tests.
- (xv) Measurement of neutral unbalance current which shall not exceed 2% of the full rated current of the transformer.
- (xvi) Magnetic balance test.
- (xvii) Leakage test.

Six (6) set of certified test reports and oscillographs shall be submitted for evaluation prior to dispatch of the equipment. The contractor shall also evaluate the test results and shall correct any defect indicated by his and Owner's evaluation of the tests without charge to the Owner.

8.4 **TANK TESTS:-**

a) **Oil leakage Test :**

The tank and oil filled compartments shall be tested for oil tightness completely filled with air or oil of viscosity not greater than that of insulating oil conforming to IS : 335 at the ambient temperature and applying a pressure equal to the normal pressure plus 35 KN/ m<sup>2</sup> measured at the base of the tank. The pressure shall be maintained for a period of not less than 12 hours of oil and one hour for air and during that time no leak shall occur.

b) **Pressure Test**

Where required by the Owner, one transformer tank of each size together with its radiator, conservator vessel and other fittings shall be subjected to a pressure corresponding to twice the normal head of oil or to the normal pressure plus 35 KN / m<sup>2</sup> whichever is lower, measured at the base of the tank and maintained for one hour.

c) **Vacuum Test**

One transformer tank of each size shall be subjected to the vacuum pressure of 60 mm of mercury. The tanks designed for full vacuum shall be tested at an internal pressure of 3.33 KN/m<sup>2</sup> (25 mm of mercury) for one hour. The permanent deflection of flat plates after the vacuum has been released shall not exceed the value specified in C.B.I.P. Manual on Transformers (Revised 1999) without affecting the performance of the transformer.

8.5 **PRE-SHIPMENT CHECK AT MANUFACTURERS WORKS**

- i) Check for proper packing and preservation of accessories like radiators, bushings, explosions vent, dehydrating breather, rollers, buchholz relay, control cubicle connecting pipes and conservator etc.
- ii) Check for proper provision of bracing to arrest the movement of core and winding assembly inside the tank.
- iii) Gas tightness test to conform tightness.

8.6 **INSPECTION AND TESTING AT SITE**

The Engineer authorized from Owner along with the contractor's site engineer shall carry out detailed inspection covering areas right from the receipt of material up to commissioning stage. An indicative program of inspection as envisaged by the Engineer is given below.

8.6.1 **Receipt and Storage Checks**

- i) Check and record conditions of each package visible parts of the transformers etc for any damage.
- ii) Check and record the gas pressure in the transformer tank as well as in the gas cylinder.
- iii) Visual check of core and coils before filling up with oil and also check condition of core and winding in general.

8.6.2 **Installation Checks**

- i) Inspection and performance testing of accessories like tap changers etc.
- ii) Check choking of the tubes of radiators

- iii) Test on oil samples taken from main tank top and bottom and cooling system. Samples should be taken only after the oil has been allowed to settle for 24 hours.
- iv) Check the whole assembly for tightness, general appearance etc.
- v) Oil leakage tests.

#### **8.6.3 Pre-Commissioning Tests**

After the transformer is installed, the following pre-commissioning tests and checks shall be done before putting the transformer in service.

- i) Dry out test
- ii) Megger Test
- iii) DC Resistance measurement of windings
- iv) Ratio test on all taps
- v) Phase relationship test ( Vector grouping test )
- vi) Buchholz relay alarm & surge operation test
- vii) Low oil level ( in conservator ) alarm
- viii) Temperature Indicators
- ix) Marshalling kiosk
- x) Protective relays
- xi) Magnetising current
- xii) Tests on OLTC

#### **8.6.4 The following additional checks shall be made :**

- i) All oil valves are in correct position closed or opened as required
- ii) All air pocket are cleared.
- iii) Thermometer pockets are filled with oil.
- iv) Oil is at correct level in the bushing, conservator, diverter switch & tank etc.
- v) Earthing connections are made.
- vi) Colour of Silica gel is blue.
- vii) Bushing arcing horn is set correctly and gap distance is recorded.
- Viii) C T polarity and ratio is correct.

#### **8.7 PERFORMANCE**

The performance of the transformer shall be measured on the following aspects.

- i) The transformer shall be capable of being operated without danger on any tapping at the rated KVA with voltage variations and  $\pm 10\%$  corresponding to the voltage of the tapping
- ii) Radio interference and Noise Level
- iii) The transformer shall be designed with particular attention to the suppression of third and fifth harmonics so as to minimize interference with communication circuits.

#### **8.8 FAULT CONDITIONS**

- a) The transformer shall be capable of withstanding for **TWO** seconds without damages any external short circuit to earth.

- b) Transformer shall be capable of withstanding thermal and mechanical stresses conveyed by symmetrical or asymmetrical faults on any winding. This shall be demonstrated through calculation as per IS : 2026.
- c) Transformer shall accept, without injurious heating, combined voltage and frequency fluctuation which produce the 125% over fluxing condition for one minute.

Certified test report and oscillograms shall be furnished to the Owner /Consultant for evaluation as per the schedule of distribution of documents. The Contractor shall also evaluate the test results and rectify the defects in the equipment based on his and the Owner's evaluations of the tests without any extra charges to the Owner. Manufacturer's Test Certificates in respect of all associated auxiliary and ancillary equipment shall be furnished.

The bidder shall state in his proposal the testing facilities available at his works. In case full testing facilities are not available, the bidder shall state the method proposed to be adopted so as to ascertain the transformer characteristics corresponding to full capacity testing.

**8.9 WITNESSING OF TESTS AND EXCESSIVE LOSSES**

- i) The owner and or his representative reserve the right to witness any or all test or to accord waiver at its sole discretion.
- ii) The Owner reserves the right to reject the Transformer if losses exceed the maximum specified as per Clause No 2. SPECIFIC TECHNICAL REQUIREMENTS (STANDARD CONDITIONS), item-35 & 36 of this specification or if temperature rise of oil and winding exceed the values specified at item -26 of the above clause.

**9.0 LOSSES:-**

SL. No	Transformer Rating	Maximum No Load Loss at rated voltage & rated frequency	Maximum Load Loss at rated current & at 75 degree C
1.	33/11KV, 1.6 MVA	2.5 KW	13.0 KW

**N.B: There shall be no positive tolerance to above losses. Capitalization of losses shall be factored in the comparative statement for selection of vendors.**

**9.1 CAPITALIZATION OF LOSSES AND LIQUIDATED DAMAGES**

The capitalization of guaranteed losses of the transformer shall be calculated and considered while evaluating the bids. The guaranteed values of no load losses and load losses shall be stated in the bid which should match the corresponding loss figures mentioned in the short circuit type test report submitted along with the offer by the bidder

**Transformers with lower losses shall be preferred.** The bidder shall indicate the values of load and no load losses of the transformer in his bid.

**9.2 CAPITALIZATION OF LOSSES**

For total cost evaluation, the capitalized cost of losses will be taken into account as per the following:

$$\text{Capitalized Cost of Transformer} = \text{Cost of Transformer (as per Bid)} + A \times W_i + B \times W_e$$

- a. Where  $W_i$  = No Load losses in KW & A = Rs. 1, 52,847.00 for no load losses.
- b.  $W_e$  = Load losses in KW & B = Rs. 20,175.00 for load losses.

The no load loss in KW at rated voltage & frequency and the load loss in KW at rated current, rated frequency, rated output and at 75<sup>0</sup> C shall be quoted and these figures shall be guaranteed.

#### 10.1 **SPARE PARTS**

i) In case the manufacturer goes out of production of spare parts, then he shall make available the drawings of spare parts and specification of materials at no extra cost to the Owner to fabricate or procure spare parts from other sources.

##### **Mandatory Spare Parts**

**The suppliers shall provide the following mandatory spares for each of Transformer supplied**

**1. H.V. & L.V. Bushing & Studs – Each 2 Nos**

**2. Bimetallic connector for H.V & L.V. Bushings – Each 2 sets**

#### 10.2 **INSTRUCTION MANUAL**

Eight sets of the instruction manuals shall be supplied at least four (4) weeks before the actual dispatch of equipment. The manuals shall be in bound volumes and shall contain all the drawings and information required for erection, operation and maintenance of the transformer. The manuals shall include amongst other, the following particular:

- a) Marked erection prints identifying the components, parts of the transformer as dispatched with assembly drawings.
- b) Detailed dimensions, assembly and description of all auxiliaries.
- c) Detailed views of the core and winding assembly, winding connections and tapings tap changer construction etc. These drawings are required for carrying out overhauling operation at site.
- d) Salient technical particulars of the transformer.
- e) Copies of all final approved drawings.
- f) Detailed O&M instructions with periodical check lists and Performa etc.

#### 10.3 **COMPLETENESS OF EQUIPMENT**

All fittings and accessories, which may not be specifically mentioned in the specification but which are necessary for the satisfactory operation of the transformer, shall be deemed to be included in the specification and shall be furnished by the supplier without extra charges. The equipment shall be complete in all details whether such details are mentioned in the specification or not, without any financial liability to the Owner under any circumstances.

#### 11.0 **TOOLS AND TACKLES**

All the necessary tools and tackles required for normal operation & maintenance of the transformers shall be supplied by the Contractor.

##### **COMMISSIONING**

#### 12.0

The equipments shall be commissioned as per CBIP manual, IS: 10028 and manufacturer's recommendations. All the related drawings and manuals shall be pre-requisite for release of final payment.

**13.0 NON COMPLIANCE SCHEDULE**

On this schedule the bidder shall provide a list of non compliance with this specification, documenting the effects that such non compliance is likely to have on the equipment’s life and operating characteristics & other Commercial Terms as per Technical & Commercial Deviation Formats enclosed at **Annexure V & VI at Section V** of this Tender Document. Each Non Compliance shall refer to the relevant clause of the specification.

Where there are no deviations from specifications, the bidder shall so indicate by stating “No deviations” in this schedule.

**14.0 TEST CERTIFICATES SCHEDULE**

On this schedule a list of the test certificates included with the bid shall be provided. The list should include type test certificates and sample routine test reports. Each certificate listed shall be referred to the relevant specification clause and item of equipment to which the test applies.

Clause No.	Type Test Certificate or Routine test Report

**Signature of the Bidder**

**(This form is to be duly filled up by the bidder & submit along with the Tender)**

**B) TECHNICAL SPECIFICATION FOR 33KV OUTDOOR VACUUM CIRCUIT BREAKERS**

**1. SCOPE**

- 1.1 This specification covers design, engineering, manufacture, testing, inspection before dispatch packing, forwarding, transportation, insurance during transit, delivery to site/stores of 33KV Outdoor Vacuum Circuit Breakers for use the 33/11KV primary substations under the distribution networks of SOUTHCO.
- 1.2 All vacuum circuit breakers must be manufactured by ISO 9000 certified Organization and shall have been type tested at CPRI or any NABL Accredited laboratory/PHELA/KERI/KEMA/CESI laboratory within five years as on the date of bid opening and in satisfactory operation for a period not less than three years. The Bidder shall demonstrate compliance with this requirement by supplying with the bid, copies of the type test certificates together with performance certificates from owners/ users.
- 1.3 The scope of supply includes the provision of type tests at CPRI or any NABL Accredited laboratory/PHELA/KERI/KEMA/CESI laboratory within last five years.
- 1.4 The scope also includes the circuit breaker and current and potential transformers, supporting structures, operating mechanism, local/ remote control cabinet, relay control panel, foundation bolts, all the accessories and auxiliary equipment mandatory spares and special tools for satisfactory installation and operation.
- 1.5 The circuit breakers shall conform in all respects to the highest standards of engineering, design, workmanship, this specification and the latest revisions of relevant standards at the time of offer and the owner shall have the power to reject any work or materials, which, in his judgment, is not in full accordance therewith.

**2. STANDARDS**

Except where modified by this specification, the circuit breakers and the accessories

shall be designed, manufactured and tested in accordance with latest editions of the following standards.

IEC/ISO/BS	IS	Subject
IEC: 56	IS : 13118	High voltage alternating current circuit breakers general requirement.
IEC: 694	IS : 12729	Common clauses of high voltage switch-gear and control gear standards (for voltage exceeding 1000 V).
IEC: 60	IS : 9135	High Voltage testing techniques.
IEC: 427	IS:13516	Method of synthetic testing of HV .A.C circuit breakers.
IEC: 1233		HV. AC. Circuit breakers- inductive load switching.
IEC: 17A/CD: 474		HV. AC. Circuit breakers- capacitive switching.
IEC: 529	IS: 13947	Degree of protection provided by enclosure.
IEC:137	IS: 2099	Insulating bushing for A.C. voltages above 1000V
IEC:233	IS : 5621	Hollow insulators for use in electrical equipment & testing.
IEC:273	IS: 5350	Characteristics of indoor and outdoor post insulators for systems with nominal voltages greater than 1000V.
IEC:815	IS: 13134	Guide for selection of insulators in respect of polluted conditions.
IEC: 34	IS : 996	A.C motors
ISO:1460 BS:729	IS:2629	Hot dip galvanizing
	IS:2633	Method of testing uniformity of zinc coated articles.
	IS: 5	Colour for ready missed paints and enamels
	IS: 6005	Code of practice for phosphating or iron and steel.
IEC: 227	IS:1554	P.V.C Insulated cables for voltages up to and including 1100 Volt.
IEC:269	IS:13703	Low voltage fuses for voltages not exceeding 1000volt.
ISO:800	IS:1300	Phenolic moulding materials.
	IS:13118	Guide for uniform marking and identification of conductors and apparatus terminals.
IEC: 185	IS: 2705	Current transformers.
IEC: 296	IS: 335	Specification for unused insulating oil for transformer and switchgear.
IEC:186	IS: 3156	Potential transformers.
CBIP Technical Report No. 88 revised July, 1996 read with amendment issued (April, 99, September, 99 and also any other amendment thereafter)		Specification for AC Static Electrical Energy Meter.

This list is not to be considered exhaustive and reference to a particular standard or recommendation in this specification does not relieve the Supplier of the necessity of providing the goods and services complying with other relevant standards or recommendations.

### **3. REQUIREMENTS**

The circuit breakers to be supplied against this specification shall be required to control the primary side of 33/11 KV power transformers in the primary sub-stations (incoming 33KV feeders) or Bus coupler or the outgoing feeders in these sub-stations. The circuit breakers shall be suitable for 3 phase 50Hz solidly grounded neutral system and shall have normal current carrying capacity and symmetrical short circuit current breaking capability as mentioned hereunder.

The required 33KV Vacuum Circuit Breakers suitable for outdoor installations are to be quoted by Manufacturers only with a valid ISO 9000 certification.

#### **3.1 BASIC TECHNICAL REQUIREMENTS:**

The vacuum circuit breakers are required to meet the following basic technical requirements. (Reference standards IEC:56, IS:13118 and associated standards listed in this specification.



**Basic Technical Requirements**

<b>Sl. No</b>	<b>Particulars</b>	<b>Requirements</b>
1	Service type	Outdoor
2	No. of Poles	3
3	Nominal system voltage	33KV
4	Highest system voltage	36KV
5	Rated normal current at 50 <sup>0</sup> C	
i)	For Bus-bar of Circuit Breaker	1250A
ii)	For Interrupter	2000A
iii)	For Outgoing Feeders	-
6	Rated short circuit breaking current (rms)	25KA
7	Rated short circuit making current (peak)	63KA
8	Rated short time current withstand capability for 1 sec.	25KA(Panel)/ 25KA (Interrupter)
9.	Rated insulation level:	
i)	One minute power frequency withstand voltage to earth (wet and dry) rms	70KV
ii)	Impulse withstand voltage to earth with 1.2/50 $\mu$ sec, wave of +ve and -ve polarity (Peak)	170KV
10	First – pole – to clear factor	1.5
11	Rated operating sequence (for auto reclosing)	O-0.3 Sec- CO-3 min-CO
12	Maximum break time	3 cycles
13	Rated out of phase breaking current	25% of the symmetrical short circuit breaking current
14	Maximum pole scatter	10 mili seconds
15	Rated Auxiliary supply for spring charge motor, lamp & heater circuit.	230V A.C
16	Rated supply voltage for trip/close coil	24V D.C
17	Minimum creepage distance (mm)	900mm
18	Minimum protected creepage distance (mm)	580mm

**4. SERVICE CONDITIONS:**

The service conditions shall be as follows:

◆	Maximum a altitude above sea level	1,000m
◆	Maximum ambient air temperature	50 <sup>0</sup> C
◆	Maximum daily average ambient air temperature	35 <sup>0</sup> C
◆	Minimum ambient air temperature	5 <sup>0</sup> C
◆	Maximum temperature attainable by an object exposed to the sun	60 <sup>0</sup> C
◆	Maximum yearly weight average ambient temperature	32 <sup>0</sup> C
◆	Maximum relative humidity	100%
◆	Average number of thunderstorm days per annum (isokeraunic level)	70
◆	Average number of rainy days per annum	120
◆	Average annual rainfall	1500mm
◆	Maximum wind pressure	260Kg/m <sup>2</sup>

**5. 33 KV VACUUM CIRCUIT BREAKERS**

**5.1 General**

The circuit breakers shall be structure mounted open type with vacuum as interrupting media incorporating separate interrupters of **2000 A rating** for each phase mounted on single frame. There shall be a common drive mechanism actuating the interrupters, which must work in synchronism. These breakers shall be provided with suitable local control while provision shall be made for remote control.

