

**BIDDING DOCUMENT**

FOR

**Supply of 40 MVA, 132/33 kV Power Transformers and  
Related Services for Srikona and Sipajhar Grid  
Substations in Assam**



**ASSAM ELECTRICITY GRID  
CORPORATION LIMITED**

**BID IDENTIFICATION NO:-AEGCL/MD/TECH-700/AP/17-18/PTR/BD**

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**Section – 1**  
**Instruction to Bidders**

# Section 1 - Instructions to Bidders

This section specifies the procedures to be followed by Bidders in the preparation and submission of their Bids. Information is also provided on the submission, opening, and evaluation of bids and on the award of contract.

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## Section 1 - Instructions to Bidders

### 1.0 General

#### 1.1. Scope of Bid

1.1.1. In support of the Invitation for Bids indicated in the Bid Data Sheet (BDS), the **Managing Director** on behalf of **Assam Electricity Grid Corporation Limited (AEGCL)** (hereinafter referred to as "the Purchaser"), issues this Bidding Document for the supply of Goods and Related Services incidental there to as specified in Section 3 (Purchaser's Requirements). The name and identification no. of this Competitive Bidding are provided in the in the Bid Data Sheet (BDS) attached as Appendix to ITB-1 of this Section.

1.1.2. Unless otherwise stated, throughout this Bidding Document definitions of terms shall be as prescribed in **Section 4** (Special Conditions of Contract).

#### 1.2. Eligible Bidders

1.2.1. Subject to the fulfilling the Qualifying Criteria (as per Appendix-2 of this Section), a Bidder may be a firm or company. When the bidder is a firm, the names and address of the partners should be indicated and a copy of the certificate of registration with the concerned Registrar of firms should be enclosed with the Bid.

1.2.2. When the bidder is a Company, the company registration document along with Memorandum of Association should be submitted.

**1.2.3. Joint Venture is not allowed to participate in this bidding.**

#### 1.3. Contents of Bidding Document

##### 1.3.1. Sections of Bidding Document

1.3.1.1. The Bidding Document consists of Parts 1, 2, and 3, which include all the Sections indicated below, and should be read in conjunction with any Addenda issued in accordance with ITB **Clause 1.3.3**.

Section 1 - Instructions to Bidders (ITB) with Appendix-1 (Bid Data Sheet, **BDS** and Appendix-2 (Evaluation & Qualifying Criteria, **EQC**)

Section 2 - Bidding Forms (**BDF**)

Section 3 - Purchaser's Requirements (**PRQ**)

Section 4 - "General Conditions of Supply and Erection of AEGCL"

(This section is supplied separately)

Section 5- Special Conditions of Contract (**SCC**)

Section 6 - Contract Forms (**COF**)

1.3.1.2. *The completed Section 6 shall constitute "the Contract".*

1.3.1.3. The Invitation for Bids issued by the Purchaser is not part of the Bidding Document.

1.3.1.4. The Purchaser is not responsible for the completeness of the Bidding Document and its addenda, if they were not obtained directly from the source stated by the Purchaser in the Invitation for Bids.

1.3.1.5. The Bidder is expected to examine all instructions, forms, terms, and specifications in the Bidding Document. Failure to furnish all information or documentation required by the Bidding Document may result in the rejection of the bid.

##### 1.3.2. Clarification of Bidding Document, Site Visit, Pre-Bid Meeting

1.3.2.1. A prospective Bidder requiring any clarification of the Bidding Document shall contact the Purchaser in writing at the Purchaser's address indicated in the **BDS** or raise his enquiries during the pre-bid meeting if provided for in accordance with **ITB Clause 1.3.2.4**. The Purchaser will respond to any request for clarification, provided that such request is received no later than seven (7) days prior to the deadline for submission of bids. The Purchaser's response shall be in writing with copies to all Bidders who have acquired the Bidding Document in accordance with **ITB Clause 1.3.1.4**, including a description of the

inquiry but without identifying its source. Should the Purchaser deem it necessary to amend the Bidding Document as a result of a request for clarification, it shall do so following the procedure under **ITB Clause 1.3.3** and **ITB Clause 1.5.2.2**.

- 1.3.2.2. The Bidder is advised to visit and examine the site where the works are to be carried out and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the bid and entering into a contract for the provision of plant and services. The costs of visiting the site shall be at the Bidder's own expense.
- 1.3.2.3. The Bidder and any of its personnel or agents will be granted permission by the Purchaser to enter upon its premises and lands for the purpose of such visit, but only upon the express condition that the Bidder, its personnel, and agents will release and indemnify the Purchaser and its personnel and agents from and against all liability in respect thereof, and will be responsible for death or personal injury, loss of or damage to property, and any other loss, damage, costs, and expenses incurred as a result of the inspection.
- 1.3.2.4. The Bidder's designated representative is invited to attend a pre-bid meeting, if provided for in the **BDS**. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.
- 1.3.2.5. The Bidder is requested, as far as possible, to submit any questions in writing, to reach the Purchaser not later than **one week** before the pre-bid meeting.
- 1.3.2.6. Minutes of the pre-bid meeting, including the text of the questions raised, without identifying the source, and the responses given, together with any responses prepared after the meeting, will be transmitted promptly to all Bidders who have acquired the Bidding Document in accordance with **ITB Clause 1.3.1.4**. Any modification to the Bidding Document that may become necessary as a result of the pre-bid meeting shall be made by the Purchaser exclusively through the issue of an Addendum pursuant to **ITB Clause 1.3.3** and not through the minutes of the pre-bid meeting.
- 1.3.2.7. Nonattendance at the pre-bid meeting will not be a cause for disqualification of a Bidder.
- 1.3.3. **Amendment of Bidding Document**
  - 1.3.3.1. At any time prior to the deadline for submission of bids, the Purchaser may amend the Bidding Document by issuing addenda.
  - 1.3.3.2. Any addendum issued shall be part of the Bidding Document and shall be communicated in writing to all who have obtained the Bidding Document from the Purchaser in accordance with **ITB Clause 1.3.1.4**.
  - 1.3.3.3. To give prospective Bidders reasonable time in which to take an addendum into account in preparing their bids, the Purchaser may, at its discretion, extend the deadline for the submission of bids, pursuant to **ITB Clause 1.5.2.2**.
- 1.4. **Preparation of Bids**
  - 1.4.1. **Cost of Bidding**
    - 1.4.1.1. The Bidder shall bear all costs associated with the preparation and submission of its Bid, and the Purchaser shall not be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.
  - 1.4.2. **Language of Bid**
    - 1.4.2.1. The Bid, as well as all correspondence and documents relating to the bid exchanged by the Bidder and the Purchaser, shall be written in the English language. Supporting documents and printed literature that are part of the Bid may be in another language provided they are accompanied by an accurate translation of the relevant passages into the English language, in which case, for purposes of interpretation of the Bid, such translation shall govern.
  - 1.4.3. **Documents Comprising the Bid**

- 1.4.3.1. The Bid shall comprise two envelopes submitted simultaneously, one called the '**Technical Bid**' containing the documents listed in **ITB Clause 1.4.3.2** and the other the **Price Bid** containing the documents listed in **ITB Clause 1.4.3.3**, both envelopes enclosed together in an outer single envelope.
- 1.4.3.2. The Technical Bid submitted by the Bidder shall comprise the following:
- (a) Letter of Technical Bid;
  - (b) Bid Security, in accordance with **ITB Clause 1.4.10**;
  - (c) Written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with **ITB Clause 1.4.11.2**;
  - (d) Documentary evidence in accordance with **ITB Clause 1.4.5** establishing the Bidder's eligibility and qualifications to perform the contract if its Bid is accepted;
  - (e) Documentary evidence establishing in accordance with **ITB Clause 1.4.6** that the plant and services offered by the Bidder conform to the Bidding Document;
  - (f) Documents as called for in **ITB Clauses 1.2.1** and **1.2.2**;
  - (g) List of manufacturer/subcontractors, in accordance with **ITB Clauses 1.4.7.1**; and
  - (h) Any other document required in the **BDS**.
- 1.4.3.3. The Price Bid submitted by the Bidder shall comprise the following:
- (a) Letter of Price Bid;
  - (b) completed schedules as required, including Price Schedules, in accordance with **ITB Clauses 1.4.4** and **1.4.8**; and
  - (c) any other document required in the **BDS**
- 1.4.4. **Letter of Bid and Schedules**
- 1.4.4.1. The Letters of Technical Bid and Price Bid, and the Schedules, and all documents listed under **ITB Clause 1.4.3**, shall be prepared using the relevant forms furnished in Section 2 (Bidding Forms). The forms must be completed without any alterations to the text, and no substitutes shall be accepted. All blank spaces shall be filled in with the information requested.
- 1.4.5. **Documents Establishing the Eligibility and Qualifications of the Bidder**
- 1.4.5.1. To establish its eligibility and qualifications to perform the Contract in accordance with Appendix 2 of ITB (Evaluation and Qualification Criteria), the Bidder shall provide the information requested in the corresponding information sheets included in Section 2 (Bidding Forms).
- 1.4.6. **Documents Establishing Conformity of the Plant and Services**
- 1.4.6.1. The documentary evidence of the conformity of the plant and services to the Bidding Document may be in the form of literature, drawings and data, and shall furnish:
- (a) a detailed description of the essential technical and performance characteristics of the plant and services, including the functional guarantees of the proposed plant and services, in response to the Specification;
  - (b) a commentary on the Purchaser's Specification and adequate evidence demonstrating the substantial responsiveness of the plant and services to those specifications. Bidders shall note that standards for workmanship, materials and equipment designated by the Purchaser in the Bidding Document are intended to be descriptive (establishing standards of quality and performance) only and not restrictive. The Bidder may substitute alternative standards, brand names and/or catalog numbers in its bid, provided that it demonstrates to the Purchaser's satisfaction that the substitutions are substantially equivalent or superior to the standards designated in the Specification.
- 1.4.7. **Subcontractors**
- 1.4.7.1. For major items of plant & equipment and services as listed by the Purchaser in Appendix 2 (Evaluation and Qualification Criteria), which the Bidder intends to purchase or subcontract, the Bidder shall give



details of the name and addresses of the proposed Subcontractors, including manufacturers, for each of those items. In addition, the Bidder shall include in its bid information establishing compliance with the requirements specified by the Purchaser for these items. Bidders are free to list more than one Subcontractor against each item of the plant and services. Quoted rates and prices will be deemed to apply to whichever Subcontractor is appointed, and no adjustment of the rates and prices will be permitted.

1.4.7.2. The Bidder shall be responsible for ensuring that any plant or services to be provided by the Subcontractor comply with the requirements of **ITB Clause 1.4.5.1**.

#### 1.4.8. **Bid Prices and Discounts**

1.4.8.1. Unless otherwise specified in the **BDS** and/or Section 3 (Purchaser's Requirements), bidders shall quote for the entire plant & equipment and services on a "single responsibility" basis such that the total bid price covers all the Contractor's obligations mentioned in or to be reasonably inferred from the bidding document in respect of the design, manufacture, including procurement and subcontracting (if any), delivery, construction, installation and completion of the plant. This includes all requirements under the Contractor's responsibilities for testing, pre-commissioning and commissioning of the plant and, where so required by the bidding document, the acquisition of all permits, approvals and licenses, etc.; the operation, maintenance and training services and such other items and services as may be specified in the Bidding Document, all in accordance with the requirements of the General Conditions. Items against which no price is entered by the Bidder will not be paid for by the Purchaser when executed and shall be deemed to be covered by the prices for other items.

1.4.8.2. Bidders are required to quote the price for the commercial, contractual and technical obligations outlined in the bidding document. No deviation in this regard normally, shall be accepted.

1.4.8.3. Bidders shall give a breakdown of the prices in the manner and detail called for in the Price Schedules included in Section 2 (Bidding Forms). Separate numbered Schedules included in Section 2 (Bidding Forms) shall be used for each of the following elements. The total amount from each Schedule (1, 2 and 2A) shall be summarized in a Grand Summary (Schedule 3) giving the total bid price(s) to be entered in the Bid Form.

- Schedule No. 1: Supply of Plant & Equipment (including (including Mandatory Spare Parts if specified)
- Schedule No. 2: Installation and Other Services (Supervision in Erection and Testing & Commissioning Services)
- Schedule No. 2A: Installation and Other Services (Freight & Insurance)
- Schedule No. 3: Grand Summary

Bidders shall note that the plant and equipment included in Schedule Nos. 1 excludes materials used for civil, foundation and other construction works and other minor items. All such materials/items shall be included and priced under Schedule No. 2, Installation and Other Services.

1.4.8.4. In the Schedules, bidders shall give the required details and a breakdown of their prices as called for in these Schedules.

1.4.8.5. Installation and other Services shall be quoted in Schedule No. 2, 2A and shall include prices for all labor, contractor's equipment, temporary works, construction or other materials/ minor items not specified in Schedule-1, consumables and all other matters and things of whatsoever nature, including operations and maintenance services, the provision of operations and maintenance manuals, training, etc., where identified in the Bidding Document, as necessary for the proper execution of the installation and other services. The prices of Installation and other services shall be inclusive of all taxes, like service taxes, work contract taxes etc. and sales & other taxes applicable on all materials/items supplied under Schedule No. 2 and 2A.

1.4.8.6. The prices shall be either fixed or adjustable as specified in the **BDS**.

- (a) In the case of Fixed Price, prices quoted by the Bidder shall be fixed during the Bidder's performance of the contract and not subject to variation on any account. A bid submitted with an adjustable price quotation will be treated **as non-responsive and rejected**.
- (b) In the case of Adjustable Price, prices quoted by the Bidder shall be subject to adjustment during performance of the contract to reflect changes in the cost elements such as labor, material, transport and contractor's equipment in accordance with the procedures specified in the corresponding Appendix to the Contract Agreement. A bid submitted with a fixed price quotation will not be rejected, but the price adjustment will be treated as zero. Bidders are required to indicate the source of labor and material indices in the corresponding Form in Section 2 (Bidding Forms).

#### 1.4.9. Period of Validity of Bids

- 1.4.9.1. Bids shall remain valid for the period specified in the **BDS** after the bid submission deadline date prescribed by the Purchaser. A bid valid for a shorter period **shall be rejected** by the Purchaser as non-responsive.
- 1.4.9.2. In exceptional circumstances, prior to the expiration of the bid validity period, the Purchaser may request Bidders to extend the period of validity of their bids. The request and the responses shall be made in writing. If a bid security is requested in accordance with **ITB Clause 1.4.10**, it shall also be extended for a corresponding period. A Bidder may refuse the request without forfeiting its bid security. A Bidder granting the request shall not be required or permitted to modify its bid.

#### 1.4.10. Bid Security

- 1.4.10.1. The Bidder shall furnish as part of its bid, in original form, either a Bid Security as specified in the **BDS**. The amount of Bid Security shall be as specified in the **BDS**.
- 1.4.10.2. The bid security shall be a demand guarantee, in the forms of an unconditional bank guarantee from a Scheduled or Nationalized Bank. The bid security shall be submitted using the 'Bid Security Form' included in Section 3 (Bidding Forms). The form must include the complete name of the Bidder. The bid security shall be valid for thirty days (30) beyond the original validity period of the bid, or beyond any period of extension if requested under **ITB Clause 1.4.9.2**.
- 1.4.10.3. Bids not complying with **ITB Clause 1.4.10.1** and **ITB Clause 1.4.10.2**, **shall be rejected** by the Purchaser as **non-responsive**.
- 1.4.10.4. The bid security of the successful Bidder shall be returned as promptly as possible once the successful Bidder has signed the Contract and furnished the required performance security.
- 1.4.10.5. The bid security of unsuccessful Bidders shall be returned as promptly as possible upon the successful Bidder's furnishing of the performance security pursuant to **ITB Clause 1.6.4**.
- 1.4.10.6. The bid security may be forfeited:
  - (a) if a Bidder withdraws its bid during the period of bid validity specified by the Bidder on the Letter of Bid Form, except as provided in **ITB Clause 1.4.9.2** or
  - (b) if the successful Bidder fails to:
    - (i) sign the Contract in accordance with **ITB Clause 1.6.1**; or
    - (ii) furnish a performance security in accordance with **ITB Clause 1.6.2**.