The circuit breakers shall be fitted with spring mechanism. The inherent design of these circuit breakers shall be such that they shall satisfactorily perform all test duties and interrupt out-of-phase current and produce very low over voltage (<2.0p.u.) on all switching circuits, capacitive and inductive to IEC:56, IS:13118 and other associated standards mentioned in the clause of this specification.

The terminal pads shall have silver-plating of at least 50 micron thickness. The design of the circuit breakers shall be such that inspection and replacement of contacts, coils, vacuum bottles and any worn or damaged components can be carried out quickly and this ease. The contact gaps shall be adjustable to allow for wear.

The mechanism and the connected interrupters shall satisfy the mechanical endurance requirements of IEC:56, IS:13118 and all additional requirements specified herein.

## **5.2 Porcelain Insulator**

External parts of the circuit breakers, which are under continuous electrical stress, shall be of hollow porcelain. The creepage and flashover distance of the insulators shall be dimensioned and the type and profile designed in accordance with IEC:815 or IS: 13134 and shall be suitable for the worst environmental conditions specified in this specification. The creepage distance across the interrupting chambers shall suite the outdoor service conditions mentioned in the relevant standards for heavily polluted atmosphere and shall be not less than 900 mm with protected creepage distance 50 percent of the total. Internal surfaces of hollow insulators shall also be glazed. The insulators shall comply with IS:5621 and tested in accordance with IEC:233.

All porcelain whether, used on the interrupting chamber or on the support insulator shall have the following properties:

Higher strength, homogeneity, uniform glaze, free from cavities and other flaws and high quality uniform finish porcelain components and shall withstand the maximum expected static and dynamic loads to which the circuit breakers may be subjected during their service life.

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## **5.3 Interrupting media**

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### **5.3.1 Vacuum:**

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In vacuum circuit breakers, facilities shall be provided for monitoring the contact erosion and any change in contact gap. The vacuum bottles shall be easily replaceable on site and the mechanism shall be conveniently adjustable to permit resetting the contact gap.

The vacuum circuit breaker poles shall be sealed to prevent contamination of the spaces surrounding the interrupters. The Bidder shall demonstrate how this is achieved by supplying technical details with the bid.

## **5.4 Auxiliary contacts**

12 auxiliary contacts (6N.O. + 6N.C.) of 24 Volt D.C grade and 10 amps DC rating shall be provided in each circuit breaker.

## **5.5 Indication**

A mechanically operated circuit breaker position indicator of non corroding material shall be provided in a location visible from the operating side of the breaker without the necessity to open the mechanism door. The word 'OFF' in white letter on green background shall be used to indicate that the breaker is in the opening position and the word 'ON' in white letters on a red background to indicate that the breaker is in the closed position. The drive for the device shall be positive in both directions and provision shall be made for local and remote electrical indication.

Indication of spring charging condition shall be provided as mentioned in this specification. Mechanical counters to record the number of closing operations shall be provided for each circuit breaker mechanism.

## **5.7 Operation and controls**

The breaker shall normally be operated by remote electrical control with electrical tripping by shunt trip coil. Provision shall be made for local electrical operation and mechanical operation.

The following facilities shall be provided in the circuit breaker local control cabinet:

- LOCAL/ REMOTE selector switch of stay put type. The selection of 'local' operation shall inhibit the operation of the breaker from any remote source.
- ON/NEUTRAL/ OFF control switch or ON and OFF push buttons. The push buttons shall be momentary contract type with rear terminal connections. The close push button shall be of green colour and the open push button red colour.
- MECHANICAL EMERGENCY TRIP DEVICE: suitable for manual operation in the event of failure of electrical supplies. The device shall be accessible without opening any access doors and distinctly labeled. It shall be shrouded and protected against inadvertent operation.
- Means shall be provided for manual operation of these circuit breakers during failure of auxiliary power in addition to electrical operation.
- Means shall be provided to prevent the mechanism from responding to a close signal when the trip coil is energized or to reclosing from a sustained close signal either opening due to a trip signal or failure to hold in the closed position.

The circuit breaker shall be able to perform 10,000 operating cycles at no load in accordance with IEC:17A/474/CD for circuit breakers for auto reclosing duties.

## **6. CURRENT TRANSFORMERS**

Current transformers, three per circuit breaker, shall be of outdoor, single phase oil immersed dead tank type and shall comply with IEC:185 and IS:2705, suitable for operation in hot and humid atmospheric conditions described in service condition. They shall be mounted on the bracket. The CT tank should be Hot Dip galvanized as per relevant ISS to prevent corrosion of all exposed metal parts.

### **6.1 Core**

High grade non- ageing cold rolled grain oriented (CRGO M4 or better grade) silicon steel of low hysteresis loss and permeability shall be used for the core so as to ensure specified accuracy at both normal and over currents. The flux density shall be limited to ensure that there is no saturation during normal service.

The instrument security factor of the core shall be low enough so as not to cause damage to the instruments in the event of maximum short circuit current.

### **6.2 Windings**

The secondary windings shall be made of electrolytic copper with suitable insulation. The conductor shall be of adequate cross- section so as to limit the temperature rise even during short circuit conditions. The insulation of windings and connections shall be free from composition liable to soften coze, shrink or collapse during service.

Polarity shall be indelibly marked on each current transformer and at the lead and termination at associated terminal blocks. CTs with multi ratio winding shall be clearly tabulated to show the connections required for different ratios. Similar numbers shall be marked on terminal block arrangement and wiring diagram. Apart from the above marking and those to be provided as per IEC 185 or IS 2705, other markings shall be provided in consultation with owner.

The continuous current rating of the primary winding shall be one hundred and fifty percent of the normal rated current. Secondary windings of current transformers shall be used for metering, instrumentation and protection and shall be rated for continuous current of one hundred and fifty percent of normal rated current of primary winding.

Secondary winding stud should be 6mm dia of length 15 mm. TB should be stud type with 3 nos. of nuts (min). The horizontal distance from studs should be 1.5 times the outside circular – dia of the nuts. Test tap should be with shorting arrangement.

### **6.3 Construction**

The current transformer enclosures shall be made of high quality steel and shall be hot dip galvanized and shall be able to withstand and stresses occurring during transportation and the terminal and mechanical stresses resulting from maximum short circuit current in service. The primary winding and terminals shall be in a tank and supported by a hollow porcelain insulator. The secondary connection shall be conducted through the hollow insulator and terminated in a terminal box mounted on the base plate.

**6.4 Hermetic sealing**

Each current transformer shall be supplied filled with insulating oil complying with IEC: 296 or IS: 335 and shall be hermetically sealed to prevent atmosphere coming in contact with oil, avoiding frequent filtration and change of oil. Nitrogen or any oil inert gas above the oil level shall be provided to permit expansion and contraction of oil without any contract with the atmosphere.

The current transformers shall have provision for draining and re-filling insulation oil after drying.

**6.5 Insulating oil**

The current transformer shall be complete with new insulating oil. The quantity of insulating oil for first filling of the equipment and complete specification of oil proposed to be used shall be stated in the bid. The oil shall conform to the requirements of latest issue of IEC: 296 or IS: 335.

**6.6 Fittings and accessories**

Fittings and accessories listed below shall be supplied with each current transformer:

- Oil level gauge;
- Oil filling hole and cap;
- Pressure relief device;
- HV terminal connectors;
- Two earthing terminals and strips with necessary nut, bolts and washers;
- Name and rating plate;
- Terminal box with LV terminal connections;
- Mounting nuts, bolts and washers;

Any other fittings deemed essential by the Supplier shall also be supplied with each current transformer.

The oil level gauge shall be mounted in such a way that the oil level can be clearly seen from ground level.

A dust, vermin and weather proof terminal box shall be provided at the lower end of the current transformer for terminating the secondary windings. The box shall have a bolted cover plate complete with gaskets. The terminal box shall have terminal blocks, cable gland plate and cable glands with shrouds suitable for different sizes of PVC insulated control cables 650/1100V grade as per IEC:227 or IS:1554. The terminal blocks shall have covering of molded insulation materials complete with brass studs, washers, nuts and lock nuts suitable for termination of 2X2.5 sqmm wires. The termination shall be made by crimping lugs or bare wire with insulating sleeves at ends.

The terminal box enclosure shall have protection as per class IP 55 as defined in IEC: 529 or IS: 13947.

**6.7 CT Junction Box/Console Box**

Each set of 3 current transformers for three phases shall be provided with a common junction box mounted on the circuit breaker supporting structure at a convenient position to accommodate the secondary wire of CT and other control cables of Owner. Separate terminals for testing the relays and instruments and short circuiting of each current transformer secondary wires shall be provided in it. The junction box enclosure shall have the same protection features as for the terminal box. It shall be provided with terminal blocks, gland plates and glands suitable for different sizes of cables. Facilities shall be provided for earthing the CT secondary wires in the junction box.

**6.8 Hollow porcelain insulators**

The insulators of the current transformers shall conform to latest edition of IS: 5621 and shall be subjected to and successfully pass the tests listed in this standard and in IEC: 233. The hollow porcelain insulators shall be brown glazed and shall meet the requirements indicated in this specification. The insulators shall be cemented with Portland cement to the flanges resulting in high mechanical, tensile and breaking strength.

**6.9 Insulation level**

The current transformers shall be designed to withstand impulse test voltages and power frequency test voltages as specified in this specification.

**6.10 Terminal connections**

The CTs shall be provided with bi-metallic solder less clamp and rigid type terminal connectors on the top tank for connection to the HV terminals. The other requirements shall be same as for the terminal connectors of the circuit breaker described in this specification. They shall be universal type suitable for both horizontal and vertical connections.

Two earthing terminals complete with necessary hardware shall be provided on each CT for connecting to earth continuity conductor to be provided. The earthing terminals shall be identified by means of appropriate symbol marked in a legible and indelible manner adjacent to the terminals. The terminals shall be adequately sized to meet the full earth fault current envisaged.

**6.11 Basic technical requirement**

Ratings: The CTs shall conform to the following ratings and other particulars of the circuit breakers:

**Technical Requirements – For 3 Core CT**

<b>Sl. No</b>	<b>Particulars</b>	<b>Requirements</b>
1	Function	To control the Primary side of 33/11 KV power transformers of ratings between 1.6MVA and 10MVA in primary substations.
2	Requirement	Core-1:Instrumentation and Metering Core-2:Combined over current and earth fault protection Core-3:Differential Protection
3	Transformation Ratio	200-100-50/1-1-1 A
4	Rated Burden (VA)	Core:1:15 Core:2:15 Core:3:PS
5	Class of Accuracy	Core- 1:0.5 Core- 2:5P Core-3: PS
6	Instrument Security Factor	Core- 1 < 5
7	Accuracy Limit Factor	Core-2 : 20 Core-3 : 20
8	Rated Voltage	36KV
9	Short Time Rating	25KA rms for 3 seconds
10	Creepage distance Protected creepage distance	900mm minimum 450mm minimum
11	Insulation Level: -Impulse Voltage1.2/50µs wave withstand level -Power frequency 1 min voltage withstand level	170KV  70KV

**Technical Requirements – For 2 Core CT**

<b>Sl. No</b>	<b>Particulars</b>	<b>Requirements</b>
1	Function	For 33 KV Feeder control in 33/11 KV primary substations.
2	Requirement	Core-1:Instrumentation and Metering Core-2:Combined over current and earth fault protection
3	Transformation Ratio	400-200-100 /1-1 A
4	Rated Burden (VA)	Core:1:15 Core:2:15
5	Class of Accuracy	Core- 1:0.5 Core- 2:5P
6	Instrument Security Factor	Core-1 < 5
7	Accuracy Limit Factor	Core-2 : 20
8	Rated Voltage	36KV
9	Short Time Rating	25KA rms for 3 seconds
10	Creepage distance Protected creepage distance	900mm minimum 450mm minimum
11	Insulation Level: -Impulse Voltage1.2/50μs wave withstand level -Power frequency 1 min voltage withstand level	170KV  70KV

**6.12 Tests and inspection**

The CTs shall be tested in accordance with the requirements of the type tests and routine tests as per the latest issues IEC: 185 or IS: 2705.

The tests to be conducted shall include:

**6.12.1 Type Tests:**

- Lightning impulse voltage;
- Power frequency wet withstand voltage;
- Temperature rise;
- Short time current;
- Composite error;
- Accuracy test (for measuring core);
- Instrument security current (for measuring core);
- Current error and phase displacement (for protection core)

**6.12.2 Routine tests**

- Verification of terminal marking and polarity;
- Power frequency dry withstand test on primary windings;
- Power frequency dry withstand test on secondary windings;
- Power frequency dry withstand test between sections;
- Over voltage inter-turn test;
- Composite error;
- Turn ratio;
- Accuracy test (for measuring core);
- Current error and phase displacement (for protection core);
- Knee point voltage and magnetizing current test (for PS class);
- Secondary winding resistance (for PS class).
- Insulation Resistance Test.

**7 POTENTIAL TRANSFORMER**

**7.1 BASIC TECHNICAL REQUIREMENTS**

## **Dy. General Manager (Tech, Proj & MRT) Southco, Berhampur**

The 33KV outdoor voltage transformers are required to meet the following basic technical requirements (Reference standards: IEC: 186, IS: 3156 and associated standards listed in the specification):

<b>Sl. No</b>	<b>Particulars</b>	<b>Requirements</b>
1	Type	Single phase
2	Nominal system voltage, phase to phase	33KV
3	Application	Instrumentation, Metering and Protection
4	Number of secondary windings	1
5	Rated normal burden*	200VA
6	Rated primary voltage	33KV/ $\sqrt{3}$
7	Rated secondary voltage	110V/ $\sqrt{3}$
8	Class of accuracy	0.5
9	Rated insulation level: (Primary winding) (Phase to earth)	
i)	One minute power frequency withstand voltage to earth (wet and dry) rms	70KV
ii)	Impulse withstand voltage to earth with 1.2/50 $\mu$ sec wave of +ve and -ve polarity (peak)	170KV
10	One minute power frequency withstand voltage of secondary winding (rms)	
i)	Between phase to earth	3KV
ii)	Between sections	3KV
11	Rated voltage factor	
i)	Continuous	1.2
ii)	For 30 seconds	1.5
12	Creepage distance to earth in mm per KV of highest phase to phase system voltage	25

\* The burden indicated is the minimum acceptable to the Owner. The Supplier shall ensure that the rated output of the voltage transformers is adequate to meet at least 120 percent of the connected load (burden).

### **7.2 GENERAL**

The voltage transformers to be supplied under this specification shall be of outdoor, single phase dead tank double wound, oil immersed type, complying with IEC:185 and IS:3156 suitable for operation in hot and humid atmospheric conditions described in this document. To prevent corrosion of the exposed surfaces, the tank should be not dip galvanized. They shall have separate HV and LV windings and shall be suitable for use as bus VTs in 33/11KV primary substations.

### **7.3 Duty requirement**

33KV Voltage transformer for all the indicating instruments and measuring meters in the primary substation on 33KV side.

### **7.4 Porcelain Insulator**



External parts of the voltage transformers which are under continuous electrical stress shall be of hollow porcelain insulators complying with latest edition of IS:6521 tested as per IEC:233. The creepage and flashover distance of the insulators shall be dimensioned and the type and profile designed in accordance with IEC:815 or IS:13134 and shall be suitable for the worst environmental conditions for heavily polluted atmosphere and shall be not less than 25mm per KV of highest phase to phase system voltage with protected creepage distance minimum 50 percent of the total. Internal surfaces of hollow insulators shall also be glazed.

The insulators shall be cemented with Portland cement to the flanges resulting in high mechanical, tensile and breaking strength.

All porcelain used on the voltage transformers shall have the following properties high strength, homogeneity, uniform glaze, free from cavities and other flaws and a high quality uniform finish porcelain components shall withstand the maximum expected static and dynamic loads to which the voltage transformers may be subjected during their service life.

The insulation of the hollow porcelain insulators shall be coordinated with that of the voltage transformers to ensure that any flash over occurs only externally.

### **7.5 Core**

High grade non-ageing cold rolled grain oriented silicone steel of low hysteresis loss and permeability shall be used for core so as to ensure accuracy at both normal and over Voltages. The flux density shall be limited to 1.6 Tesla at normal voltage and frequency. There shall be no saturation at any stage during operation.

The instrument security factor of the core shall be low enough so as not to cause damage to the instruments in the event of maximum short circuit current or over voltages.