#### 1.4.11. Format and Signing of Bid

- 1.4.11.1. The Bidder shall prepare one original of the Technical Bid and one original of the Price Bid comprising the Bid as described in **ITB Clause 1.4.3**.
- 1.4.11.2. The original and all copies of the Bid shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Bidder. This authorization shall consist of a written confirmation as specified in the **BDS** and shall be attached to the bid. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the bid where entries or amendments have been made shall be signed or initialed by the person signing the bid.
- 1.4.11.3. A bid submitted by a JV shall be signed so as to be legally binding on all partners.

1.4.11.4. Any interlineations, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the bid.

## 1.5. Submission and Opening of Bids

### 1.5.1. Online Submission of Bids

1.5.1.1. The technical as well as Price bid should be submitted through online portal only.:

1.5.1.2. For technical bid, all forms and supporting documents as required by ITB clause 1.3.3 and duly signed and stamped as per ITB clause 1.3.10 are to be uploaded in the portal. The documents are to be uploaded in PDF format and each file should not exceed 5 MB in size. In case the a document is more than 5MB in size the same may be split to make the size below 5 MB.

1.5.1.3. The price bid must be submitted in the price schedule provided in the portal as per the online price schedule.

### 1.5.2. Deadline for Submission of Bids

1.5.2.1. Bid shall be received ONLINE on or before the date and time in the BDS.

1.5.2.2. The Purchaser may, at its discretion, extend the deadline for the submission of bids by amending the Bidding Document in accordance with **ITB Clause 1.3.3**, in which case all rights and obligations of the Purchaser and Bidders previously subject to the deadline shall thereafter be subject to the deadline as extended.

### 1.5.3. Late Bids

1.5.3.1. E-tendering portal shall allow bidders to submit bids upto the date and time specified in ITB clause 1.4.2 as per server time. However, bidders are advised to submit their bids well in advance of the deadline for submission of bids to avoid any last moment difficulties.

### 1.5.4. Withdrawal, Substitution, and Modification of Bids

1.5.4.1. E-tendering portal shall allow modification of bids any time before the deadline for bid submission A Bidder may withdraw its bid, by sending a written notice, duly signed by an authorized representative, and shall include a copy of the authorization in accordance with **ITB Clause 1.4.11.2**. Notices must be:

(a) received by the Purchaser prior to the deadline prescribed for submission of bids, in accordance with **ITB Clause 1.5.2**.

1.5.4.2. Bids requested to be withdrawn in accordance with **ITB Clause 1.5.2.1** shall not be opened and bid security BG shall be returned.

1.5.4.3. No bid may be withdrawn, substituted, or modified in the interval between the deadline for submission of bids and the expiration of the period of bid validity specified by the Bidder on the Letter of Technical Bid or any extension thereof.

### 1.5.5. Bid Opening

1.5.5.1. The Purchaser shall conduct the opening of Technical Bids **through e-tender portal** at the address, date and time specified in the BDS. The Bid opening committee shall open on-line received Bids in the presence of Bidders designated representatives who choose to attend. The Price Bids will remain unopened until the specified time of their opening.

1.5.5.2. First, physical envelopes marked "WITHDRAWAL" shall be read out and the corresponding bid shall not be considered/rejected with comments. No bid withdrawal shall be permitted unless the corresponding withdrawal notice contains a valid authorization to request the withdrawal duly signed by an authorized representative and is read out at bid opening.

1.5.5.3. All envelopes holding the Technical Bids shall be opened one at a time, and the following read out and recorded:

- a) the name of the Bidder;
- b) the presence of a Bid Security, if required; and
- c) any other details as the Purchaser may consider appropriate.

Only Technical Bids and alternative Technical Bids read out and recorded at bid opening shall be considered for evaluation. No Bid shall be rejected at the opening of Technical Bids, except for withdrawn bids.

- 1.5.5.4. The Purchaser shall prepare a record of the opening of Technical Bids that shall include, as a minimum: the name of the Bidder, whether there is a withdrawal and alternative proposals and presence or absence of a bid security or a bid securing declaration, if one is required. The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record.
- 1.5.5.5. At the end of the evaluation of the Technical Bids, the Purchaser will invite bidders who have submitted substantially responsive Technical Bids and who have been determined as being qualified for award to attend the opening of the Price Bids. The date, time, and location of the opening of Price Bids will be advised in writing by the Purchaser. Bidders shall be given reasonable notice of the opening of Price Bids.
- 1.5.5.6. The Purchaser shall conduct the opening of Price Bids through e-tender portal of all Bidders who submitted substantially responsive Technical Bids, in the presence of Bidders' representatives who choose to attend at the address, date and time specified by the Purchaser. The Bidder's representatives who are present shall be requested to sign a register evidencing their attendance.
- 1.5.5.7. All envelopes containing Price Bids shall be opened one at a time and the following read out and recorded:
- the name of the Bidder;
  - the Bid Prices, including any discounts and alternative offers; and
  - any other details as the Purchaser may consider appropriate.

Only Bid Prices and discounts read out and recorded during the opening of Price Bids shall be considered for evaluation. No Bid shall be rejected at the opening of Price Bids.

- 1.5.5.8. The Purchaser shall prepare a record of the opening of Price Bids that shall include, as a minimum: the name of the Bidder, the Bid Price (per lot if applicable), any discounts. The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record.

#### 1.5.6. Confidentiality

- 1.5.6.1. Information relating to the evaluation of bids and recommendation of contract award shall not be disclosed to Bidders or any other persons not officially concerned with such process.
- 1.5.6.2. Any attempt by a Bidder to influence the Purchaser in the evaluation of the bids or Contract award decisions may result in the rejection of its bid.
- 1.5.6.3. Notwithstanding **ITB Clause 1.5.6.2**, from the time of bid opening to the time of Contract award, if any Bidder wishes to contact the Purchaser on any matter related to the bidding process, it should do so in writing.

#### 1.5.7. Clarification of Bids

- 1.5.7.1. To assist in the examination, evaluation, and comparison of the Technical and Price Bids, and qualification of the Bidders, the Purchaser may, at its discretion, ask any Bidder for a clarification of its bid. Any clarification submitted by a Bidder that is not in response to a request by the Purchaser shall not be considered. The Purchaser's request for clarification and the response shall be in writing. No change in the substance of the Technical Bid or prices in the Price Bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Purchaser in the evaluation of the bids, in accordance with **ITB Clause 1.5.15**.
- 1.5.7.2. If a Bidder does not provide clarifications of its bid by the date and time set in the Purchaser's request for clarification, its bid may be rejected.

#### 1.5.8. Deviations, Reservations, and Omissions

- 1.5.8.1. During the evaluation of bids, the following definitions apply:
- "Deviation" is a departure from the requirements specified in the Bidding Document;

- b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the Bidding Document; and
- c) "Omission" is the failure to submit part or all of the information or documentation required in the Bidding Document.

#### 1.5.9. Preliminary Examination of Technical Bids

- 1.5.9.1. The Purchaser shall examine the Technical Bid to confirm that all documents and technical documentation requested in **ITB Sub-Clause 1.4.3.2** have been provided, and to determine the completeness of each document submitted. If any of these documents or information is missing, **the Bid may be rejected**.
- 1.5.9.2. The Purchaser shall confirm that the following documents and information have been provided in the Technical Bid. If any of these documents or information is missing, the offer **shall be rejected**.
  - a) Letter of Technical Bid;
  - b) written confirmation of authorization to commit the Bidder;
  - c) Bid Security, if applicable; and
  - d) Technical Proposal in accordance with **ITB 1.4.7**.

#### 1.5.10. Responsiveness of Technical Bid

- 1.5.10.1. The Purchaser's determination of a bid's responsiveness is to be based on the contents of the bid itself, as defined in **ITB Clause 1.4.3**.
  - 1.5.10.2. A substantially responsive Technical Bid is one that meets the requirements of the Bidding Document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that,
    - a) if accepted, would:
      - (i). affect in any substantial way the scope, quality, or performance of the plant and services specified in the Contract; or
      - (ii). limit in any substantial way, inconsistent with the Bidding Document, the Purchaser's rights or the Bidder's obligations under the proposed Contract; or
    - b) if rectified, would unfairly affect the competitive position of other Bidders presenting substantially responsive bids.
  - 1.5.10.3. The Purchaser shall examine the technical aspects of the Bid submitted in accordance with **ITB Clause 1.4.7**, Technical Proposal, in particular to confirm that all requirements of Section 3 (Purchaser's Requirements) have been met without any material deviation or reservation.
  - 1.5.10.4. If a bid is not substantially responsive to the requirements of the Bidding Document, it shall be rejected by the Purchaser and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.
- #### 1.5.11. Nonmaterial Nonconformities
- 1.5.11.1. Provided that a Bid is substantially responsive, the Purchaser may waive any nonconformity in the bid that does not constitute a material deviation, reservation or omission.
  - 1.5.11.2. Provided that a Bid is substantially responsive, the Purchaser may request that the Bidder submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities in the Bid related to documentation requirements. Requesting information or documentation on such nonconformities shall not be related to any aspect of the Price Bid. Failure of the Bidder to comply with the request may result in the rejection of its Bid.
  - 1.5.11.3. Provided that a Bid is substantially responsive, the Purchaser shall rectify nonmaterial nonconformities related to the Bid Price. To this effect, the Bid Price shall be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component. The adjustment shall be made using the method indicated in **Appendix 2 of ITB (EQC)**.

#### 1.5.12. Detailed Evaluation of Technical Bids

- 1.5.13. The Purchaser will carry out a detailed technical evaluation of the bids not previously rejected as being substantially non-responsive, in order to determine whether the technical aspects are in compliance with the Bidding Document. In order to reach such a determination, the Purchaser will examine and compare the technical aspects of the bids on the basis of the information supplied by the bidders, taking into account the following:
- a) overall completeness and compliance with the Purchaser's Requirements; deviations from the Purchaser's Requirements; conformity of the plant and services offered with specified performance criteria; suitability of the plant and services offered in relation to the environmental and climatic conditions prevailing at the site; and quality, function and operation of any process control concept included in the bid. The bid that does not meet minimum acceptable standards of completeness, consistency and detail will be rejected for non-responsiveness;
  - b) type, quantity and long-term availability of mandatory and recommended spare parts and maintenance services; and
  - c) other relevant factors, if any, listed in **Appendix to ITB-2 (Evaluation and Qualification Criteria)**.
- 1.5.14. **Eligibility and Qualification of the Bidder**
- 1.5.14.1. The Purchaser shall determine to its satisfaction during the evaluation of Technical Bids whether a Bidder meets the eligibility and qualifying criteria specified in **Appendix to ITB-2 (Evaluation and Qualification Criteria)**.
- 1.5.14.2. The determination shall be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to **ITB Clause 1.4.5**.
- 1.5.14.3. **An affirmative determination shall be a prerequisite for the opening and evaluation of a Bidder's Price Bid. A negative determination shall result into the disqualification of the Bid, in which event the Purchaser shall not open the Price Bid of the Bidder.**
- 1.5.14.4. The capabilities of the manufacturers and subcontractors proposed in its Bid to be used by the Bidder will also be evaluated for acceptability in accordance with **Appendix to ITB-2 (Evaluation and Qualification Criteria)**. Their participation should be confirmed with a letter of intent between the parties, as needed. Should a manufacturer or subcontractor be determined to be unacceptable, the Bid will not be rejected, but the Bidder will be required to substitute an acceptable manufacturer or subcontractor without any change to the bid price. Prior to signing the Contract, the corresponding **Appendix to the Contract Agreement** shall be completed, listing the approved manufacturers or subcontractors for each item concerned.
- 1.5.15. **Correction of Arithmetical Errors**
- 1.5.15.1. During the evaluation of Price Bids, the Purchaser shall correct arithmetical errors on the following basis:
- a) where there are errors between the total of the amounts given under the column for the price breakdown and the amount given under the Total Price, the former shall prevail and the latter will be corrected accordingly;
  - b) where there are errors between the total of the amounts of Schedule Nos. 1, 2 and 2A and the amount given in Schedule No. 3 (Grand Summary), the former shall prevail and the latter will be corrected accordingly; and
  - c) if there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetical error, in which case the amount in figures shall prevail subject to (a) and (b) above.
- 1.5.15.2. If the Bidder that submitted the lowest evaluated bid does not accept the correction of errors, its bid shall be **disqualified and its bid security may be forfeited**.
- 1.5.16. **Evaluation of Price Bids**
- 1.5.16.1. The Purchaser shall use the criteria and methodologies listed in this Clause. No other evaluation criteria or methodologies shall be used.
- 1.5.16.2. To evaluate a Price Bid, the Purchaser shall consider the following:

- a) the bid price, including taxes, as quoted in the Price Schedules;
  - b) price adjustment for correction of arithmetical errors in accordance with **ITB Clause 1.5.15.1**; and
  - c) the evaluation factors if any indicated in Appendix 2 (Evaluation and Qualification Criteria).
- 1.5.16.3. If price adjustment is allowed in accordance with **ITB Clause 1.4.8.6**, the estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in bid evaluation.
- 1.5.17. **Comparison of Bids**
- 1.5.17.1. The Purchaser shall compare all substantially responsive Bids to determine the lowest evaluated bid, in accordance with **ITB Clause 1.5.16.2**.
- 1.5.18. **Purchaser's Right to Accept Any Bid, and to Reject Any or All Bids**
- 1.5.18.1. The Purchaser reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids at any time prior to contract award, without thereby incurring any liability to Bidders. In case of annulment, all bids submitted and specifically, bid securities, shall be promptly returned to the Bidders.
- 1.6. **Award of Contract**
- 1.6.1. **Award Criteria**
- 1.6.1.1. The Purchaser shall award the Contract to the Bidder whose offer has been determined to be the lowest evaluated bid and is substantially responsive to the Bidding Document, provided further that the Bidder is determined to be eligible and qualified to perform the Contract satisfactorily.
- 1.6.2. **Notification of Award**
- 1.6.2.1. Prior to the expiration of the period of bid validity, the Purchaser shall notify the successful Bidder, in writing, that its bid has been accepted. The notification letter (hereinafter and in the Conditions of Contract and Contract Forms called the "Letter of Acceptance") shall specify the sum that the Purchaser will pay the Contractor in consideration of the execution and completion of the plant and services (hereinafter and in the Conditions of Contract and Contract Forms called "the Contract Price").
- 1.6.2.2. Until a formal contract is prepared and executed, the notification of award shall constitute a binding Contract.
- 1.6.3. **Signing of Contract**
- 1.6.3.1. Within fifteen (15) days of issue of the Letter of Acceptance, the successful Bidder shall be required to sign the Contract Agreement.
- 1.6.3.2. The contract signing shall take place at the premises of the Purchaser.
- 1.6.4. **Performance Security**
- 1.6.5. Within ten (10) days of the issue of notification of award from the Purchaser, the successful Bidder shall furnish the performance security in accordance with the conditions of contract, using for that purpose the Performance Security Form included in **Appendix – 4, Section 6 (Contract Forms)**, or another form acceptable to the Purchaser.
- 1.6.6. Failure of the successful Bidder to submit the above-mentioned Performance Security or sign the Contract shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid security. In that event the Purchaser may award the Contract to the next lowest evaluated Bidder whose offer is substantially responsive and is determined by the Purchaser to be qualified to perform the Contract satisfactorily.