### **7.6 Windings**

The primary and secondary windings shall be electrolytic copper of high purity and conductivity and covered with double paper insulation. The conductor shall be of adequate cross-section so as to limit the temperature rise even during maximum over voltages.

The insulation of windings and connections shall be free from composition liable to soften, ooze, shrink or collapse during service.

The current rating of the primary winding shall be one hundred and fifty percent of the normal rated burden and the windings shall be suitable to withstand continuously the maximum system voltage.

The secondary windings of the voltage transformers shall also be suitable for continuous over voltage corresponding to the maximum system voltage at the primary winding. The winding supports shall be suitably reinforced to withstand normal handling and the thermal and dynamic stresses during operation without damage.

The voltage transformer secondary circuits will be taken out to form the star point and earthed at one point outside the voltage transformers.

Both primary and secondary winding terminals shall be clearly and indelibly marked to show polarity in accordance with IEC:186. The connections required for different secondary windings in case of multi-winding voltage transformers shall be clearly indicated in terminal blocks and the wiring diagrams.

### **7.7 Tank**

Both expansion chamber and tank of the voltage transformers shall be made of high quality steel and shall be hot dip galvanized and shall be able to withstand the stress occurring during transit and all thermal and mechanical stresses resulting from maximum short circuit current during operation.

### **7.8 Insulating Oil**

The voltage transformers shall be supplied filled with new insulating oil. The oil shall conform to the requirements of latest issue of IEC:296 of IS:335. The quantity of insulating oil for first filling of the equipment and complete specification of oil proposed to be used shall be stated in the bid.



**7.9 Hermetic Sealing**

The voltage transformers shall be supplied filled with insulating oil and shall be hermetically sealed to prevent atmosphere coming in contact with oil, avoiding filtration and change of oil. Nitrogen or other inert gas shall be provided above the oil surface to permit expansion and contraction of oil. Provision shall be made for draining and re-filling the insulating oil.

**7.10 Fitting and Accessories**

Fittings and accessories listed below shall be supplied with each voltage transformer:

- Oil level gauge.
- Oil drain, sampling and filling hole with cap;
- Pressure relief device;
- HV terminals;
- Two earthing terminals with necessary nuts, bolts and washers;
- Name and rating plate;
- Secondary terminal box with LV terminal connections;
- Mounting nuts, bolts and washers;
- L.V HRC cartridge fuses for the protection of secondary winding;

Any other fitting deemed essential by the contractor shall also be supplied along with each voltage transformer:

The oil level gauge shall be mounted in such a way that the oil level can be clearly seen from the ground level.

The name and rating plate shall contain all the particulars as provided in IEC:186 and also the name of the employer and year of manufacture. They shall comply with the clause termed label in this specification.

**7.11 SECONDARY TERMINAL BOX**

A dust, vermin and weather proof terminal box shall be provided at the lower end of each voltage transformer for terminating the secondary windings. The box shall have a bolted removable cover plate complete with gaskets. The terminal box shall have cable gland plate and cable glands with shrouds suitable for entry of 4 core x2.5mm<sup>2</sup> PVC insulated control cables as per IEC:227 or IS:1554.

For 33KV Voltage Transformer one 4 core 2.5mm<sup>2</sup>

The terminal box enclosure shall have protection of class IP 55 as defined in IEC:529 or IS:13947 and shall be painted or galvanized in accordance with specification of Surface Treatment.

**7.12 Terminal blocks**

Terminal blocks of brass studs rated for 10 Amps continuous current, 650 Volt grade enclosed in moulded insulating materials shall be provided with adequate electrical clearance for terminating the secondary wiring and outgoing connections. The terminal blocks shall be suitable for termination of 2.5mm<sup>2</sup> wires. The termination shall be made by crimping Jugs or bare wire with insulating sleeves at ends. All terminals must be marked with numbers and wire termination provided with numbered ferrules for identification.

**7.13 Fuse protection**

The secondary windings shall be protected by HRC cartridge fuses in fuse holder consisting of carriers and bases. The carriers and bases shall be of high grade flame retarding and non hygroscopic moulded insulating materials with hard glass surface. Each fuse shall be identified with engraved plastic label.

**7.14 Circuit diagram**

A durable copy of the circuit wiring diagram shall be affixed to the inner side of the terminal box cover. Labels shall be provided inside the cover to describe the functions of various items of equipments.

**7.15 TERMINATION**

The equipment shall be supplied with HV electrical connection terminals of a size and rating appropriate for all the duties, including overload duty specified for the equipment. The terminals shall be of the bi-metallic type, suitable for connection of all aluminium alloy conductor (AAAC) or aluminium conductor steel reinforced (ACSR). In general connections using palm type solderless sockets shall be preferred. The proposed method of connections shall be stated in the offer and shall be subject to approval by the DGM (Tech.), CSO. Where the terminals are of the clamp type, they shall be suitable for taking a range of conductors appropriate to the rating of the equipment.

All nuts, bolts, washers and spring washers required to complete the connection shall be supplied with the equipment.

**7.16 EARTHING TERMINAL**

Two earthing terminals complete with necessary hardware shall be provided on each voltage transformer for connecting to earth continuity conductors of the Employer. They shall be of electroplated brass and of adequate size to carry the earth fault current. The earthing terminals shall be identified by means of appropriate symbol marked in a legible and indelible manner adjacent to the terminals.

**7.17 TEST AND INSPECTIONS**

The voltage transformers shall be tested in accordance with the requirements of the type tests and routine tests as provided in the latest issues of IEC:186 or IS:3516.

The tests to be conducted shall include;

**7.17.1 Type tests:**

- Lightning impulse voltage test;
- High voltage power frequency wet withstand voltage;
- Temperature rise test;
- Short circuit withstand capability test;
- **Determination of limits of voltage error and phase displacement.**

**7.17.2 Routine tests:**

- Verification of terminal marking and polarity;
- Power frequency withstand tests on primary winding;
- Power frequency dry withstand tests on secondary winding;
- Power frequency withstand tests between sections;
- Determination of limits of voltage errors and phase displacement;
- Partial discharge measurement.
- Insulating Resistance measurement.

**7.18 TEMPERATURE RISE**

The temperature rise of any part of the voltage transformer under continuous operating and exposed in the direct rays of the sun shall not exceed the permissible limits as provided in IEC publication 186 or IS: 3156. These shall not be exceeded when corrected for the difference between the ambient temperature at site and the ambient temperature specified in the standard. The correction proposed shall be stated in the bid.

**8 PROTECTIVE RELAY & CONTROL PANEL**

Outdoor control panels with protective relay and meter shall be provided by the supplier suitable for above breakers. The equipment shall have protection scheme with the following relays:

(i) Triple pole IDMTL type combined over current (2Nos) & Earth fault (1No) relay (Draw out type) preferably Non communicable numerical relay.

Plug setting range of the over current and earth fault relays shall be 5% to 250%.

- (ii) 3 elements auxiliary relay for transformer fault, trip for Buchholz, winding temperature & oil temperature.
  - (iii) Master trip relay for inter tripping.
  - (iv) Differential relay.
  - (v) One alarm bell scheme with bell (24V DC).
- N.B:- The relays should be Areva, Easun Rerolle, ABB or of any reputed make (subject to approval)

## **9. METERS:**

The following meters shall be provided.

- i) Ammeter:- 1 No. , 0-100-200 A/ 1 Amp Preferable Make- IMP/ AE or any reputed make (Dial type or Digital).
- ii) Volt meter:- 1 No., 0- 40 KV (size :144mm x 144mm), make IMP/AE or any reputed make (Dial type or Digital).
- iii) Ammeter selector switch- 1 No. Make – Kaycee or any other reputed make.
- iv) Volt meter selector switch- 1No. Make- Kaycee or any other reputed make.
- v) 40 watt lamp with switch- 1 No.
- vi) Plug & Socket- 1 No.
- vii) Fuses & Links- 1 No.

viii) Test terminal Blocks- Test terminal Block need be provided for testing relays & breakers.

- ix) Indication Lamp- (24V DC LED type)
  - Red- Breaker 'ON'
  - Green Breaker 'OFF'
  - Amber- Breaker 'AUTO TRIP'
  - Blue- Spring charge indication.
  - White-Healthy Trip illuminated push bottom switch

## **10. OTHER EQUIPMENTS**

### **10.1 Out Door Control- Relay Panel**

#### **10.1.1 1. General**

The electrical controls, relays, instruments, meters, annunciation scheme shall be provided in a sheet steel enclosure conforming to IEC:298 or IS:3427 mounted on support base on the floor. The panel shall be free standing, dust, moisture and rodent and vermin proof suitable for outdoor installation. The panel shall have a high degree of protection for outdoor installation with relevant standard.

Each panel shall comprise of rigid welded structure frame enclosed completely by metal sheet of thickness not less than 2mm. The sheets shall be cold rolled with smooth finish leveled and free from flaws. The structural frame and all load bearing members of the enclosure shall have minimum thickness of 2.5mm.

The enclosure shall have hinged door at the front and back for access to the low voltage wiring. All door panels and removable covers shall be gasketed all round with neoprene bonded gasket. Ventilating louvers shall be provided to limit the temperature rise as provided in IEC: 694 and 298 or IS:12729 and 3427. They shall be provided with filters encased in fine wire screens for non-ferrous metal or stainless steel unaffected by moisture and rain water. A 230V AC heater with auto temperature control shall be provided in the cabinet to prevent moisture condensation.

The housing shall be surface treated and painted in accordance with the clause on Surface Treatment of this specification.

### **10.1.2 Panel wiring and accessories.**

#### **10.1.3 Wiring**

Each panel shall be supplied with all internal wiring complete.

Panel wiring shall be suitably bunched and clamped for neat appearance. The conductors used for wiring purpose shall be PVE insulated 650/1100 volt grade semi-flexible heat resistant, flame retardant and vermin proof electrolytic copper cable conforming to IEC:227, 502 or IS:1554. The wiring shall be securely supported and taken through PVC troughs. Each wire shall be continuous from end to end without any joint in between. All panel wiring shall be capable of withstanding a voltage of 2KV AC 50Hz for one minute.

Cable and wire for connections within the switchgear and between the switchgear and terminal blocks shall have a minimum temperature rating of 90 degree Celsius. The size of the conductors for panel wiring shall be not less than 2.5mm<sup>2</sup>. For CT secondary wiring, two such wires shall be used in parallel.

#### **10.1.4**

##### **Panel wiring protection**

The panels shall be equipped with links and HRC cartridge fuses conforming to IEC:269 or IS:13703 in 650 Volt grade phenolic moulded fuse holder consisting of fuse carrier and base or miniature circuit breakers conforming to IEC:947-2 or IS:13947-2 at appropriate locations. The carriers and bases shall be made of high grade flame retardant and non hygroscopic phenolic moulded material with hard glass surface. Each fuse or MCB shall be identified with engraved plastic label.

In general, fuses and MCBs shall be limited to the minimum required for safety. The protection scheme shall include fuses for VT secondary circuits and DC supply to each panel and fuses for MCB for spring charging motor and incoming AC supply.

#### **10.1.5 Terminal blocks**

Terminal blocks of brass studs rated for 10 amps continuous current, 650 volt DC grade covered by moulded insulating materials with adequate electrical clearances shall be provided for terminating the panel wiring and outgoing connections. The termination shall be made by crimping lugs or bare conductor with insulating sleeves at ends. The arrangement can be horizontal or vertical as per standard practice adopted by the manufacturer. All terminals must be numbered and wire termination provided with numbered ferrules for identification. All numbering and marking including those in wiring diagram shall follow the guidelines provided in IS:11353. All circuit breaker auxiliary contacts including spare contacts shall be wired to the terminal blocks. Ten percent spare terminals shall be provided.

The CT Terminal Box should be bolted Type with stud dia 6mm & length 15mm with 3nos. of nuts. The distance from stud to stud be 1.5times the outside circular dia of nuts.

#### **10.1.6 Colour and numbering**

The wiring used for 230V AC supply for illumination lamp, panel heater and other devices shall be coloured red for phase wire and black for the neutral. The colour of wires connecting directly to Earth shall be black. All other panel wires shall be of one colour to be approved.

Engraved core identification plastic ferrules marked to correspond with the panel wiring diagram shall be fixed at both ends of each wire. Ferrules shall fit tightly on the wire and shall not fall off when the wire is disconnected from the terminal block. Numbers 6 and 9, if used shall be under scored to enable differentiation.

#### **10.1.7 Circuit diagram**

A durable copy of the circuit wiring diagram shall be affixed to the inner side of the door of the switchgear compartment. Labels shall be provided inside the compartment to describe the functions of the various items of equipment.

The scope of the supply shall include the panel mounting base plate and all special equipment, bolts, nuts and washers necessary for making the supporting.

### **Supporting Structure**

#### **10.2**

The supply of the material shall be complete with mounting structures of mild steel sections conforming to IS: 226 or equivalent ISO. The supporting structure shall be designed and constructed to withstand the maximum combined effects of the circuit breaker dead weight, its maximum dynamic load and maximum effect of wind loading. The supporting structure shall be hot dip galvanized as per clause on surface treatment of this specification.

### **CT and PT mounting bracket**

#### **10.3**

The supporting structure shall be fitted with a bracket for supporting the three oil filled 33KV single phase current transformers and 3 nos. 33KV(1 Phase)PTs. The support bracket shall be provided opposite the circuit breaker poles and shall ensure adequate clearance between the breaker poles and the CTs as well as between the CTs and PTs. The CTs & PTs shall be supplied by the Supplier as per specification above and is included in the scope. The drawings of the structure with bracket shall be subject to Owner's approval before fabrication.

The CT and PT mounting bracket shall be hot dip galvanized as per clause on surface treatment of this specification.

#### **10.4 Local control cabinet**

The operating mechanism, local controls and monitoring shall be provided in a metal clad control cabinet fitted to the same structure supporting the breaker and mounted at a convenient height for safe operation from ground level or from platform to be supplied under the contract.

The cabinet shall be made of minimum 2 mm sheet steel and shall be constructed as a dust, weather and vermin proof outdoor housing with protection of IP-54 class as defined in IEC:529 or IS:13947. It shall have single door and transparent windows for reading the circuit breaker ON or OFF position and spring charge position without opening the door. The door and any removable covers shall be gasketed all round with neoprene bonded gaskets. A ventilating louver shall be provided with fine wire non-ferrous metal or stainless steel screen and filter. A 230V AC heater with auto temperature control shall be provided in the cabinet to prevent moisture condensation and also a 230 volt lamp for internal illumination with door operated switch.

The local control cabinet shall be subjected to surface treatment and painting as per clause on surface treatment of this specification.

#### **10.5 Panel wiring and accessories**

Panel wiring shall be suitably bunched and clamped for neat appearance. The conductor used for wiring purpose shall be PVC insulated 650 volt/ 1100V grade semi-flexible copper cable conforming to IEC:227 or IS:1554, heat resistant, flame, vermin and rodent proof. The wiring shall be securely supported and taken through PVC troughs. All panel wiring shall be capable of withstanding a voltage of 2KV AC 50Hz for 1 minute. Each wire shall be continuous from end to end without any joint in between.

The sizes of the control cable for wiring in the cabinet shall be not less than 2.5mm<sup>2</sup>. CT secondary wiring shall be though two such wires in parallel.

##### **10.5.1 Fuse protection**

The cabinet shall be equipped with links and HRC cartridge fuses in 650 volt grade fuse holders consisting of fuse carrier and base. The holders shall be made of high grade, flame retardant and non hygroscopic phenolic moulded material of dark brown colour with hard glass surface. Each fuse shall be identified with engraved plastic labels.

### **10.5.2 Terminal blocks**

Terminal blocks rated for 10 amps continuous current, 650 volt grade covered by moulded insulating materials with adequate electrical clearances shall be provided for terminating the panel wiring and outgoing connections. The termination shall be made by crimping lugs or bare wire with insulating sleeves at ends. The arrangement can be horizontal or vertical as per standard practice adopted by the manufacturer. All terminals must be numbered and wire termination provided with numbered ferrule for identification. All numbering and marking include those in wiring diagram shall follow the guidelines provided in IS: 11353. Ten percent spare terminals shall be provided.

### **10.5.3 Colours**

The wiring used for AC supply for illumination lamp and heater shall be differently coloured from control wiring so that these can be distinguished from each other. The colour of all earth wire shall be black.

### **10.6 Circuit diagram**

A durable copy of the circuit wiring diagram shall be affixed to the inner side of the control cabinet. Labels shall be provided inside the cabinet to describe the functions of the various items of equipment.

### **10.7 Cable Entry**

A removable gland plate shall be provided at the bottom of the cabinet for entry of Owner's control and auxiliary power cables in the cabinet. Required number of electroplated brass cable glands of appropriate sizes with shrouds shall be provided in consultation with the Owner in the gland plate for the control and power cables. Provision shall be made for earthing of the cable armours in the gland.