## APPENDIX TO ITB - 1 Bid Data Sheet

### A. Introduction

ITB 1.1.1	<p>The number of the Invitation for Bids is : <b>AEGCL/MD/Tech- 700/40 MVA PTR/AP/17-18/IFB/01</b></p> <p>The Purchaser is: <b>Assam Electricity Grid Corporation Limited.</b></p> <p>The name of the Bid is: Supply of 40 MVA, 132/33 kV Power Transformers with Related Services for Srikona and Sipajhar Grid Substations in Assam.</p> <p>The identification number of Bid is: <b>AEGCL/MD/TECH-700/AP/17-18/PTR/BD</b></p> <p>Destination Substation: 1. Srikona 132/33 KV Substation, Dist-Cachar, Assam 2. Sipajhar 132/33 KV Substation, Dist-Mangaldai, Assam</p> <p>Note: Delivery destinations may vary at the time of dispatch.</p>
ITB 1.3.2.1	<p>For <b>clarification purposes</b> only, the Purchaser's address is:</p> <p>Attention: <b>The Managing Director, AEGCL</b> Street Address: <b>Bijulee Bhawan, Paltanbazar</b> Floor/Room number: <b>First Floor</b> City: <b>Guwahati</b> PIN Code: <b>781001</b> Country: <b>India</b> Telephone: +91 361 2739520 Facsimile number: +91 361 2739513 Electronic mail address: <a href="mailto:managing.director@aeqcl.co.in">managing.director@aeqcl.co.in</a></p>
ITB 1.3.2.4	<p>Purchaser may invite intending Bidders to a pre-bid meeting, if Purchaser feels it is necessary. The date and time of such pre-bid meeting shall be intimated to intending bidders in due course of time.</p>
ITB 1.4.3.2(h)	<p>The Bidder shall submit with its Technical Bid the following additional documents:</p> <ol style="list-style-type: none"> <li>1. <b>Schedule-1, Schedule-2, Schedule-3 and Schedule-4</b>, as required in Section 3, 'Purchaser's Requirements', duly filled in and completed.</li> <li>2. <b>Type Test Certificates</b> as per Clause 3.6, Section - 3</li> </ol>
ITB 1.4.8.1	<p>Unless otherwise specifically indicated in the Section 3 (Purchaser's Requirements), bidders shall quote for the entire plant and services on 'single responsibility basis'.</p>
ITB 1.4.8.6	<p>The prices quoted by the Bidder shall be <b>FIRM</b></p>
ITB 1.4.9.1	<p>The bid validity period shall be <b>180 (one hundred Eighty)</b> days.</p>
ITB 1.4.10.1	<p><b>The Bidder shall furnish a bid security in the amount of Rs. 12, 00, 000.00(Twelve Lakh Only).</b></p>
ITB	<p>The bidding is through E-tendering portal and received online. However, bidder has to submit any</p>



1.4.11.1	documents in hard copy if asked by the purchaser.
ITB 1.4.11.2	The written confirmation of authorization to sign on behalf of the Bidder shall consist of a written confirmation of Authorization to sign on behalf of the Bidder shall consist of <b>Notarized Power of Attorney.</b>
ITB 1.5.2.1	<p>For <b>bid submission purposes</b> only, the Purchaser's address is <b>(E-Tenders shall be accepted through online portal only)</b></p> <p>Attention: <b>The Managing Director, AEGCL</b> Street Address: <b>Bijulee Bhawan, Paltanbazar</b></p> <p>Floor/Room number: <b>First Floor</b></p> <p>City: <b>Guwahati</b></p> <p>PIN Code: <b>781001</b></p> <p><b>The deadline for bid submission is</b> Date: <b>31.05.2017</b> Time:12.00 Hours</p>
ITB 1.5.5.1	<p>The bid opening of Technical Bids shall take place at</p> <p><b>Office of The Managing Director, AEGCL</b> Street Address: <b>Bijulee Bhawan, Paltanbazar</b></p> <p>Floor/Room number: <b>First Floor</b></p> <p>City: <b>Guwahati (Assam)</b></p> <p>PIN Code: <b>781001</b></p> <p>Country: <b>India</b></p> <p>Date: <b>31.05.2017</b> Time: 14.00 Hours</p>

## APPENDIX TO ITB - 2

### Evaluation and Qualification Criteria

This Appendix contains all the criteria that the Purchaser shall use to evaluate bids and qualify Bidders. In accordance with ITB 1.5.12 and ITB 1.5.14, no other methods, criteria and factors shall be used. The Bidder shall provide all the information requested in the forms included in Section 2 (Bidding Forms).

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2.5 Subcontractors/Manufacturers	18
2.6 Equipment	18

## 1. Evaluation

### 1.1 Technical Evaluation

In addition to the criteria listed in ITB 1.5.13 (a) – (c) the following factors shall apply:

**For additional factors refer Clause -3.6, Section-3 'Purchaser's Requirements'.**

### 1.2 Economic Evaluation

Any adjustments in price that result from the procedures outlined below shall be added, for purposes of comparative evaluation only, to arrive at an "Evaluated Bid Price." Bid prices quoted by bidders shall remain unaltered.

#### 1.2.1 Quantifiable Deviations and Omissions

*Quantifiable Deviations and Omissions from the contractual obligations:* No financial assessment shall be made by the Purchaser for deviations and omissions from the requirements of the Bidding Document. All such deviations, omissions or reservations shall be dealt with in accordance with ITB Clauses 1.5.10.2, 1.5.10.3, 1.5.10.4, 1.5.11.1, 1.5.11.2, 1.5.11.3, 1.5.13(a) and 1.5.15.

#### 1.2.2 Time Schedule

Time to complete Works from the Commencement Date specified in **Article 3** of the Contract Agreement for determining time for completion the works is **6 (six) months (5 months for supply of transformers with accessories and spares and 1 month thereafter for supervision in erection, testing and commissioning at site)**. Bids not meeting the above time schedule shall be rejected. However, no credit will be given for earlier completion.

#### 1.2.3 Specific additional criteria

No additional criteria other than mentioned shall be considered.

## 2. Qualification

### 2.1 Eligibility

Criteria	Compliance Requirements			Documents	
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	At Least One Partner	

#### 2.1.1 Eligibility Requirements

Requirement of document as per ITB Sub-Clause 1.2	Must meet requirement	Not applicable	Not applicable	Not applicable	Required documents as per ITB Sub-Clause 1.2
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### 2.2 Pending Litigation

Criteria	Compliance Requirements			Documents	
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
All pending litigation shall be treated as resolved against the Bidder and so shall in total not represent more than <b>50% percent</b> of the Bidder's net worth.	Must meet requirement by itself or as partner to past or existing JV	Not applicable	Not applicable	Not applicable	Form LIT - 1

## 2.3 Financial Situation

Criteria	Compliance Requirements			Documents	
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	

## 2.3.1 Historical Financial Performance

Submission of audited balance sheets or, if not required by the law of the Bidder's country, other financial statements acceptable to the Purchaser, for the last <b>3 (three)</b> years to demonstrate the current soundness of the Bidders financial position and its prospective long-term profitability. As a minimum, a Bidder's net worth calculated as the difference between total assets and total liabilities should be positive.	Must meet requirement	Not applicable	Not applicable	Not applicable	Form FIN - 1 with attachments
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## 2.3.2 Average Annual Turnover

Minimum average annual turnover of <b>Rs. 24,00,00,000.00</b> calculated as total certified payments received for contracts in progress or completed, within the <b>last 3 years</b> .	Must meet requirement	Not applicable	Not applicable	Not applicable	Form FIN - 2
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## 2.3.3 Financial Resources