## **11 OPERATING MECHANISM**

### **11.1 General**

The operating mechanism of the circuit breaker shall be motor wound spring charged type. It shall be electrically and mechanically trip free with anti pumping device (as per IEC:694 definition). All working parts in the mechanism shall be of corrosion resistant material. Self lubricating, wearing resistant bearings shall be provided in the mechanism.

The mechanism shall fully close the circuit breaker and sustain it in the closed position against the forces of the rated making current and shall fully open the circuit breaker without undue contact bounce at a speed commensurate with that shown by tests to be necessary to achieve the rated breaking capacity in accordance with IEC:56 or IS:13118. The mechanism shall be capable of being locked in either the open or closed position. The mechanism shall be capable of fully closing and opening again after the auto-reclose time interval specified as 0.3 second in this specification.

### **11.2 Spring mechanism**

The spring operating mechanism shall be with spring charging motor, opening and closing springs with limit switches and all accessories necessary for automatic charging. In normal operation, recharging of the operating springs shall commence immediately and automatically upon completion of the closing operation so that a complete sequence of closing and opening operation should be possible.

It shall be possible to hand charge the operating spring with the circuit breaker in either the open or closed position conveniently from the ground level. Closure whilst a spring charging operation is in progress shall be prevented and release of the springs shall not be possible until they are fully charged.

The state of charge of the operating springs shall be indicated by a mechanical device showing '**SPRING CHARGED**' when closing spring is fully charged and operation is permissible and '**SPRING FREE**' when closing spring is not fully charged and the operation is not possible. Provision shall be made for remote electrical indication of 'Spring Charged' and 'Spring Free' conditions.



The operating mechanism shall be such that the failure of any auxiliary spring shall not cause tripping or closing the circuit breaker but shall not prevent tripping against trip command.

Closing action of the circuit breaker shall charge the opening spring ready for tripping. From the close position with spring charged, one open-close-open operation shall be possible without recharging the spring.

### **11.3 Motor**

The motor for spring charging shall be single phase 230 Volt A. C motor. Continuous motor rating shall be at least ten percent above the maximum load demand of the driven equipment. It shall remain within its rated capacity at all operating points that will arise in service. It shall be protected by H.R.C cartridge fuses or MCB. The motor shall comply with IEC: 34 or IS:996.

## **12. AUXILIARY POWER SUPPLY**

The operating mechanism shall be suitable to operate with the following auxiliary power supplies.

- a) 230V,50Hz Single phase For spring charging motor  
A.C-
- b) DC supply 24 Volts- For close and open coils, indication & Alarm

(Power pack input supply: 230V & 110V AC and Output: 24V DC)

The DC supply shall be from a Power Pack. The Input to Power Pack is 110V from PT and 230V from main supply. The power pack should be capable for minimum 3 Trippings even if input to power pack is failed.

The mechanism shall be designed to operate satisfactorily despite fluctuations of auxiliary power supplies as under:

- AC supply:
  - Voltage From 115% to 85% of normal voltage
  - Frequency From 105% to 95% of normal frequency
  - Combined voltage and frequency variation From 115% to 85% of normal
- DC supply:
  - Voltage From 120% to 70% of normal voltage

## **13. INTERLOCKS**

The circuit breaker shall be capable of being mechanically and electrically interlocked with the associated line isolator so that the isolator cannot be operated with the breaker in the closed position.

All doors or shutters which give access to live parts shall be interlocked in such a way that these cannot be opened unless the circuit breaker is in the open position.

Other interlocks shall be provided as deemed necessary for safety.

## **PROTECTION AND METERING**

### **14.**

Protective relays and metering will be provided in a control panel by separate agency in Owner's control room. The circuit breaker shall be particularly suitable for the following protection schemes:

- Inter-tripping for simultaneous tripping other circuit breaker.

### **15. TERMINAL CONNECTOR**

Suitable terminal connectors of bi-metallic type suitable for both horizontal and vertical connection shall be provided on the terminal pad both on the incoming and the outgoing side for connection of jumpers of ACSR or AAAC conductor. The size of the conductor may vary between 50mm<sup>2</sup> and 232mm<sup>2</sup> depending upon the location of the circuit breaker. The terminal connection drawing and details are to be approved by the Owner before fabrication. The terminal connectors shall be bi-metallic type to avoid bi-metallic corrosion.

### **16. INSULATION AND CLEARANCE**

a) The insulation to ground, the insulation between open contacts and insulation between phases of the circuit breaker shall be capable of satisfactorily withstanding dielectric test voltages.

b) The minimum clearance in open air shall be as follows:

- Between poles - 460mm
- Phase to earth - 400mm
- Ground clearance for live part - 3700mm

## **17. TEMPERATURE RISE**

The temperature rise and the maximum temperature of any part of the circuit breaker under continuous load condition and exposed in the direct rays of the sun shall not exceed the permissible limits as provided in Table V of IEC publication 694 or table 4 of IS:12729. These limits shall not be exceeded when corrected for the difference between the ambient temperature at site and the ambient temperature specified in the standard. The correction proposed shall be stated in the tender.

## **18. TESTS**

### **18.1 Type and routine tests**

The circuit breakers shall be subjected to routine and type tests in accordance with the standards listed in this specification including the following IEC and IS standards with the latest amendments:

- Circuit breaker IEC: 56 and IS:13118 and relevant other standards
- Porcelain insulator IEC: 233 and IS:5621 and relevant other standards

The tests shall include but not limited to the following:

### **18.2 Short circuit tests**

The circuit breaker shall satisfactorily perform the out of phase and short circuit duties specified in IEC: 56, IEC: 17A(Sect.) and IEC:17A/CD/474, IS-13118 and IS:13516.

The circuit breaker shall be capable of performing at least twenty five (25) open operations at the rated short circuit current before maintenance or inspection is required.

### **18.3 Capacitive current switching**

Capacitive switching tests shall be performed in accordance with IEC:56 or IS:13118 and IEC:17A/CD/474 at 1.3U preferably by direct test method or alternatively using synthetic method to IEC:427 or IS:13516. The test circuits shall simulate the most onerous site conditions.

### **18.4 Reactor Switching**

In addition to the capacitive current switching tests to IEC:56 or IS:13118 and IEC:17A/CD/474, the circuit breakers shall be tested for shunt reactor switching in accordance with IEC:1233, Examination of the interrupter after the tests shall not show any evidence of surface tracking or erosion of contracts.

### **18.5 Dielectric tests**

At zero gauge loss of vacuum inside the interrupter chamber, the open contracts shall withstand continuously, the rated phase to ground voltage and it shall be possible to break normal current in these conditions. During the dielectric type tests, no flashover external or internal shall be acceptable.

The circuit breakers shall be subjected to a power frequency AC voltage test for one minute in dry and wet conditions and there shall be no external flash over to earth.

### **18.6 Mechanical endurance**



In addition to the requirements of IEC:56, an extended mechanical endurance test is required to show that the circuit breaker is capable of at least 10,000 operations at no load in accordance with IEC:17A/474/CD. Between the specified test series in IEC: 17A/474/CD, some maintenance such as lubrication and mechanical adjustment is allowed and shall be performed in accordance with manufacturer's instructions. Change of contracts is not permitted.

**18.7 Low current switching**

The circuit breakers shall produce very low over voltage (<2.0 pu) on all switching circuits inductive current including reactor switching to IEC-1233 and capacitive current switching to IEC:17A (Secretariat) 438 and IEC 17A/CD/474 the circuit breaker shall be re-ignition or re-strike free for all duties.

**18.8 Duty requirement tests**

Apart from auto-reclosing and the other duties mentioned above, the breakers shall be able to perform the following duties for which type tests are to be conducted as per IEC:56 or IS:13118.

1. Breaking the steady and the transient magnetizing current of the transformer.
2. Breaking 25% of rated fault current at twice the rated voltage as per IEC/IS.
3. Cable charging breaking current.
4. Back-to-back capacitor bank breaking current.
5. Single capacitor bank breaking current.
6. Capacitor bank in rush making current.

Test for the resistance of the main circuit shall also be conducted.

**18.9 Temperature rise test**

Temperature rise test is to be conducted on the circuit breaker and the accessories in accordance with IEC:56 or IS:13118. The temperature rise shall be limited as per this specification.

**19. PERFORMANCE REQUIREMENTS**

The supplier shall declare the circuit breaker opening and closing times at 120 percent, 100 percent and 70 per cent of the rated voltage of the opening and closing devices when measured at the terminals of the trip and closing coils. The minimum make break time at rated voltage and total break time of the CB shall be stated. The total break time must not exceed 60m.sec.

**20. EARTHING**

All metal parts not intended for carrying current or not alive shall be connected to duplicate earthing system and suitable electroplated brass earthing terminals shall be provided on each circuit breaker in conformity with IEC:56 or IS:13118. Suitable identification mark for the earth terminals shall be provided adjacent to the terminal.

Earth continuity conductors shall be provided down to the ground level for earth connection to owner's earthing grid. It shall have sufficient cross sectional area to afford a low resistance path for the full fault current envisaged. Such conductor shall also be provided for the CTs up to the ground level.

The size of the earth continuity conductor shall be large enough to reduce the potential rise of the metal frame of the breaker in the even of fault to minimum but in any case not more than 10V. The size of the conductor shall also be adequate to restrict the temperature rise without causing any damage to the earth connection in the case of fault. No riveted joints in the earth conducting path shall be permissible and only bolted joints of adequate size shall be provided with nuts, bolts and plain and spring washers. The surfaces to be jointed shall be perfectly flat without any unevenness to ensure that there is no contact resistance.

### **C) TECHNICAL SPECIFICATION FOR 11 KV OUTDOOR VACUUM CIRCUIT BREAKERS**

#### **1. SCOPE**

- 1.1 This specification covers design, engineering, manufacture, testing, inspection before dispatch packing, forwarding, transportation, insurance during transit, delivery to site/stores of 11 KV Outdoor Vacuum Circuit Breakers for use the 33/11KV primary substations under the distribution networks of SOUTHCO.
- 1.2 All vacuum circuit breakers must be manufactured by ISO 9000 certified Organization and shall have been type tested at CPRI or any NABL Accredited laboratory/PHELA/KERI/KEMA/CESI laboratory within five years as on the date of bid opening and in satisfactory operation for a period not less than three years. The Bidder shall demonstrate compliance with this requirement by supplying with the bid, copies of the type test certificates together with performance certificates from owners/ users.
- 1.3 The scope of supply includes the provision of type tests at CPRI or any NABL Accredited laboratory/PHELA/KERI/KEMA/CESI laboratory within last five years.
- 1.4 The scope also includes the circuit breaker and current and potential transformers, supporting structures, operating mechanism, local/ remote control cabinet, relay control panel, foundation bolts, all the accessories and auxiliary equipment mandatory spares and special tools for satisfactory installation and operation.
- 1.5 The circuit breakers shall conform in all respects to the highest standards of engineering, design, workmanship, this specification and the latest revisions of relevant standards at the time of offer and the owner shall have the power to reject any work or materials, which, in his judgment, is not in full accordance therewith.

#### **2. STANDARDS**

Except where modified by this specification, the circuit breakers and the accessories shall be designed, manufactured and tested in accordance with latest editions of the following standards.

**Dy. General Manager (Tech, Proj & MRT) Southco, Berhampur**

<b>IEC/ISO/BS</b>	<b>IS</b>	<b>Subject</b>
IEC: 56	IS: 13118	High voltage alternating current circuit breakers general requirement.
IEC: 694	IS: 12729	Common clauses of high voltage switch-gear and control gear standards (for voltage exceeding 1000 V).
IEC: 60	IS: 9135	High Voltage testing techniques.
IEC: 427	IS: 13516	Method of synthetic testing of HV .A.C circuit breakers.
IEC: 1233		HV. AC. Circuit breakers- inductive load switching.
IEC: 17A/CD:474		HV. AC. Circuit breakers- capacitive switching.
IEC: 529	IS: 13947	Degree of protection provided by enclosure.
IEC: 137	IS: 2099	Insulating bushing for A.C. voltages above 1000V
IEC: 233	IS : 5621	Hollow insulators for use in electrical equipment & testing.
IEC: 273	IS: 5350	Characteristics of indoor and outdoor post insulators for systems with nominal voltages greater than 1000V.
IEC: 815	IS: 13134	Guide for selection of insulators in respect of polluted conditions.
IEC: 34	IS: 996	A.C motors
ISO: 1460 BS: 729	IS: 2629	Hot dip galvanizing
	IS: 2633	Method of testing uniformity of zinc coated articles.
	IS: 5	Colour for ready mixed paints and enamels
	IS: 6005	Code of practice for phosphating or iron and steel.
IEC: 227	IS: 1554	P.V.C Insulated cables for voltages up to and including 1100 Volt.
IEC: 269	IS: 13703	Low voltage fuses for voltages not exceeding 1000volt.
ISO: 800	IS: 1300	Phenolic moulding materials.
	IS: 13118	Guide for uniform marking and identification of conductors and apparatus terminals.
IEC: 185	IS: 2705	Current transformers.
IEC: 296	IS: 335	Specification for unused insulating oil for transformer and switchgear.
IEC:186	IS: 3156	Potential transformers.
CBIP Technical Report No. 88 revised July, 1996 read with amendment issued (April, 99, September, 99 and also any other amendment thereafter)		Specification for AC Static Electrical Energy Meter.

This list is not to be considered exhaustive and reference to a particular standard or recommendation in this specification does not relieve the Supplier of the necessity of providing the goods and services complying with other relevant standards or recommendations.

**3. REQUIREMENTS**

The circuit breakers to be supplied against this specification shall be required to control the secondary side of 33/11 KV power transformers in the primary sub-stations or Bus coupler or the outgoing feeders in these sub-stations. The circuit breakers shall be suitable for 3 phase 50Hz solidly grounded neutral system and shall have normal current carrying capacity and symmetrical short circuit current breaking capability as mentioned hereunder.

The required 11 KV Vacuum Circuit Breakers suitable for outdoor installations are to be quoted by Manufacturers only with a valid ISO 9000 certification.

**3.1 BASIC TECHNICAL REQUIREMENTS:**

The vacuum circuit breakers are required to meet the following basic technical requirements. (Reference standards IEC: 56, IS:13118 and associated standards listed in this specification.

**Basic Technical Requirements**

<b>Sl. No</b>	<b>Particulars</b>	<b>Requirements</b>
1	Service type	Outdoor
2	No. of Poles	3
3	Nominal system voltage	11 KV
4	Highest system voltage	12 KV
5	Rated normal current at 50 <sup>0</sup> C	
i)	For Bus-bar of Circuit Breaker	800 A
ii)	For Interrupter	1250 A
iii)	For Outgoing Feeders	630 A
6	Rated short circuit breaking current (rms)	25KA
7	Rated short circuit making current (peak)	63KA
8	Rated short time current withstand capability for 3 sec.	25KA
9.	Rated insulation level:	
i)	One minute power frequency withstand voltage to earth (wet and dry) rms	28 KV
ii)	Impulse withstand voltage to earth with 1.2/50 $\mu$ sec, wave of +ve and -ve polarity (Peak)	75 KV
10	First – pole – to clear factor	1.5
11	Rated operating sequence (for auto reclosing)	O-0.3 Sec- CO-3 min-CO
12	Maximum break time	3 cycles
13	Rated out of phase breaking current	25% of the symmetrical short circuit breaking current
14	Maximum pole scatter	10 mille seconds
15	Rated Auxiliary supply for spring charge motor, lamp & heater circuit.	230V A.C
16	Rated supply voltage for trip/close coil	24V D.C
17	Minimum creepage distance (mm)	350 mm
18	Minimum protected creepage distance (mm)	280 mm

**4. SERVICE CONDITIONS:**

The service conditions shall be as follows:

- ◆ Maximum a altitude above sea level 1,000m
- ◆ Maximum ambient air temperature 50<sup>0</sup>C
- ◆ Maximum daily average ambient air temperature 35<sup>0</sup>C
- ◆ Minimum ambient air temperature 5<sup>0</sup>C
- ◆ Maximum temperature attainable by an object exposed to the sun 60<sup>0</sup>C
- ◆ Maximum yearly weight average ambient temperature 32<sup>0</sup>C
- ◆ Maximum relative humidity 100%
- ◆ Average number of thunderstorm days per annum (isokeraunic level) 70
- ◆ Average number of rainy days per annum 120
  
- ◆ Average annual rainfall 1500mm
  
- ◆ Maximum wind pressure 260Kg/m<sup>2</sup>

**5. 11 KV VACUUM CIRCUIT BREAKERS**

**5.1 General**

The circuit breakers shall be structure mounted open type with vacuum as interrupting media incorporating separate interrupters of **1250 A** rating for each phase mounted on single frame. There shall be a common drive mechanism actuating the interrupters, which must work in synchronism. These breakers shall be provided with suitable local control while provision shall be made for remote control.

The circuit breakers shall be fitted with spring mechanism. The inherent design of these circuit breakers shall be such that they shall satisfactorily perform all test duties and interrupt out-of-phase current and produce very low over voltage (<2.0p.u.) on all switching circuits, capacitive and inductive to IEC:56, IS:13118 and other associated standards mentioned in the clause of this specification.

The terminal pads shall have silver-plating of at least 50 micron thickness. The design of the circuit breakers shall be such that inspection and replacement of contacts, coils, vacuum bottles and any worn or damaged components can be carried out quickly and this ease. The contact gaps shall be adjustable to allow for wear.

The mechanism and the connected interrupters shall satisfy the mechanical endurance requirements of IEC: 56, IS: 13118 and all additional requirements specified herein.

## **5.2 Porcelain Insulator**

External parts of the circuit breakers, which are under continuous electrical stress, shall be of hollow porcelain. The creepage and flashover distance of the insulators shall be dimensioned and the type and profile designed in accordance with IEC:815 or IS: 13134 and shall be suitable for the worst environmental conditions specified in this specification. The creepage distance across the interrupting chambers shall suite the outdoor service conditions mentioned in the relevant standards for heavily polluted atmosphere and shall be not less than 350 mm with minimum protected creepage distance 280 mm. Internal surfaces of hollow insulators shall also be glazed. The insulators shall comply with IS:5621 and tested in accordance with IEC:233.

All porcelain whether, used on the interrupting chamber or on the support insulator shall have the following properties:

Higher strength, homogeneity, uniform glaze, free from cavities and other flaws and high quality uniform finish porcelain components and shall withstand the maximum expected static and dynamic loads to which the circuit breakers may be subjected during their service life.

## **5.3 Interrupting media**

### **5.3.1 Vacuum:**

In vacuum circuit breakers, facilities shall be provided for monitoring the contact erosion and any change in contact gap. The vacuum bottles shall be easily replaceable on site and the mechanism shall be conveniently adjustable to permit resetting the contact gap.

The vacuum circuit breaker poles shall be sealed to prevent contamination of the spaces surrounding the interrupters. The Bidder shall demonstrate how this is achieved by supplying technical details with the bid.

## **5.4 Auxiliary contacts**

12 auxiliary contacts (6N.O + 6N.C.) of 24 Volt D.C grade and 10 amps DC rating shall be provided in each circuit breaker.

## **5.5 Indication**

A mechanically operated circuit breaker position indicator of non corroding material shall be provided in a location visible from the operating side of the breaker without the necessity to open the mechanism door. The word 'OFF' in white letter on green background shall be used to indicate that the breaker is in the opening position and the word 'ON' in white letters on a red background to indicate that the breaker is in the closed position. The drive for the device shall be positive in both directions and provision shall be made for local and remote electrical indication.

Indication of spring charging condition shall be provided as mentioned in this specification. Mechanical counters to record the number of closing operations shall be provided for each circuit breaker mechanism.

## **5.7 Operation and controls**

The breaker shall normally be operated by remote electrical control with electrical tripping by shunt trip coil. Provision shall be made for local electrical operation and mechanical operation.

The following facilities shall be provided in the circuit breaker local control cabinet:

- LOCAL/ REMOTE selector switch of stay put type. The selection of 'local' operation shall inhibit the operation of the breaker from any remote source.
- ON/NEUTRAL/ OFF control switch or ON and OFF push buttons. The push buttons shall be momentary contract type with rear terminal connections. The close push button shall be of green colour and the open push button red colour.
- MECHANICAL EMERGENCY TRIP DEVICE: suitable for manual operation in the event of failure of electrical supplies. The device shall be accessible without opening any access doors and distinctly labelled. It shall be shrouded and protected against inadvertent operation.
- Means shall be provided for manual operation of these circuit breakers during failure of auxiliary power in addition to electrical operation.
- Means shall be provided to prevent the mechanism from responding to a close signal when the trip coil is energized or to reclosing from a sustained close signal either opening due to a trip signal or failure to hold in the closed position.

The circuit breaker shall be able to perform 10,000 operating cycles at no load in accordance with IEC: 17A/474/CD for circuit breakers for auto reclosing duties.

## **6. CURRENT TRANSFORMERS**

Current transformers, three per circuit breaker, shall be of outdoor, single phase oil immersed dead tank type and shall comply with IEC:185 and IS:2705, suitable for operation in hot and humid atmospheric conditions described in service condition. They shall be mounted on the bracket. The CT tank should be Hot Dip galvanized as per relevant ISS to prevent corrosion of all exposed metal parts.

### **6.1 Core**

High grade non- ageing cold rolled grain oriented (CRGO M4 or better grade) silicon steel of low hysteresis loss and permeability shall be used for the core so as to ensure specified accuracy at both normal and over currents. The flux density shall be limited to ensure that there is no saturation during normal service.

The instrument security factor of the core shall be low enough so as not to cause damage to the instruments in the event of maximum short circuit current.

### **6.2 Windings**

The secondary windings shall be made of electrolytic copper with suitable insulation. The conductor shall be of adequate cross- section so as to limit the temperature rise even during short circuit conditions. The insulation of windings and connections shall be free from composition liable to soften coze, shrink or collapse during service.

Polarity shall be indelibly marked on each current transformer and at the lead and termination at associated terminal blocks. CTs with multi ratio winding shall be clearly tabulated to show the connections required for different ratios. Similar numbers shall be marked on terminal block arrangement and wiring diagram. Apart from the above marking and those to be provided as per IEC 185 or IS 2705, other markings shall be provided in consultation with owner.

The continuous current rating of the primary winding shall be one hundred and fifty percent of the normal rated current. Secondary windings of current transformers shall be used for metering, instrumentation and protection and shall be rated for continuous current of one hundred and fifty percent of normal rated current of primary winding.

**6.3 Construction**

The current transformer enclosures shall be made of high quality steel and shall be hot dip galvanized and shall be able to withstand stresses occurring during transportation and the terminal and mechanical stresses resulting from maximum short circuit current in service. The primary winding and terminals shall be in a tank and supported by a hollow porcelain insulator. The secondary connection shall be conducted through the hollow insulator and terminated in a terminal box mounted on the base plate.

**6.4 Hermetic sealing**

Each current transformer shall be supplied filled with insulating oil complying with IEC: 296 or IS: 335 and shall be hermetically sealed to prevent atmosphere coming in contact with oil, avoiding frequent filtration and change of oil. Nitrogen or any oil inert gas above the oil level shall be provided to permit expansion and contraction of oil without any contact with the atmosphere.

The current transformers shall have provision for draining and re-filling insulation oil after drying.

**6.5 Insulating oil**

The current transformer shall be complete with new insulating oil. The quantity of insulating oil for first filling of the equipment and complete specification of oil proposed to be used shall be stated in the bid. The oil shall conform to the requirements of latest issue of IEC: 296 or IS: 335.

**6.6 Fittings and accessories**

Fittings and accessories listed below shall be supplied with each current transformer:

- Oil level gauge;
- Oil filling hole and cap;
- Pressure relief device;
- HV terminal connectors;
- Two earthing terminals and strips with necessary nut, bolts and washers;
- Name and rating plate;
- Terminal box with LV terminal connections;
- Mounting nuts, bolts and washers;

Any other fittings deemed essential by the Supplier shall also be supplied with each current transformer.

The oil level gauge shall be mounted in such a way that the oil level can be clearly seen from ground level.

A dust, vermin and weather proof terminal box shall be provided at the lower end of the current transformer for terminating the secondary windings. The box shall have a bolted cover plate complete with gaskets. The terminal box shall have terminal blocks, cable gland plate and cable glands with shrouds suitable for different sizes of PVC insulated control cables 650/1100V grade as per IEC:227 or IS:1554. The terminal blocks shall have covering of moulded insulation materials complete with brass studs, washers, nuts and lock nuts suitable for termination of 2X2.5 sqmm wires. The termination shall be made by crimping lugs or bare wire with insulating sleeves at ends.

The terminal box enclosure shall have protection as per class IP 55 as defined in IEC: 529 or IS: 13947.

**6.7 CT Junction Box/Console Box**



Each set of 3 current transformers for three phase shall be provided with a common junction box mounted on the circuit breaker supporting structure at a convenient position to accommodate the secondary wire of CT and other control cables of Owner. Separate terminals for testing the relays and instruments and short circuiting of each current transformer secondary wires shall be provided in it. The junction box enclosure shall have the same protection features as for the terminal box. It shall be provided with terminal blocks, gland plates and glands suitable for different sizes of cables. Facilities shall be provided for earthing the CT secondary wires in the junction box.

**6.8 Hollow porcelain insulators**

The insulators of the current transformers shall conform to latest edition of IS: 5621 and shall be subjected to and successfully pass the tests listed in this standard and in IEC: 233. The hollow porcelain insulators shall be brown glazed and shall meet the requirements indicated in this specification. The insulators shall be cemented with Portland cement to the flanges resulting in high mechanical, tensile and breaking strength.

**6.9 Insulation level**

The current transformers shall be designed to withstand impulse test voltages and power frequency test voltages as specified in this specification.

**6.10 Terminal connections**

The CTs shall be provided with bi-metallic solderless clamp and rigid type terminal connectors on the top tank for connection to the HV terminals. The other requirements shall be same as for the terminal connectors of the circuit breaker described in this specification. They shall be universal type suitable for both horizontal and vertical connections.

Two earthing terminals complete with necessary hardware shall be provided on each CT for connecting to earth continuity conductor to be provided. The earthing terminals shall be identified by means of appropriate symbol marked in a legible and indelible manner adjacent to the terminals. The terminals shall be adequately sized to meet the full earth fault current envisaged.

**Basic technical requirement**

**6.11**

Ratings: The CTs shall conform to the following ratings and other particulars of the circuit breakers:



## Technical Requirements

Sl. No	Description	Requirements
1	Rated voltage	: 12 KV
2	Insulation level	:
a)	Impulse withstand voltage	: 75 KVP
b)	One minute power frequency with voltage on	:
i)	Primary winding	: 28KV rms
ii)	Secondary winding	: 3KV rms
3	Frequency	: 50Hz
4	Rated continuous thermal current	: 120% of rated primary current
5	Short time thermal rating and its duration	: 25KA for 3 sec.
6	Transformation ratio of CTs	
i)	Category- A: 600-300-150-1-1-1A	<b>Core-I</b> <b>Core-II</b> <b>Core-III</b>
a)	Rated output	15VA      15VA      -
b)	Class of accuracy	0.5      5P      PS
c)	Accuracy limit factor	-      20
d)	Purpose	Metering      Protection      Protection
e)	Maximum exciting current at $V_k/2$	30mA
f)	Max. Instrument Security Factor	10      -      -
ii)	Category- B 400-200-100/1-1 A	<b>Core-I</b> <b>Core-II</b>
a)	Rated output	15VA      15VA
b)	Class of accuracy	5P      0.5
c)	Accuracy limit factor	20
d)	Purpose	Protection      Metering
e)	Max. of Instrument security factor	: -      10
7	Type	: Single phase, outdoor, Dead tank, oil filled & hermetically sealed

### 6.12 Tests and inspection

The CTs shall be tested in accordance with the requirements of the type tests and routine tests as per the latest issues IEC: 185 or IS: 2705.

The tests to be conducted shall include:

#### 6.12.1 Type Tests:

- Lightning impulse voltage;
- Power frequency wet withstand voltage;
- Temperature rise;
- Short time current;
- Composite error;
- Accuracy test (for measuring core);
- Instrument security current (for measuring core);
- Current error and phase displacement (for protection core)

#### 6.12.2 Routine tests

- Verification of terminal marking and polarity;
- Power frequency dry withstand test on primary windings;
- Power frequency dry withstand test on secondary windings;
- Power frequency dry withstand test between sections;
- Over voltage inter-turn test;
- Composite error;
- Turn ratio;
- Accuracy test (for measuring core);
- Current error and phase displacement (for protection core);

- Knee point voltage and magnetizing current test (for PS class);
- Secondary winding resistance (for PS class).
- Insulation Resistance Test.

## **7 POTENTIAL TRANSFORMER**

### **BASIC TECHNICAL REQUIREMENTS**

#### **7.1**

The 11 KV outdoor voltage transformers are required to meet the following basic technical requirements (Reference standards: IEC:186, IS:3156 and associated standards listed in the specification):

<b>Sl. No</b>	<b>Particulars</b>	<b>Requirements</b>
1	Type	Single phase, outdoor, oil filled & hermetically sealed
2	Nominal system voltage, phase to phase	11 KV
3	Application	Instrumentation, Metering and Protection
4	Number of secondary windings	1
5	Rated normal burden*	100VA
6	Rated primary voltage	12 KV
7	Rated secondary voltage	110V
8	Class of accuracy	0.5
9	One min. power frequency withstand voltage for primary	70 KV (rms)
10	One minute power frequency withstand voltage of secondary winding (rms)	3 KV (rms)
11	Rated voltage factor	
i)	Continuous	1.2
ii)	For 30 seconds	1.5
12	Creepage distance to earth in mm per KV of highest phase to phase system voltage	25

\* The burden indicated is the minimum acceptable to the Employer. The supplier shall ensure that the rated output of the voltage transformers is adequate to meet at least 120 percent of the connected load (burden).

#### **7.2 GENERAL**

The voltage transformers to be supplied under this specification shall be of outdoor, single phase dead tank double wound, oil immersed type, complying with IEC:185 and IS:3156 suitable for operation in hot and humid atmospheric conditions described in this document. To prevent corrosion of the exposed surfaces, the tank should be not dip galvanized. They shall have separate HV and LV windings and shall be suitable for use as bus VTs in 33/11KV primary substations.

#### **7.3 Duty requirement**

11 KV Voltage transformer for all the indicating instruments and measuring meters in the primary substation on 11 KV side.

#### **7.4 Porcelain Insulator**

External parts of the voltage transformers which are under continuous electrical stress shall be of hollow porcelain insulators complying with latest edition of IS:6521 tested as per IEC:233. The creepage and flashover distance of the insulators shall be dimensioned and the type and profile designed in accordance with IEC:815 or IS:13134 and shall be suitable for the worst environmental conditions for heavily polluted atmosphere and shall be not less than 25mm per KV of highest phase to phase system voltage.. Internal surfaces of hollow insulators shall also be glazed.

The insulators shall be cemented with Portland cement to the flanges resulting in high mechanical, tensile and breaking strength.

All porcelain used on the voltage transformers shall have the following properties high strength, homogeneity, uniform glaze, free from cavities and other flaws and a high quality uniform finish porcelain components shall withstand the maximum expected static and dynamic loads to which the voltage transformers may be subjected during their service life.

The insulation of the hollow porcelain insulators shall be coordinated with that of the voltage transformers to ensure that any flash over occurs only externally.

**7.5 Core**

High grade non-ageing cold rolled grain oriented silicone steel of low hysteresis loss and permeability shall be used for core so as to ensure accuracy at both normal and over Voltages. The flux density shall be limited to 1.6 Tesla at normal voltage and frequency. There shall be no saturation at any stage during operation.

The instrument security factor of the core shall be low enough so as not to cause damage to the instruments in the event of maximum short circuit current or over voltages.

**7.6 Windings**

The primary and secondary windings shall be electrolytic copper of high purity and conductivity and covered with double paper insulation. The conductor shall be of adequate cross-section so as to limit the temperature rise even during maximum over voltages.

The insulation of windings and connections shall be free from composition liable to soften, ooze, shrink or collapse during service.

The current rating of the primary winding shall be one hundred and fifty percent of the normal rated burden and the windings shall be suitable to withstand continuously the maximum system voltage.

The secondary windings of the voltage transformers shall also be suitable for continuous over voltage corresponding to the maximum system voltage at the primary winding. The winding supports shall be suitably reinforced to withstand normal handling and the thermal and dynamic stresses during operation without damage.

The voltage transformer secondary circuits will be taken out to form the star point and earthed at one point outside the voltage transformers.

Both primary and secondary winding terminals shall be clearly and indelibly marked to show polarity in accordance with IEC: 186. The connections required for different secondary windings in case of multi-winding voltage transformers shall be clearly indicated in terminal blocks and the wiring diagrams.

**7.7 Tank**

Both expansion chamber and tank of the voltage transformers shall be made of high quality steel and shall be hot dip galvanized and shall be able to withstand the stress occurring during transit and all thermal and mechanical stresses resulting from maximum short circuit current during operation.

**7.8 Insulating Oil**

The voltage transformers shall be supplied filled with new insulating oil. The oil shall conform to the requirements of latest issue of IEC:296 of IS:335. The quantity of insulating oil for first filling of the equipment and complete specification of oil proposed to be used shall be stated in the bid.

**7.9 Hermetic Sealing**

The voltage transformers shall be supplied filled with insulating oil and shall be hermetically sealed to prevent atmosphere coming in contact with oil, avoiding filtration and change of oil. Nitrogen or other inert gas shall be provided above the oil surface to permit expansion and contraction of oil. Provision shall be made for draining and re-filling the insulating oil.