Using Forms FIN – 3 and FIN - 4 in Section 4 (Bidding Forms) the Bidder must demonstrate access to, or availability of, financial resources such as liquid assets, unencumbered real assets, lines of credit, and other financial means, other than any contractual advance payments to meet: (1) the following cash-flow requirement, <b>Rs. 2, 00,00,000.00</b> , and (2) the overall cash flow requirements for this contract and its current works commitment.	Must meet requirement	Not applicable	Not applicable	Not applicable	Form FIN - 3
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## 2.4 Experience

Criteria	Compliance Requirements			Documents	
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	

## 2.4.1 General Experience

Experience as manufacturer of power transformers of 132 kV and/or above for at least last <b>10 (ten)</b> years prior to the bid submission deadline	Must meet requirement	Not applicable	Not applicable	Not applicable	Form EXP - 1
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### 2.4.2 Specific Experience

The bidder must have designed, manufactured; type tested, supplied at least <b>20 (twenty)</b> Power Transformers of 132 kV and/or higher voltage class and of capacity of at least 40 MVA, which are in successful operation for at <b>least three years</b> as on the date of Bid opening. The bidder should furnish a list of such works executed along with clients' performance certificates to substantiate the requirement of this Clause. <i>(If Bidder is proposed to appoint subcontractor for supply of transformer accessories and equipment listed in Clause .2.5, he must also meet the requirements of that clause).</i>	Must meet requirement	Not applicable	Not applicable	Not applicable	Form EXP - 2
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### 2.5 Subcontractors/Manufacturers

Subcontractors/manufacturers for the following major items of supply must meet the following minimum criteria, herein listed for that item. Failure to comply with this requirement will result in rejection of the subcontractor/manufacturer.

Item No.	Description of Item	Minimum Criteria to be met
1	Tap changer	The Bidder or if the Bidder is not a manufacturer of listed items his supplier, must have designed, manufactured; type tested, supplied listed equipment, which are in successful operation for at least three years as on the date of bid opening. The bidder/manufacturer should list such works executed to substantiate the requirement of this Clause using <b>Form EXP-2</b> .
2	Transformer Oil	
3.	132 & 33 kV Bushings	
4	Buchholz Relay	
5	Pressure Relief Device	
6	Bushing Current Transformer	
7	Nitrogen Fire Extinguishing & Prevention system	
8	Online H <sub>2</sub> & Moisture monitoring system	
9	Maintenance free dehydrating breather	

### 2.6 Equipment/Facilities

The Bidder must demonstrate that it has the key equipment & facilities listed hereafter at their manufacturing unit:

Sl. No.	Equipment & Facilities	Submission Requirements
1	Vapour phase drying system	Yes. Declaration using Form FCT - 1
2	De-humidifier plant for its floor shop	
3	Winding construction area is under positive pressure	
4	Vertical winding machine available.	
5	NABL accreditation of testing laboratory	

## Section –2

# Bidding Forms

## Section 2 - Bidding Forms

*This Section contains the forms which are to be completed by the Bidder and submitted as part of his Bid.*

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1 Letter of Technical Bid

[Bidder's Letterhead]

Date: .....

Bid Identification No.: .....

Invitation for Bid No.: .....

To:.....

We, the undersigned, declare that:

- (a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instructions to Bidders (ITB) 1.3.3;
- (b) We offer to design, manufacture, test, deliver, install, and commission in conformity with the Bidding Document the following Plant and Services: ..... ;
- (c) Our Bid consisting of the Technical Bid and the Price Bid shall be valid for a period of . . . . . days from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period

Name .....

In the capacity of .....

Signed .....

.....

Duly authorized to sign the Bid for and on behalf of .....

Date .....

.....



2 Letter of Price Bid

[Bidder's Letterhead]

Date: .....

Bid Identification No No.: .....

Invitation for Bid No.: .....

To:.....

We, the undersigned, declare that:

- (i). We have examined and have no reservations to the Bidding Document, including Addenda issued in accordance with Instructions to Bidders (ITB) 1.3.3;
- (ii). We offer to design, manufacture, test, deliver, install, and commission in conformity with the Bidding Document the following Plant and Services: . . . . . ;
- (iii). The total price of our Bid is the sum of:
- (iv). Discount offered (if any) for (i) Supply .....%, (ii) Erection.....%.
- (v). Our bid shall be valid for a period of ..... days from the date fixed for the submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;
- (vi). If our bid is accepted, we commit to obtain a performance security in accordance with the Bidding Document;
- (vii). We understand that this bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal contract is prepared and executed; and
- (viii). We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive.

Name .....

In the capacity of .....

Signed .....

Duly authorized to sign the Bid for and on behalf of .....

Date .....

**NOTE: For e-tendering, above form is not required to be filled. All price proposals are to be submitted in e-tendering portal only.**

### 3 Price Schedules

#### PREAMBLE

##### General

1. The Price Schedules are divided into separate Schedules as follows:

Schedule No. 1:	Plant & Equipment (including Mandatory Spare Parts)
Schedule No. 2:	Installation and Other Services (Supervision in Erection and Testing & Commissioning Services)
Schedule No. 2A:	Installation and Other Services (Freight & Insurance)
Schedule No. 2A:	Installation and Other Services (Type Test Charges)
Schedule No. 3:	Grand Summary
2. The Schedules do not generally give a full description of the plant to be supplied and the services to be performed under each item. Bidders shall be deemed to have read the Purchaser's Requirements and other sections of the Bidding Document and reviewed the Drawings to ascertain the full scope of the requirements included in each item prior to filling in the rates and prices. The entered rates and prices shall be deemed to cover the full scope as aforesaid, including overheads and profit.
3. If bidders are unclear or uncertain as to the scope of any item, they shall seek clarification in accordance with **ITB 1.3.2** prior to submitting their bid.

##### Pricing

4. Prices shall be filled in indelible ink, and any alterations necessary due to errors, etc., shall be initialed by the Bidder.

As specified in the Bid Data Sheet and Special Conditions of Contract, prices shall be fixed and firm for the duration of the Contract.
5. Bid prices shall be quoted in the manner indicated in Schedules.

As specified in the Bid Data Sheet and Special Conditions of Contract, prices shall be fixed and firm for the duration of the Contract, or prices shall be subject to adjustment in accordance with the corresponding Appendix (Price Adjustment) to the Contract Agreement.

Prices given in the Schedules against each item shall be for the scope covered by that item as detailed in Section 3 (Purchaser's Requirements) or elsewhere in the Bidding Document.
6. When requested by the Purchaser for the purposes of making payments or part payments, valuing variations or evaluating claims, or for such other purposes as the Purchaser may reasonably require, the Contractor shall provide the Purchaser with a breakdown of any composite or lump sum items included in the Schedules.

**NOTE: For e-tendering, price proposals are to be submitted in e-tendering portal only. The price schedules given below are for reference only. In price schedules uploaded in e-tender portal, please use remarks column specifying tax details. In absence of any remarks regarding any specific taxes not quoted in price schedule, it will be deemed for evaluation purpose that such taxes are included in quoted price.**

## Schedule No. 1 – Supply of Plants &amp; Equipment and Mandatory Spare Parts

Item	Description <sup>(a)</sup>	Measuring Unit	Qty	Unit Prices		Total EXW Price including ED (including EC) <sup>1</sup>	Unit Sales & other Taxes		Total Sales and other Taxes	Total Price including all Taxes
				Unit Price without any taxes <sup>1</sup>	Unit ED (including EC) <sup>1</sup>		Sales Taxes	Other Taxes if any (specify) <sup>2</sup>		
1	2	3	4	5	6	7 = 4 x (5 + 6)	8	9	10=4x(8 + 9)	11=7 + 10
1	(a) Supply of 40 MVA, 132/33kV three Phase Power Transformer (without transformer Oil) with all fittings and accessories as specified including cost of all routine tests including loading and unloading at site.	No	2							
	(b) Transformer oil for above Transformer plus 10% extra.	Lot for one Transformer	2							
2	Supply of N <sub>2</sub> Fire prevention & extinguishing system as per clause 3.28, Section-3	No	2							
3	Supply of Stainless steel Oil sampling bottles (1 Litre Capacity) as per clause 3.26, Section-3 & Syringes for Oil Sampling	Set	6							
4	<b>SUPPLY OF MANDATORY SPARES</b>									
	(i) HV Bushing	No	2							
	(ii) LV Bushing	No	2							
	(iii) Neutral Bushing	No	2							
	(iv) Magnetic oil level gauge with low oil level	Set	2							
	(v) Buchholz Relay complete with float and contacts (Main tank)	Set	2							
	(vi) Local WTI complete with sensing device & contacts	Set	2							
	(vii) Local oil temperature indicator with contacts & sensing device	Set	2							

FOR REFERENCE ONLY

Item	Description <sup>(a)</sup>	Measuring Unit	Qty	Unit Prices		Total EXW Price including ED (including EC) <sup>1</sup>	Unit Sales & other Taxes		Total Sales and other Taxes	Total Price including all Taxes
				Unit Price without any taxes <sup>1</sup>	Unit ED (including EC) <sup>1</sup>		Sales Taxes	Other Taxes if any (specify) <sup>2</sup>		
1	2	3	4	5	6	7 = 4 x (5 + 6)	8	9	10=4x(8 + 9)	11=7 + 10
	(viii) Remote WTI complete with three sets of 4-20mA contacts	No	2							
	(ix) Remote OTI complete with three sets of 4-20mA contacts	No	2							
	(x) Pressure Relief device	Set	2							
	(xi) Set of valves (complete set for one transformer)	Set	2							
	(xii) Breather assembly (one of each type) for conservator and OLTC	Set	2							
	(xiii) Remote tap position indicator	No	2							
	(xiv) Oil surge relay	No	2							
	(xv) Complete set of gasket	Set	2							
	(xvi) Cooler Fan with Motor	Nos.	2							
<b>TOTAL Column 7 and 10 to be carried forward to Schedule No. 3. Grand Summary</b>										

**FOR REFERENCE ONLY**

Name of Bidder \_\_\_\_\_  
Signature of Bidder \_\_\_\_\_

<sup>1</sup>All amounts shall be in Rupees.

<sup>2</sup>Use separate columns for each type of taxes. If such taxes are not shown here, then it will be considered for all purposes that the EXW prices are inclusive of such taxes.

**Schedule No. 2 - Installation and Other Services (Supervision of Erection and Testing & Commissioning Services)**

Item	Description	Measuring Unit	Qty.	Unit Price <sup>1</sup>	Total Price <sup>1</sup>
1	2	3	4	5	6 = 4 x 5
1	Supervision charges on Erection & Commissioning for 40 MVA, 132/33 kV Power Transformer	No	2		
<b>FOR REFERENCE ONLY</b>					
<b>TOTAL Columns 6 to be carried forward to Schedule No. 3. Grand Summary</b>					

Name of Bidder \_\_\_\_\_

Signature of Bidder \_\_\_\_\_

<sup>1</sup>All amounts shall be in Rupees.

<sup>2</sup>Prices shall be inclusive of all taxes as applicable.

## Schedule No. 2A - Installation and Other Services (Freight &amp; Insurance)

Item	Description <sup>(a)</sup>	Measuring Unit	Qty	Unit Prices <sup>1</sup>	Total Price
1	2	3	4	5	6=4x5
1	(a) 40 MVA, 132/33kV three Phase Power Transformer (without transformer Oil) with all fittings and accessories as specified.	No	2		
	(b) Transformer oil for above Transformer plus 10% extra.	Lot for one Transformer	2		
2	Supply of N <sub>2</sub> Fire extinguishing & prevention system as per clause 3.28, Section-3	No	2		
3	Supply of Stainless steel Oil sampling bottles (1 Litre Capacity) as per clause 3.26, Section-3	Set	6		
4	<b>SUPPLY OF MANDATORY SPARES</b>				
	(i) HV Bushing	No	2	<b>FOR REFERENCE ONLY</b>	
	(ii) LV kV Bushing	No	2		
	(iii) Neutral Bushing	No	2		
	(iv) Magnetic oil level gauge with low oil level	Set	2		
	(v) Buchholz Relay complete with float and contacts (Main tank)	Set	2		
	(vi) Local WTI complete with sensing device & contacts	Set	2		
	(vii) Local oil temperature indicator with contacts & sensing device	Set	2		
	(viii) Remote WTI complete with three sets of 4-20mA contacts	No	2		
	(ix) Remote OTI complete with three sets of 4-20mA contacts	No	2		
	(x) Pressure Relief device	Set	2		
	(xi) Set of valves (complete set for one transformer)	Set	2		
	(xii) Breather assembly (one of each type) for conservator and OLTC	Set	2		
	(xiii) Remote tap position indicator	No	2		
	(xiv) Oil surge relay	No	2		
	(xv) Complete set of gasket	Set	2		
	(xvi) Cooler Fan with Motor	No	2		
<b>TOTAL Column 6 to be carried forward to Schedule No. 3. Grand Summary</b>					

Name of Bidder \_\_\_\_\_  
Signature of Bidder \_\_\_\_\_

<sup>1</sup>All amounts shall be in Rupees.

<sup>2</sup>Prices shall be inclusive of all taxes as applicable.

## Schedule No. 3 - Grand Summary

Schedule No.	Column No.	Title	TOTAL
1	7	Plant & Equipment and Mandatory Spares (Total EXW with ED)	
1	10	Plant & Equipment and Mandatory Spares (Total Sales and other Taxes)	
2	6	Installation and Other Services (Supervision in Erection and Testing & Commissioning Services)	
2A	6	Installation and Other Services (Freight & Insurance)	
<b>GRAND TOTAL to be carried forward to Letter of Price Bid</b>			<b>FOR REFERENCE ONLY</b>

Name of Bidder

Signature of Bidder

**Schedule No. 4 - Schedule of Co-efficient and Indices for Price Adjustment**

Coefficient Scope of Index	Source of Index Title/ Definition	Value on stated dates	
a =			
b =	<b>NOT</b>		
c =			
d =			
etc.			
		<b>APPLICABLE</b>	

- Notes: 1. The base date shall be the date thirty (30) days prior to the Bid closing date.  
 2. Co-efficient and indices shall be furnished with specific reference to the items of Price Schedules.



## 5 Form of Bid Security

### Bank Guarantee

(To be stamped in accordance with Stamp Act)  
(The non-Judicial Stamp Paper should be in the name of issuing Bank)

..... **Bank's Name, and Address of Issuing Branch or Office** .....

**Beneficiary:** ..... **Name and Address of Purchaser** .....

**Date:** .....

**Bid Security No.:** .....

We have been informed that . . . . . **name of the Bidder** . . . . . (hereinafter called "the Bidder") has submitted to you its bid dated . . . . . (hereinafter called "the Bid") for the execution of . . . . . **name of contract** . . . . . under Invitation for Bids No. . . . . ("the IFB").

Furthermore, we understand that, according to your conditions, bids must be supported by a bid guarantee.

At the request of the Bidder, we . . . . . **name of Bank** . . . . . hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of . . . . . **amount in figures** . . . . . (. . . . . **amount in words** . . . . .) upon receipt by us of your first demand in writing accompanied by a written statement stating that the Bidder is in breach of its obligation(s) under the bid conditions, because the Bidder:

- (a) has withdrawn its Bid during the period of bid validity specified by the Bidder in the Form of Bid; or
- (b) does not accept the correction of errors in accordance with the Instructions to Bidders (hereinafter "the ITB"); or
- (c) having been notified of the acceptance of its Bid by the Purchaser during the period of bid validity, (i) fails or refuses to execute the Contract Agreement, or (ii) fails or refuses to furnish the Performance Security, in accordance with the ITB.