**7.10 Fitting and Accessories**

Fittings and accessories listed below shall be supplied with each voltage transformer:

- Oil level gauge.
- Oil drain, sampling and filling hole with cap;
- Pressure relief device;
- HV terminals;
- Two earthing terminals with necessary nuts, bolts and washers;
- Name and rating plate;
- Secondary terminal box with LV terminal connections;
- Mounting nuts, bolts and washers;
- L.V HRC cartridge fuses for the protection of secondary winding;

Any other fitting deemed essential by the contractor shall also be supplied along with each voltage transformer:

The oil level gauge shall be mounted in such a way that the oil level can be clearly seen from the ground level.

The name and rating plate shall contain all the particulars as provided in IEC:186 and also the name of the employer and year of manufacture. They shall comply with the clause termed label in this specification.

#### **7.11 SECONDARY TERMINAL BOX**

A dust, vermin and weather proof terminal box shall be provided at the lower end of each voltage transformer for terminating the secondary windings. The box shall have a bolted removable cover plate complete with gaskets. The terminal box shall have cable gland plate and cable glands with shrouds suitable for entry of 4 core x2.5mm<sup>2</sup> PVC insulated control cables as per IEC:227 or IS:1554.

The terminal box enclosure shall have protection of class IP 55 as defined in IEC:529 or IS:13947 and shall be painted or galvanized in accordance with specification of Surface Treatment.

#### **7.12 Terminal blocks**

Terminal blocks of brass studs rated for 10 Amps continuous current, 650 Volt grade enclosed in moulded insulating materials shall be provided with adequate electrical clearance for terminating the secondary wiring and outgoing connections. The terminal blocks shall be suitable for termination of 2.5mm<sup>2</sup> wires. The termination shall be made by crimping Jugs or bare wire with insulating sleeves at ends. All terminals must be marked with numbers and wire termination provided with numbered ferrules for identification.

#### **7.13 Fuse protection**

The secondary windings shall be protected by HRC cartridge fuses in fuse holder consisting of carriers and bases. The carriers and bases shall be of high grade flame retarding and non hygroscopic molded insulating materials with hard glass surface. Each fuse shall be identified with engraved plastic label.

#### **7.14 Circuit diagram**

A durable copy of the circuit wiring diagram shall be affixed to the inner side of the terminal box cover. Labels shall be provided inside the cover to describe the functions of various items of equipments.

**7.15 TERMINATION**

The equipment shall be supplied with HV electrical connection terminals of a size and rating appropriate for all the duties, including overload duty specified for the equipment. The terminals shall be of the bi-metallic type, suitable for connection of all aluminium alloy conductor (AAAC) or aluminium conductor steel reinforced (ACSR).

In general connections using palm type solder less sockets shall be preferred. The proposed method of connections shall be stated in the offer and shall be subject to approval by the Owner. Where the terminals are of the clamp type, they shall be suitable for taking a range of conductors appropriate to the rating of the equipment.

All nuts, bolts, washers and spring washers required to complete the connection shall be supplied with the equipment.

**7.16 EARTHING TERMINAL**

Two earthing terminals complete with necessary hardware shall be provided on each voltage transformer for connecting to earth continuity conductors of the Employer. They shall be of electroplated brass and of adequate size to carry the earth fault current. The earthing terminals shall be identified by means of appropriate symbol marked in a legible and indelible manner adjacent to the terminals.

**7.17 TEST AND INSPECTIONS**

The voltage transformers shall be tested in accordance with the requirements of the type tests and routine tests as provided in the latest issues of IEC: 186 or IS: 3516.

The tests to be conducted shall include;

**7.17.1 Type tests:**

- Lightning impulse voltage test;
- High voltage power frequency wet withstand voltage;
- Temperature rise test;
- Short circuit withstand capability test;
- **Determination of limits of voltage error and phase displacement.**

**7.17.2 Routine tests:**

- Verification of terminal marking and polarity;
- Power frequency withstand tests on primary winding;
- Power frequency dry withstand tests on secondary winding;
- Power frequency withstand tests between sections;
- Determination of limits of voltage errors and phase displacement;
- Partial discharge measurement.
- Insulating Resistance measurement.

**7.18 TEMPERATURE RISE**

The temperature rise of any part of the voltage transformer under continuous operating and exposed in the direct rays of the sun shall not exceed the permissible limits as provided in IEC publication 186 or IS: 3156. These shall not be exceeded when corrected for the difference between the ambient temperature at site and the ambient temperature specified in the standard. The correction proposed shall be stated in the bid.

**8 PROTECTIVE RELAY & CONTROL PANEL**

Outdoor control panels with protective relay and meter shall be provided by the supplier suitable for above breakers. The equipment shall have protection scheme with the following relays:

(i) Triple pole IDMTL type combined over current (2Nos) & Earth fault (1No) relay (Draw out type) preferably Non-communicable numerical relay.

Plug setting range of the over current and earth fault relays shall be 5% to 250%.

(ii) 3 elements auxiliary relay for transformer fault, trip for Buchholz, winding temperature & oil temperature.

(iii) Master trip relay for inter tripping.

(iv) Differential relay.

(v) One alarm bell scheme with bell (24V DC).

N.B:- The relays should be Areva, Easun Reyrolle, ABB or of any reputed make (subject to approval)

**9. METERS:**

The following meters shall be provided.

i) Ammeter: - 1 No. , 0-300-600 A/ 1 Amp Preferable Make- IMP/ AE or any reputed make (Dial type or Digital).

ii) Volt meter: - 1 No., 0- 15 KV (size : 144mm x 144mm), make IMP/AE or any reputed make (Dial type or Digital).

iii) Ammeter selector switch- 1 No. Make – Kaycee or any other reputed make.

iv) Volt meter selector switch- 1No. Make- Kaycee or any other reputed make.

v) 40 watt lamp with switch- 1 No.

vi) Plug & Socket- 1 No.

vii) Fuses & Links- 1 No.

viii) Test terminal Blocks- Test terminal Block need be provided for testing relays & breakers.

ix) Indication Lamp-	Red- Breaker 'ON'
(24V DC LED type)	Green Breaker 'OFF'
	Amber- Breaker 'AUTO TRIP'
	Blue- Spring charge indication.
	White-Healthy Trip illuminated push bottom switch

**10. OTHER EQUIPMENTS**

**10.1 Out Door Control- Relay Panel**

**10.1.1 1. General**

The electrical controls, relays, instruments, meters, annunciation scheme shall be provided in a sheet steel enclosure conforming to IEC: 298 or IS: 3427 mounted on support base on the floor. The panel shall be free standing, dust, moisture and rodent and vermin proof suitable for outdoor installation. The panel shall have a high degree of protection for outdoor installation with relevant standard.

Each panel shall comprise of rigid welded structure frame enclosed completely by metal sheet of thickness not less than 2mm. The sheets shall be cold rolled with smooth finish leveled and free from flaws. The structural frame and all load bearing members of the enclosure shall have minimum thickness of 2.5mm.

The control & relay panel board shall consist of panel, vertical independent, structure mounted with equipment mounted & wiring access on front and having double door protection (inside door to be glass covered) to prevent water entry inside the panel. Doors shall have handles with built in locking facility. All door panels and removable covers shall be gasketed all round with neoprene bonded gasket. Vewntilating louvers shall be provided to limit the temperature rise as provided in IEC: 694 and 298 or IS: 12729 and 3427. They shall be provided with filters encased in fine wire screens for non-ferrous metal or stainless steel unaffected by moisture and rain water. A 230V AC heater with auto temperature control shall be provided in the cabinet to prevent moisture condensation.

The housing shall be surface treated and painted in accordance with the clause on Surface Treatment of this specification.

**10.1.2 Panel wiring and accessories.**

**10.1.3 Wiring**

Each panel shall be supplied with all internal wiring complete.

Panel wiring shall be suitably bunched and clamped for neat appearance. The conductors used for wiring purpose shall be PVC insulated 650/1100 volt grade semi-flexible heat resistant, flame retardant and vermin proof electrolytic copper cable conforming to IEC:227, 502 or IS:1554. The wiring shall be securely supported and taken though PVC through PVC troughs. Each wire shall be continuous from end to end without any joint in between. All panel wiring shall be capable of withstanding a voltage of 2KV AC 50Hz for one minute.

Cable and wire for connections within the switchgear and between the switchgear and terminal blocks shall have a minimum temperature rating of 90 degree Celsius. The size of the conductors for panel wiring shall be not less than 2.5mm<sup>2</sup>. For CT secondary wiring, two such wires shall be used in parallel.

**10.1.4 Panel wiring protection**

The panels shall be equipped with links and HRC cartridge fuses conforming to IEC:269 or IS:13703 in 650 Volt grade phenolic moulded fuse holder consisting of fuse carrier and base or miniature circuit breakers conforming to IEC:947-2 or IS:13947-2 at appropriate locations. The carriers and bases shall be made of high grade flame retardant and non hygroscopic phenolic moulded material with hard glass surface. Each fuse or MCB shall be identified with engraved plastic label.

In general, fuses and MCBs shall be limited to the minimum required for safety. The protection scheme shall include fuses for VT secondary circuits and DC supply to each panel and fuses for MCB for spring charging motor and incoming AC supply.



**10.1.5 Terminal blocks**

Terminal blocks of brass studs rated for 10 amps continuous current, 650 volt DC grade covered by moulded insulating materials with adequate electrical clearances shall be provided for terminating the panel wiring and outgoing connections. The termination shall be made by crimping lugs or bare conductor with insulating sleeves at ends. The arrangement can be horizontal or vertical as per standard practice adopted by the manufacturer. All terminals must be numbered and wire termination provided with numbered ferrules for identification. All numbering and marking including those in wiring diagram shall follow the guidelines provided in IS: 11353. All circuit breaker auxiliary contacts including spare contacts shall be wired to the terminal blocks. Ten percent spare terminals shall be provided.

**10.1.6 Colour and numbering**

The wiring used for 230V AC supply for illumination lamp, panel heater and other devices shall be coloured red for phase wire and black for the neutral. The colour of wires connecting directly to Earth shall be black. All other panel wires shall be of one colour to be approved.

Engraved core identification plastic ferrules marked to correspond with the panel wiring diagram shall be fixed at both ends of each wire. Ferrules shall fit tightly on the wire and shall not fall off when the wire is disconnected from the terminal block. Numbers 6 and 9, if used shall be under scored to enable differentiation.

**10.1.7 Circuit diagram**

A durable copy of the circuit wiring diagram shall be affixed to the inner side of the door of the switchgear compartment. Labels shall be provided inside the compartment to describe the functions of the various items of equipment.

The scope of the supply shall include the panel mounting base plate and all special equipment, bolts, nuts and washers necessary for making the supporting.

**10.2 Supporting Structure**

The supply of the material shall be complete with mounting structures of mild steel sections conforming to IS: 226 or equivalent ISO. The supporting structure shall be designed and constructed to withstand the maximum combined effects of the circuit breaker dead weight, its maximum dynamic load and maximum effect of wind loading. The supporting structure shall be hot dip galvanized as per IS 2629.

**10.3 CT mounting bracket**

The supporting structure shall be fitted with a bracket for supporting three oil filled 11 KV single phase current transformers as per enclosed GA drawing. The support bracket shall be provided opposite the circuit breaker poles and shall ensure adequate clearance between the breaker poles and the CTs as well as between the CTs. The CTs shall be supplied by the Supplier as per specification above and is included in the scope. The drawings of the structure with bracket shall be subject to Owner's approval before fabrication.

The CT mounting bracket shall be hot dip galvanized as per IS-2629.

**10.4 Local control cabinet**

The operating mechanism, local controls and monitoring shall be provided in a metal clad control cabinet fitted to the same structure supporting the breaker and mounted at a convenient height for safe operation from ground level or from platform to be supplied under the contract.

The cabinet shall be made of minimum 2.00mm sheet steel and shall be constructed as a dust, weather and vermin proof outdoor housing with protection of IP-54 class as defined in IEC:529 or IS:13947. It shall have single door and transparent windows for reading the circuit breaker ON or OFF position and spring charge position without opening the door. The door and any removable covers shall be gasketed all round with neoprene bonded gaskets. A ventilating louver shall be provided with fine wire non-ferrous metal or stainless steel screen and filter. A 230V AC heater with auto temperature control shall be provided in the cabinet to prevent moisture condensation and also a 230 volt lamp for internal illumination with door operated switch.

The local control cabinet shall be subjected to surface treatment and painting as per clause on surface treatment of this specification.



**10.5 Panel wiring and accessories**

Panel wiring shall be suitably bunched and clamped for neat appearance. The conductor used for wiring purpose shall be PVC insulated 650 volt/ 1100V grade semi-flexible copper cable conforming to IEC: 227 or IS: 1554, heat resistant, flame, vermin and rodent proof. The wiring shall be securely supported and taken through PVC troughs. All panel wiring shall be capable of withstanding a voltage of 2KV AC 50Hz for 1 minute. Each wire shall be continuous from end to end without any joint in between. The sizes of the control cable for wiring in the cabinet shall be not less than 2.5mm<sup>2</sup>. CT secondary wiring shall be though two such wires in parallel.

**10.5.1 Fuse protection**

The cabinet shall be equipped with links and HRC cartridge fuses in 650 volt grade fuse holders consisting of fuse carrier and base. The holders shall be made of high grade, flame retardant and non hygroscopic phenolic moulded material of dark brown colour with hard glass surface. Each fuse shall be identified with engraved plastic labels.

**10.5.2 Terminal blocks**

Terminal blocks rated for 10 amps continuous current, 650 volt grade covered by moulded insulating materials with adequate electrical clearances shall be provided for terminating the panel wiring and outgoing connections. The termination shall be made by crimping lugs or bare wire with insulating sleeves at ends. The arrangement can be horizontal or vertical as per standard practice adopted by the manufacturer. All terminals must be numbered and wire termination provided with numbered ferrule for identification. All numbering and marking include those in wiring diagram shall follow the guidelines provided in IS: 11353. Ten percent spare terminals shall be provided.

**10.5.3 Colours**

The wiring used for AC supply for illumination lamp and heater shall be differently coloured from control wiring so that these can be distinguished from each other. The colour of all earth wire shall be black.

**10.6 Circuit diagram**

A durable copy of the circuit wiring diagram shall be affixed to the inner side of the control cabinet. Labels shall be provided inside the cabinet to describe the functions of the various items of equipment.

**10.7 Cable Entry**

A removable gland plate shall be provided at the bottom of the cabinet for entry of Owner's control and auxiliary power cables in the cabinet. Required number of electroplated brass cable glands of appropriate sizes with shrouds shall be provided in consultation with the Owner in the gland plate for the control and power cables. Provision shall be make for earthing of the cable armours in the gland.

**11 OPERATING MECHANISM**

**11.1 General**

The operating mechanism of the circuit breaker shall be motor wound spring charged type. It shall be electrically and mechanically trip free with anti pumping device (as per IEC: 694 definitions). All working parts in the mechanism shall be of corrosion resistant material. Self lubricating, wearing resistant bearings shall be provided in the mechanism.

The mechanism shall fully close the circuit breaker and sustain it in the closed position against the forces of the rated making current and shall fully open the circuit breaker without undue contact bounce at a speed commensurate with that shown by tests to be necessary to achieve the rated breaking capacity in accordance with IEC:56 or IS:13118. The mechanism shall be capable of being locked in either the open or closed position. The mechanism shall be capable of fully closing and opening again after the auto-reclose time interval specified as 0.3 second in this specification.

**11.2 Spring mechanism**

The spring operating mechanism shall be with spring charging motor, opening and closing springs with limit switches and all accessories necessary for automatic charging. In normal operation, recharging of the operating springs shall commence immediately and automatically upon completion of the closing operation so that a complete sequence of closing and opening operation should be possible.

It shall be possible to hand charge the operating spring with the circuit breaker in either the open or closed position conveniently from the ground level. Closure whilst a spring charging operation is in progress shall be prevented and release of the springs shall not be possible until they are fully charged.

The state of charge of the operating springs shall be indicated by a mechanical device showing 'SPRING CHARGED' when closing spring is fully charged and operation is permissible and 'SPRING FREE' when closing spring is not fully charged and the operation is not possible. Provision shall be made for remote electrical indication of 'Spring Charged' and 'Spring Free' conditions.

The operating mechanism shall be such that the failure of any auxiliary spring shall not cause tripping or closing the circuit breaker but shall not prevent tripping against trip command.

Closing action of the circuit breaker shall charge the opening spring ready for tripping. From the close position with spring charged, one open-close-open operation shall be possible without recharging the spring.

**11.3 Motor**

The motor for spring charging shall be single phase 230 Volt A. C motor. Continuous motor rating shall be at least ten percent above the maximum load demand of the driven equipment. It shall remain within its rated capacity at all operating points that will arise in service. It shall be protected by H.R.C cartridge fuses or MCB. The motor shall comply with IEC: 34 or IS: 996.

**12. AUXILIARY POWER SUPPLY**

The operating mechanism shall be suitable to operate with the following auxiliary power supplies.

- a) 230V, 50Hz Single phase A.C- For spring charging motor
- b) DC supply 24 Volts- For close and open coils, indication & Alarm  
(Power pack input supply: 230V & 110V AC and Output:24V DC)

The DC supply shall be from a Power Pack. The Input to Power Pack is 110V from PT and 230V from main supply. The power pack should be capable for minimum 3 Trippings even if input to power pack is failed.

The mechanism shall be designed to operate satisfactorily despite fluctuations of auxiliary power supplies as under:

AC supply:	Voltage	From 115% to 85% of normal voltage
	Frequency	From 105% to 95% of normal frequency
	Combined voltage and frequency variation	From 115% to 85% of normal
DC supply:	Voltage	From 120% to 70% of normal voltage

**13. INTERLOCKS**

The circuit breaker shall be capable of being mechanically and electrically interlocked with the associated line isolator so that the isolator cannot be operated with the breaker in the closed position.

All doors or shutters which give access to live parts shall be interlocked in such a way that these cannot be opened unless the circuit breaker is in the open position.

Other interlocks shall be provided as deemed necessary for safety.

**15. TERMINAL CONNECTOR**

Suitable terminal connectors of bi-metallic type suitable for both horizontal and vertical connection shall be provided on the terminal pad both on the incoming and the outgoing side for connection of jumpers of ACSR or AAAC conductor. The size of the conductor may vary between 50mm<sup>2</sup> and 232mm<sup>2</sup> depending upon the location of the circuit breaker. The terminal connection drawing and details are to be approved by the Owner before fabrication. The terminal connectors shall be bi-metallic type to avoid bi-metallic corrosion.

**INSULATION AND CLEARANCE**

**16.**

- a) The insulation to ground, the insulation between open contacts and insulation between phases of the circuit breaker shall be capable of satisfactorily withstanding dielectric test voltages.
- b) The minimum clearance in open air shall be as follows:

- Phase to phase spacing in switchyard i.e. interpole spacing for Breaker (min) - 320 mm
- Ground clearance from the lowest line terminal if both the terminals are not in same horizontal plane (min) - 2700mm

**17. TEMPERATURE RISE**

The temperature rise and the maximum temperature of any part of the circuit breaker under continuous load condition and exposed in the direct rays of the sun shall not exceed the permissible limits as provided in Table V of IEC publication 694 or table 4 of IS:12729. These limits shall not be exceeded when corrected for the difference between the ambient temperature at site and the ambient temperature specified in the standard. The correction proposed shall be stated in the tender.

**18. TESTS**

**18.1 Type and routine tests**

The circuit breakers shall be subjected to routine and type tests in accordance with the standards listed in this specification including the following IEC and IS standards with the latest amendments:

- Circuit breaker IEC: 56 and IS:13118 and relevant other standards
- Porcelain insulator IEC: 233 and IS: 5621 and relevant other standards

The tests shall include but not limited to the following:

**18.2 Short circuit tests**

The circuit breaker shall satisfactorily perform the out of phase and short circuit duties specified in IEC:56, IEC:17A(Sectt.) and IEC:17A/CD/474, IS-13118 and IS:13516. The circuit breaker shall be capable of performing at least twenty five (25) open operations at the rated short circuit current before maintenance or inspection is required.

**18.3 Capacitive current switching**

Capacitive switching tests shall be performed in accordance with IEC:56 or IS:13118 and IEC:17A/CD/474 at 1.3U preferably by direct test method or alternatively using synthetic method to IEC:427 or IS:13516. The test circuits shall simulate the most onerous site conditions.

**18.4 Reactor Switching**

In addition to the capacitive current switching tests to IEC:56 or IS:13118 and IEC:17A/CD/474, the circuit breakers shall be tested for shunt reactor switching in accordance with IEC:1233, Examination of the interrupter after the tests shall not show any evidence of surface tracking or erosion of contracts.

**18.5 Dielectric tests**

At zero gauge loss of vacuum inside the interrupter chamber, the open contracts shall withstand continuously, the rated phase to ground voltage and it shall be possible to break normal current in these conditions. During the dielectric type tests, no flashover external or internal shall be acceptable.

The circuit breakers shall be subjected to a power frequency AC voltage test for one minute in dry and wet conditions and there shall be no external flash over to earth.

**18.6 Mechanical endurance**

In addition to the requirements of IEC:56, an extended mechanical endurance test is required to show that the circuit breaker is capable of at least 10,000 operations at no load in accordance with IEC:17A/474/CD. Between the specified test series in IEC: 17A/474/CD, some maintenance such as lubrication and mechanical adjustment is allowed and shall be performed in accordance with manufacturer's instructions. Change of contracts is not permitted.

**18.7 Low current switching**

The circuit breakers shall produce very low over voltage (<2.0 pu) on all switching circuits inductive current including reactor switching to IEC-1233 and capacitive current switching to IEC:17A (Secretariat) 438 and IEC 17A/CD/474 the circuit breaker shall be re-ignition or re-strike free for all duties.

**18.8 Duty requirement tests**

Apart from auto-reclosing and the other duties mentioned above, the breakers shall be able to perform the following duties for which type tests are to be conducted as per IEC:56 or IS:13118.

1. Breaking the steady and the transient magnetising current of the transformer.
2. Breaking 25% of rated fault current at twice the rated voltage as per IEC/IS.
3. Cable charging breaking current.
4. Back-to-back capacitor bank breaking current.
5. Single capacitor bank breaking current.
6. Capacitor bank in rush making current.

Test for the resistance of the main circuit shall also be conducted.

**18.9 Temperature rise test**

Temperature rise test is to be conducted on the circuit breaker and the accessories in accordance with IEC:56 or IS:13118. The temperature rise shall be limited as per this specification.

**19. PERFORMANCE REQUIREMENTS**

The supplier shall declare the circuit breaker opening and closing times at 120 percent, 100 percent and 70 per cent of the rated voltage of the opening and closing devices when measured at the terminals of the trip and closing coils. The minimum make break time at rated voltage and total break time of the CB shall be stated. The total break time must not exceed 60m. sec.

**20. EARTHING**

All metal parts not intended for carrying current or not alive shall be connected to duplicate earthing system and suitable electroplated brass earthing terminals shall be provided on each circuit breaker in conformity with IEC:56 or IS:13118. Suitable identification mark for the earth terminals shall be provided adjacent to the terminal.

Earth continuity conductors shall be provided down to the ground level for earth connection to owner's earthing grid. It shall have sufficient cross sectional area to afford a low resistance path for the full fault current envisaged. Such conductor shall also be provided for the CTs up to the ground level.

The size of the earth continuity conductor shall be large enough to reduce the potential rise of the metal frame of the breaker in the event of fault to minimum but in any case not more than 10V. The size of the conductor shall also be adequate to restrict the temperature rise without causing any damage to the earth connection in the case of fault. No riveted joints in the earth conducting path shall be permissible and only bolted joints of adequate size shall be provided with nuts, bolts and plain and spring washers. The surfaces to be jointed shall be perfectly flat without any unevenness to ensure that there is no contact resistance.

An earth bus bar of copper strip shall be provided inside the local control cabinet to which all earthing connections must be made. The earth bus bar shall be terminated into two electroplated brass earthing terminals of adequate size with nuts, bolts and washers for connecting to earth continuity conductor mentioned above.

**D. TECHNICAL SPECIFICATION OF G.I EARTH PIPE**

1. **SCOPE:** The Specification provides for the manufacture, testing at manufacturer's works before supply of G.I Earth Pipes.
2. **STANDARDS:** The G.I Earth Pipes shall conform in all respects to the Indian Standard IS-1239 (Part-I)/ 1990.
3. **GENERAL REQUIREMENTS:** The G.I Earth Pipes shall be 40mm bore and 3.25mm wall thickness as per IS-1239 (Part-I), 1990 length 3meters as per specification.

4. **TESTS AND TEST CERTIFICATES:** All the tests shall be carried out as per the IS-1239 (Part-i), 1990.

Sl. No	Description Parameters	Expected Value
1	Makers Name	
2.	Standard to which the earthing pipe confirm	REC Standard-J 2
3.	Size of the pipe	40 mm nominal Bore as per ISS (Medium gauge) 1239/Part-I/1979
4.	Length of the pipe	3.0mtrs
5.	Thickness of the pipe	3.25mm
6.	Outer diameter of the pipe	48.8mm maximum 47.9 mm minimum
7.	Standard for processing of Galvanising and testing for uniformity and mass of Zinc coating of the pipe	IS:2620/1985, IS:2629/1986 SI:6745/1972
8.	G.I Clamp for earthing pipe	40mm X 6mm
9.	G.I Bolts Size	5/8"X1 & 1/2"

### **E.TECHNICAL SPECIFICATION MILD STEEL CHANNEL & ANGLE**

#### **1. General:**

The structure materials for DP structure and others shall be fabricated with specified sections of mild steel materials as per the drawing and bill of quantity. These structure materials and cross arms shall be fastened with clamps or other structure materials by means of 5/8" diameter G.I. bolts of appropriate length only. After fabrication or erection the structure materials/ cross arms shall be painted with two coats each of red oxide primer and aluminium paint.

#### **2. 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.

Sl.No.	Standard No.	Title
1	IS: 2062 Grade 'A' Quality	Specification for M.S.Angles, M.S.Channel
2	IS: 2062	Chemical and Physical composition of material
3	IS: 1852	Rolling and Cutting Tolerances for Hot Rolled Steel products

#### **3) 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.

### **F. R.S.Joist Pole (150x150mm)**

#### **TECHNICAL SPECIFICATION OF R.S Joist Pole:-**

##### **1.0 Scope of Work:**

This specification covers design, manufacture, testing and supply of 150x150mm RS Joist pole. The bidder should enclose Performance Certificates from the above users, issued in favour of the Sub Vendor / manufacturer, as proof of successful operation in field.

##### **Applicable Standards:**

This specification covers the manufacturing, testing before dispatch and delivery of following R.S Joists

**2.0 Standards:**

The R.S Joists shall comply with the requirements of latest issue of IS – 2062 Gr – A except where specified otherwise.

**3.0 Rolled Steel Joists**

The Rolled Steel joist (RSJ) support structures shall be fabricated from mild steel, grade A and in lengths dictated by design parameters .The joists, may include, but shall not be limited to the size i.e.150 X 150 mm

**4.1 MECHANICAL PROPERTIES:**

Tensile Test :	Requirement as per IS:2062/ 1999 Grade-A
Yeild Stress(MPa)	Min250
Tensile Strength(MPa)	Min410
Lo=(5.65So)Elongation%	Min23
Bend Test	Shall not Crack

**4.2. CHEMICAL PROPERTIES:**

Chemical Composition	Requirement as per IS:2062/ 1999 Grade-A	Permissible variation over the Specified Limit,Percent,Max
Gr a d e	A	-
Chemical Name	Fe-410W A	-
Carbon(%Max.)	0.23	0.02
Manganese(%Max.)	1.5	0.05
Sulphur(%Max.)	0.05	0.005
Phosphorous(%Max.)	0.05	0.005
Silicon(%Max.)	0.4	0.03
Carbon Equivalent(%Max.)	0.42	-
Deoxidation Mode	Semi-killed or killed	
Supply condition	As rolled	

**4.3.** However, In case of any discrepancy between the above data & the relevant ISS, the values indicated in the IS shall prevail.

**4.4.** The Acceptance Tests shall be carried out as per Relevant ISS.

**GUARANTEED TECHNICAL PARTICULARS FOR RS JOISTS**  
**of sizes 150x150mm**

**1.1. Dimensions and Properties:**

PARTICULARS	150X150 mm RS joist	Specification By the Bidder
		150X150 mm RS joist
Length of Joist in Mtr with +100mm/-0% Tolerance		
Weight kg/m with±2.5% Tolerance	34 .6	
Sectional Area (cm2)	39	
Depth(D) of Section (mm) with +3.0mm/ - 2.0mm Tolerance as per IS 1852-1985	150	

**Dy. General Manager (Tech, Proj & MRT) Southco, Berhampur**

Width (B)of Flange (mm) with $\pm 2.5$ mm Tolerance for 116 x 100 mm ISMB & $\pm 4.0$ mm Tolerance for 150 x 150 mm ISHB IS 1852-1985	150	
Thickness of Flange (Tf) (mm) with $\pm 1.5$ mm Tolerance	9.00	
Thickness of Web(Tw) (mm) with $\pm 1.0$ mm Tolerance	8.40	
Corner Radius of fillet or root (R1) (mm)	8.00	
Corner Radius of Tow (R2) (mm)	4.00	
Moment of Inertia Ixx (cm <sup>4</sup> ) Iyy (cm <sup>4</sup> )	1540.00 460.00	
Radius of Gyration (cm) Rxx Ryy	6.29 3.44	
Modulus of Section Zxx (cm <sup>3</sup> ) Zyy (cm <sup>3</sup> )	205 60.2	
Tolerance in Dimension	As per IS:1852	

**Signature of the Bidder**

**(This form is to be duly filled up by the bidder & submit along with the Tender)**

**G.TECHNICAL SPECIFICATION FOR 33 KV & 11 KV LIGHTENING ARRESTOR**

**01 SCOPE**

This Specification covers Design, Engineering, Manufacture, testing, inspection before despatch, forwarding, packing, transportation to site, Insurance (both during transit & storage), Storage, Erection, Supervision, testing and commissioning of 33KV & 11KV Surge Arrestor (L.A) for use in the networks of SOUTHCO, Orissa.

**02 STANDARDS**

Except where modified by the specification, the Surge Arresters shall be designed, manufactured and tested in accordance with the latest editions of the following standards.

<b>IEC/ISO/BS</b>	<b>IS</b>	<b>Subject</b>
IEC 99 – Part-1	IS 3070- Part 1	Non linear resistor gapped surge arresters for a.c. systems.
IEC 99- Part 4	IS 3070- Part 3	Metal-oxide surge arresters without gaps for a.c systems.
	IS 5621	Hollow insulators for use in electrical equipment.
IEC 233		Tests on hollow insulators for use in electrical equipment.
IEC 270		Partial discharge measurement.
IEC 455		Guide for solvent less polymerisable resinous compounds used for electrical insulator.
IEC 815	IS 13134	Guide for selection of insulators in respect of polluted conditions.
BS 729 ISO 1460	IS 2629, IS 4736, IS 2633	Hot dip galvanizing. Method of testing uniformity of zinc coated articles.



**GURANTEED TECHNICAL PARTICULARS FOR 33KV & 11KV LA**

(To be submitted along with offer)

Sl No	Particulars	To be Specified by the bidder	
		11KV	33KV
1.	Type		
2.	Model		
3.	No.of Units		
4.	Rated voltage (KV) RMS.		
5.	Nominal Discharge current ( K Amps.)		
6.	Discharge Class		
7.	Reference Current ( MA)		
8.	Reference voltate (KV)		
9.	Current at MCOV.		
	i) Resistive current IR (Micro Amps)		
	ii)Capacitive current IC ( - do-)		
10.	Protective ratio.		
11.	Maximum residual voltage for discharge		
	Current of 8/ 20 micro sec. Wave at.		
	i) 0.5 time the nominal discharge current (KV Peak)		
	ii) 1 time -do-(KV rms)		
	iii)2 times -do-(KV rms)		
12	Maximum continous operative voltage (KV rms)		
13	High Current impulse withstand(KA)		
14	Energy dissipation capability (KJ/KV)		
15	Insulation withstands.		
	i) Lightning Impulse (KV Peak)		
	ii)P.F. Dry/ Wet (KV rms)		
16	Temporary over voltage withstand		
	Capability (KV Peak)		
	i) At 0.1 second		
	ii) At 2 Seconds		
	iii) At 10 Seconds		
	iv)At 100 Seconds		
17	Maximum radio interference voltage		
	(KV rms) / partial discharge.		
18	Maximum step current impulse		
	Residential voltage at nominal		
	Discharge current of 1 micro sec.front time(KV Peak).		
19	Maximum switching impulse residual		
	Voltage at 50 x 100 micro sec.wave at 500 Amp.		
	(KV Peak)		
20	Height of complete unit (mm)		
21	Maximum recommended spacing between		
	Arrestor centre to centre(mm)		
22	Clearance required from ground equipment		



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	To various heights of arrestor unit(mm)		
<b>23</b>	Earthing arrangement.		
<b>24</b>	Mounting flange dimensional details (mm)		
<b>25</b>	Total crepage distance (mm)		
<b>26</b>	Weight of complete unit (kg.)		

**Signature of Bidder**

**(This form is to be duly filled up by the bidder & submit along with the Tender)**

**H. TECHNICAL SPECIFICATIONS FOR 33KV & 11KV AB SWITCH**

**1. 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.

**1.1 DESCRIPTION OF THE MATERIALS:-**

The A.B. Switch sets shall confirm to the following parameters:-

Sl. No.	Description	Parameters of AB Switch	
		33 KV	11
i)	Number of poles	3	
ii)	Number of Post insulator per pole	4 nos. 22/24 KV class	2 nos. 12 KV class
iii)	Nominal system voltage (KV)	33	11
iv)	Highest System Voltage (KV)	36	12
v)	Rated frequency	50HZ	
vI)	System earthing	Effectively earthed.	
vII)	Rated nominal current Amp.	400	<b>400</b>
viii)	Altitude of installation	Not exceeding 1000 M	

The post insulators used in the A.B. Switches shall have the following ratings

Sl. No.	Description	Parameters P.I. of AB Switches for	
		33 KV	11 KV
i)	Power frequency withstand voltage (dry) KV (RMS)	95	35
ii)	Power frequency withstand voltage (wet) KV (RMS)	75	35
iii)	Impulse withstand voltage (dry) KV	17	7

iv)	Power frequency puncture withstand voltage	1.3 times the actual dry flashover voltage of
-----	--	---

**1.2 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.

**1.3 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.

**1.4 TECHNICAL DETAILS:-**

**1.4.1** 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- 736/1968.

**1.4.2 Mounting:** - The A.B. Switches shall be suitable for horizontal mounting in all type of sub-station structures.

**1.4.3 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

**1.4.4 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.

**1.4.5 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.

**1.4.6 Terminal Connectors:-** Terminal connectors shall be robust in design. The size of fixed connector shall be ( 80 x 50 x8 mm) and size of movable connector shall be of ( 80 x50) 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 mm<sup>2</sup> conductor.

**1.4.7 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<sup>0</sup>. This shall be exhibited in the drawing.

**1.4.8 Drawing & Literatures:-** Drawings of each item i.e. 11 KV, 630 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.

## **1.5 TESTS & TEST CERTIFICATE**

**1.5.1 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.
- xii. Mechanical strength test for the post insulator as per IS-2544/1973.
- xiii. Test for galvanization of metal (ferrous) parts as perm IS-2633/1973.

Besides, mechanical endurance test will have to be conducted on one set in the presence of our authorized person who shall be deputed to carry out acceptance tests before delivery of the materials.

**1.5.2 Routine Tests:** - The following routine tests shall have to be conducted on each set and results are to be furnished for consideration of deputed 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.

#### **5.0 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.

#### **6.0 INSPECTION:-**

Routine and acceptance tests shall be conducted at the place of manufacturer. The bidders 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.

#### **7.0 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.

#### **8.0 INSPECTION:-**

Routine and acceptance tests shall be conducted at the place of manufacturer. The bidders 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.

#### **9.0 Final Checking, Testing and Commissioning**

a) After stringing have been done as approved by the engineer, to ensure that everything is complete in all respects, the works shall be thoroughly inspected keeping in view the following main points.

b) All the bolts and nuts should be of GI materials as per relevant IS.

**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.

**Section-V**  
**PRICE BID**

**Tender Notification :Tech/RLTAP 2013-14/08/2014-15**

**Supply and Installation For Installation of additional 1x1.6MVA, 33/11KV with associated works at 33/11KV Dangasarada S/S under Rayagada District RLTAAP Scheme 2013-14 on Turnkey Basis**

**A. Installation of additional 1x1.6 MVA, 33/11KV power transformer on plinth mounted**

Sl. No.	Description of materials	Unit	Qty.	Supply rate per unit (in Rs)	Installation rate per unit (in Rs.)	Unit supply & Installation Rate (Rs.)	Amount (Rs.)
1	1.6 MVA, 33/11KV power transformer	No	1				
2	11 KV,3 Pole,630A,50 HZ,25 KA 11 KV VCB,CT,CRPS with Power Pack and control cable with other accessories.	No	1				
3	25x6 mm G.I flat for earthing	Kg	100				
4	40 mm earthing device	No	3				
5	Material for masonry work for earth pit charcoal, salt for earthing	No	3				
6	Sundries	LS	1				
7	33KV Lighting Arrestor	No	3.00				
8	11KV Lighting Arrestor	No	3				
9	50x6 mm G.I Flat	Kg	300				
10	40 mm earthing device	No	6				
11	Material for masonry work for earth pit charcoal, salt for earthing	No	6				
12	M.S Nut Bolt washer	Kg	10				

**B. 33 KV Bay Extension with 4-pole structurearrangment including VCB arrangement**

1	150x150 mm 11Mtr RS Joist Pole-4 nos	Kg	1522.4				
2	Base plate	No	4				
3	100x50x6 MM MS Channel 4.2mtr long(23nos)	Kg	888.72				
4	Bracing 50x50x6 MM MS Angle 4.8 mtr long(18nos)	Kg	388.80				
5	33KV Lighting Arrestor	No	6.00				
6	33 kv A.B Switch (for incoming & outgoing)	Set	2.00				
7	33 kv G.I Pin	No	6.00				
8	33 kv Disc Insulator( B&S) 70 KN	No	45.00				
9	33 kv HW Fitting ( B&S)	Each	15.00				
10	33 kv Pin Insulator	No	6.00				
11	25x6 mm G.I Flat	Kg	80				
12	50x6 mm G.I Flat	Kg	200				
13	40 mm earthing device	No	4				
14	Material for masonry work for earth pit charcoal, salt for earthing	No	4				
15	33 KV, 3 Pole 1250 A,50 HZ,25 KA VCB, CT, CRPS with Power Pack ( For Group Control) and control cable with other accessories.	No	1				
16	M.S Nut Bolt washer	Kg	100				
17	232 mm2 AAA Conductor	KM	0.05				

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18	Clamp, connector & jumpering material	LS	1				
19	Special Cement Concreting padding with coupling of pole	No	4				
20	Sundries	LS	1				
<b>C. Erection of 11 KV DP with AB switch arrangement &amp; 11KV VCB</b>							
1	150x150 mm 9mtr RS Joist Pole - 2 nos	Kg	622.8				
2	Base plate	No	2				
3	100x50x6 MM MS Channel 3.5mtr long(4nos)	Kg	257.6				
4	50x50x6 MM MS Angle (3.5mtr-2nos.+ 5mtr-2nos.)	Kg	76.5				
5	11KV Disc Insulator( T&C)	No	6				
6	11 kv HW Fitting ( T&C)	No	6				
7	11 kv AB Switch 3 pole (400A)	Set	1				
8	25x6 mm G.I Flat	Kg	50				
9	50x6 mm G.I Flat	Kg	100				
10	40 mm earthing device	No	2				
11	Material for masonry work for earth pit charcoal, salt for earthing	No	2				
12	11 KV,3 Pole,630A,50 HZ,25 KA 11 KV VCB,CT,CRPS with Power Pack and control cable with other accessories.	No	1				
13	M.S Nut Bolt washer	Kg	20				
14	232 mm <sup>2</sup> AAA Conductor	KM	0.05				
15	Clamp, connector & jumpering material	LS	1				
16	Special Cement Concreting padding with coupling of pole	No	2				
17	Sundries	LS	1				
<b>D. Civil Work</b>							
1	Power Transformer Plinth (15'x8'x5'6" size)	No	1				
2	33KV VCB Plinth	No	1				
3	11KV VCB Plinth	No	2				
4	Levelling of the S/s yard with sand and metal spreading	LS	1				
<b>Total</b>							

**Rupees.....**

**Bid proposal sheets enclosed with this tender specification. Bidder will be permitted to only enter the item wise rates. No other modification shall be permitted. Bidders are required to sign each and every page and enclose the same in the price Bid in sealed condition. One soft copy in CD shall also be submitted in the price Bid. Bidder are required to enter their item wise rates in each sheet of the prospective package for which he wants to submit their bid.**

**Note**

1. Unit rate is inclusive of all taxes and duties.
2. Any discrepancy in unit rate and amount, Unit rates stands.
3. Any column left blank shall be treated as nil / inclusive of.

(Signature of the Bidders)



**Section- VI**

**FORMS AND FORMATS**

**Tender Notification No: Tech/RLTAP2013-14/08/2014-15**

**BID FORM**

**To**

The Dy, General Manager  
(Tech, Proj & MRT)  
Southco, Berhampur.

Sir,

1. We understand that SOUTHCO is desirous For Installation of additional 1x1.6MVA, 33/11KV power transformer and 33KV Bay extension with associated works at 33/11KV Dangasarada S/S under Rayagada District under RLTA Scheme 2013-14.
2. Having examined the Bidding Documents for the above named works, we the undersigned, offer to deliver the goods in full conformity with the Drawings, Conditions of Contract and specifications for the sum of..... (Figures.....) or such other sums as may be determined in accordance with the terms and conditions of the contract. The above amounts are in accordance with the Price Schedules attached herewith and are made part of this bid.
3. If our Bid is accepted, we undertake to complete the entire works within 90 days from the date of award of purchase order/letter of intent.
4. If our Bid is accepted, we will furnish a Contract Performance Bank Guarantee for an amount of 10% (Ten) percent of the total contract value for due performance of the Contract as well as covering the Guarantee & warrantee obligations of the products, in accordance with the General Conditions of Contract.
5. We agree to abide by this Bid for a period of 180 days from the date fixed for bid opening, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.
6. We declare that we have studied the provision of Indian Income Tax Law and other Indian Laws for supply of equipments/materials and the prices have been quoted accordingly.
7. Unless and until Letter of Intent is issued, this Bid, together with your written acceptance thereof, shall constitute a binding contract between us.
8. We understand that you are not bound to accept the lowest, or any bid you may receive.
9. There is provision for Resolution of Disputes under this Contract, in accordance with the Laws and Jurisdiction of Contract.

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

Signature..... In the capacity of .....  
.....duly authorized to sign for and on behalf of  
(IN BLOCK CAPITALS).....

**PROFORMA FOR COMPOSITE PERFORMANCE BANK GUARANTEE**

This Guarantee Bond is executed this \_\_\_\_ day of \_\_\_\_\_ by us the \_\_\_\_\_ Bank at \_\_\_\_\_

P.O. \_\_\_\_\_ P.S. \_\_\_\_\_ Dist \_\_\_\_\_ State \_\_\_\_\_

(Indicate designation of Owner)

Whereas Southern Electricity Supply Company of Orissa Ltd.(SOUTHCO) , Corporate Office: Courtmeta, Berhampur, Ganjam - 760004 registered under the Company Act 1956 (here in after called “the Owner”) has placed works Order No. \_\_\_\_\_ Dt. \_\_\_\_\_ (hereinafter called “the Agreement”) with M/s \_\_\_\_\_ (hereinafter called “the Contractor”) and whereas SOUTHCO (as the case may be) has agreed (1) to exempt the Contractor from making payment of security deposit, (2) to release 100% payment of the cost of works as per the said agreement and (3) to exempt from performance guarantee on furnishing by the Contractor to the SOUTHCO 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 SOUTHCO 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 SOUTHCO an amount not exceeding Rs. \_\_\_\_\_ (Rupees \_\_\_\_\_) only against any loss or damage caused to or suffered by SOUTHCO 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 SOUTHCO stating that the amount claimed is due by way of loss or damage caused to or suffered by SOUTHCO 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 SOUTHCO 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 un revocable. The payment so made by us under this bond shall be valid discharge of our liability for payment there under 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 affect 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 SOUTHCO under by virtue of the said Agreement have been fully paid and its claim satisfied or discharged or till SOUTHCO 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 \_\_\_\_\_  
\_\_\_\_\_ (Local Bank Name, address and code No.)  
\_\_\_\_\_, Berhampur in writing on or before  
\_\_\_\_\_ (date) we shall be discharged from all liability under this guarantee  
thereafter.

5. We, the \_\_\_\_\_ Bank further agree that SOUTHCO 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 SOUTHCO or any indulgence by SOUTHCO 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 SOUTHCO in writing.

Dated \_\_\_\_\_ the \_\_\_\_\_ day of Two thousand \_\_\_\_\_.

Not withstanding 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.

We are 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 a written claim or demand and received by us 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 Works order / agreement:
- (3) Amount of Works Order.:
- (4) Name of Works:
- (5) Name of the Bank:
- (6) Amount of the Bank Guarantee:
- (7) Validity period or date up to which the agreement is valid:
- (8) Signature of the Constituent Authority of the Bank with seal:
- (9) Name & addresses of the Witnesses with signature:
- (10) The Bank Guarantee shall be accepted only after getting confirmation from the respective Banks.

**Annexure - III**

**ABSTRACT OF GENERAL TERMS AND CONDITIONS**

- |  |          |
|--|----------|
| 1. Whether the bidder is a Contractor & furnished relevant documents:  | Yes / No |
| 2. Required Cost of Tender Furnished   | Yes / No |
| 3. Required Earnest Money Furnished in Demand Draft  | Yes / No |
| 4. Whether valid HT electrical license enclosed with the bid:  | Yes / No |
| 5. Whether valid labour license enclosed with the bid  | Yes / No |
| 6. Contractor's past experience including Owner's certificate furnished or not: -  | Yes / No |
| 7. Audited annual reports for the last 3 years furnished or not:   | Yes / No |
| 8. Deviation to the specification , if any (List enclosed or not):-  | Yes / No |
| 9. Whether agreed to Owner's completion schedule:  | Yes / No |
| 10. Whether agreed to Owner's Guarantee clause:-   | Yes / No |
| 11. Whether agreed for 180 days' validity period of Prices   | Yes / No |
| 12. Whether the Prices are <b>FIRM</b> ?   | Yes / No |
| 13. Whether agreed to furnish security deposit in shape of B.G. en-cashable at Berhampur in case his tender is successful: - | Yes / No |
| 14. Whether agreed to penalty for delayed completion: -  | Yes / No |
| 15. Whether agreed to Owner's standard terms of payment or not:  | Yes / No |
| 16. Valid ITCC & STCC furnished or not:  | Yes / No |
| 17. Registration under Building and Other Construction Workers Welfare Cess Act  | Yes / No |

Signature of the bidder  
With seal of the Bidder

This form is to be duly filled up & signed by the Bidder along with seal & submitted along with the Part-I of tender.

**ANNEXURE – IV**

**LETTER OF COMPLIANCE OF QUALIFYING REQUIREMENT  
(In case of Bidder being a Single Firm)**

To  
The Dy, General Manager  
(Tech, Proj & MRT)  
Southco, Berhampur.

Sir,

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**

Package Quoted for	Description of Proposed Works	Tender Qty	Qty Installed & Commissioned					Documents provided in proof of having executed the works during the relevant FY.
			Sl No	FY	Name of Client	WO Ref	Qty Installed	

**Table – B: Average Annual Turnover**

Package Quoted for	Estimated Cost of the Package (Rs. inLakh)	Annual Turnover(Rs. in Lakh)	
		Name of Member	1
		Financial Year	Turnover (Rs. in Lakh)
		FY	
		FY	
		FY	
		Total	
Total Estimated Cost of the packages quoted for		Average Turnover	

**Table – C: Access to Credit Facility:**

Package Quoted for	Estimated Cost of the Package (Rs. in Lakh)	Liquid Assets as on Dt 30.04.14		Credit Facility	
		Description	(Rs. in Lakh)	Description	(Rs. in Lakh)
		Cash in Hand		Cash Credit	
		Cash at Bank		LC	
		Fixed Deposits		Others (Pl Specify)	
Total Estimated Cost of the packages quoted for		Total Liquid Assets		Total Credit Facility	
One fifth of the total Estimated Cost as above.					

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).

**ANNEXURE – V**

**DETAILS OF COMMERCIAL DEVIATIONS**

Bidder's Name & Address

To,  
The Dy, General Manager  
(Tech, Proj & MRT)  
Southco, Berhampur.

Dear Sir,

**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

<b>Volume / Clause</b>	<b>Ref / Page No</b>	<b>As specified in the Specification</b>	<b>Commercial deviation and variation to the specification</b>

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. This will be read out during opening of Part-I Bid.



**ANNEXURE – VI**

**DETAILS TECHNICAL DEVIATIONS**

Bidder's Name & Address

To,  
The Dy, General Manager  
(Tech, Proj & MRT)  
Southco, Berhampur.

Dear Sir,

**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

<b>Volume / Clause</b>	<b>Ref./Page No</b>	<b>As specified in the Specification / Relevant ISS</b>	<b>Technical deviation and variation to the specification</b>

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.
  3. This will be read out during opening of Part – I bid.

**SELF-DECLARATION FORM**

**Name Of The Owner.....**

**Tender No :.....**

**Sir,**

1. I/We the undersigned do hereby declare that, I/We have never been blacklist and/or there were no debaring 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, may bid/ contract shall be liable for truncation/ cancellation /termination without any notice at the sole discretion of the purchaser.

Place :

Date :

Yours faithfully,

Signature of the bidder with seal.  
(This form shall be duly filled-up and signed  
by the bidder and submitted along with  
the original copy of the bid).