This guarantee will expire: (a) if the Bidder is the successful Bidder, upon our receipt of copies of the Contract Agreement signed by the Bidder and the performance security issued to you upon the instruction of the Bidder; and (b) if the Bidder is not the successful Bidder, upon the earlier of (i) our receipt of a copy your notification to the Bidder of the name of the successful Bidder; or (ii) twenty-eight days after the expiration of the Bidder's bid.

Consequently, any demand for payment under this guarantee must be received by us at the office on or before that date.

..... **Bank's seal and authorized signature(s)** .....

**Note: All italicized text is for use in preparing this form and shall be deleted from the final document**

## 6 Contract Execution Schedule

***The Bidder shall indicate here his proposed Contract Execution Schedule if the contract is awarded to him. The Construction Schedule shall match with the time for completion specified.***

### **Proposed Subcontractors/Manufacturers for Major Items of Plant and Services**

The following Subcontractors and/or manufacturers are proposed for carrying out the item of the facilities indicated. Bidders are free to propose more than one for each item.

<b>Major Items of Plant and Services</b>	<b>Proposed Subcontractors/Manufacturers</b>	<b>Nationality</b>

## 8 Bidders Qualification

To establish its qualifications to perform the contract in accordance with Appendix 2 of ITB (Evaluation and Qualification Criteria) the Bidder shall provide the information requested in the corresponding Information Sheets included hereunder.

### 8.1 Form ELI - 1: Bidder's Information Sheet

<b>Bidder's Information</b>	
<b>Bidder's legal name</b>	
<b>Bidder's country of constitution</b>	
<b>Bidder's year of constitution</b>	
<b>Bidder's legal address in country of constitution</b>	
<b>Bidder's authorized representative</b> (name, address, telephone numbers, fax numbers, e-mail address)	
<b>Attached are copies of the following original documents.</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> 1. In case of single entity/firm, documents, in accordance with ITB 1.2.1.</li> <li><input type="checkbox"/> 2. In case of single entity/firm, documents, in accordance with ITB 1.2.2.</li> </ul>	

## 8.2 Form LIT - Pending Litigation

Each Bidder must fill in this form

<b>Pending Litigation</b>			
<input type="checkbox"/> <b>No pending litigation in accordance with Criteria 2.2 of Appendix 2 of ITB (Evaluation and Qualification Criteria)</b>			
<input type="checkbox"/> <b>Pending litigation in accordance with Criteria 2.2 of Appendix 2 of ITB (Evaluation and Qualification Criteria)</b>			
Year	Matter in Dispute	Value of Pending Claim in Rupees	Value of Pending Claim as a Percentage of Net Worth

### 8.3 Form FIN - 1: Financial Situation

Each Bidder must fill in this form

Financial Data for Previous 3 Years [Rupees]		
Year 1:	Year 2:	Year 3:

#### Information from Balance Sheet

Total Assets			
Total Liabilities			
Net Worth			
Current Assets			
Current Liabilities			

#### Information from Income Statement

Total Revenues			
Profits Before Taxes			
Profits After Taxes			

- Attached are copies of financial statements (balance sheets including all related notes, and income statements) for the last three years, as indicated above, complying with the following conditions.
- All such documents reflect the financial situation of the Bidder or partner to a JV, and not sister or parent companies.
  - Historic financial statements must be audited by a certified accountant.
  - Historic financial statements must be complete, including all notes to the financial statements.
  - Historic financial statements must correspond to accounting periods already completed and audited (no statements for partial periods shall be requested or accepted).

**8.4 Form FIN - 2: Average Annual Turnover**

Each Bidder must fill in this form

<b>Annual Turnover Data for the Last 3 Years</b>	
<b>Year</b>	<b>Amount (Rupees)</b>

**Average Annual Turnover**

The information supplied should be the Annual Turnover of the Bidder in terms of the amounts billed to clients for each year for contracts in progress or completed.

### 8.5 Form FIN – 3: Financial Resources

Specify proposed sources of financing, such as liquid assets, unencumbered real assets, lines of credit, and other financial means, net of current commitments, available to meet the total construction cash flow demands of the subject contract or contracts as indicated in **Appendix 2 of ITB** (Evaluation and Qualification Criteria)

Financial Resources		
No.	Source of financing	Amount (Rupees)
1		
2		
3		

### 8.6 Form FIN- 4: Current Contract Commitments

Bidders should provide information on their current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued.

<b>Current Contract Commitments</b>					
<b>No .</b>	<b>Name of Contract</b>	<b>Purchaser's Contact Address, Tel, Fax</b>	<b>Value of Outstanding Work [Rupees]</b>	<b>Estimated Completion Date</b>	<b>Average Monthly Invoicing Over Last Six Months [Rs/month]</b>
1					
2					
3					
4					
5					



### 8.7 Form EXP – 1: General Experience

Each Bidder must fill in this form

<b>General Experience</b>				
<b>Starting Month Year</b>	<b>Ending Month Year</b>	<b>Years</b>	<b>Contract Identification and Name Name and Address of Purchaser Brief Description of the Works Executed by the Bidder</b>	<b>Role of Bidder</b>

**8.8 Form EXP – 2: Specific Experience**

Fill up one (1) form per contract.

Contract of Similar Size and Nature		
Contract No. . . . . of . . . . .	Contract Identification	
Award Date	Completion Date	
Role in Contract	<input type="checkbox"/> Contractor <span style="margin-left: 200px;"><input type="checkbox"/> Subcontractor</span>	
Total Contract Amount	(Rupees)	
If partner in a JV or subcontractor, specify participation of total contract amount	Percent of Total	Amount
Purchaser's Name Address Telephone/Fax Number E-mail		
Description of the similarity in accordance with Criteria 2.4.2 /2.5 of Section 3		
1. Capacity & Nos. of transformer supplied 2. Date of commissioning.		
<b>Attached are copies of the following original documents.</b> <input type="checkbox"/> 1. Type Test Certificates. <input type="checkbox"/> 2. Recent performance certificates		

### 8.9 Form FCT – 1: Facilities at Manufacturing Unit

SI No	Shop Floor Equipped with	Requirement	Declaration by the Bidder
1.0	Whether Core Construction floor have de-humidifier plant	Must have facility	Declaration should be specific
2.0	Whether Vertical winding machine is available.	Must have facility -	Declaration should be specific
3.0	Whether winding construction area is under positive pressure	Must have facility -	Declaration should be specific
4.0	Core lamination cutting facilities in-house or out source	-	
5.0	Whether Vapour Phase drying facilities are available	Must have facility	Declaration should be specific
6.0	Whether followed six sigma quality control tool	-	
7.0	Whether testing laboratory is acoustically shielded	-	

## **Section - 3**

# **Purchaser's Requirements**

## Section 3 - Purchaser's Requirements

This Section contains the Specification, the Drawings, and supplementary information that describe the Works to be procured.

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## Section 3

### Purchaser's Requirements

#### 3.0 Scope of Works

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

- a) Design and manufacture of 02(two) numbers of 132/33 kV, 40 MVA Power Transformer, testing at manufacturer's works, supply and delivery at substation site with all accessories, mandatory spares & special tools/kits unloading at sites.
- b) Supervision of erection, testing at site and commissioning of transformers.
- (j). **Contractor will be required to arrange all equipment for unloading at site.**
- (ii). **It is also responsibility of the Contractor to obtain any road permits and any other permits or licenses to execute the works.**

#### 3.1. Bill of Materials

3.1.1. **The Bill of Quantities is furnished in Schedule Nos. 1, 2, 2A of Section – 2.**

3.1.2. **The items mentioned in these Schedules shall only be used while quoting the bid prices. If any item which is not specifically mentioned in these Schedules but required to complete the works as per Specification shall deemed to be included in any of the items of these schedules. No modifications/ additions/ deletions shall be made by the bidder to the items and quantities given in these schedules.**

#### 3.2. Contractor to Inform Himself Fully

- 3.2.1. The contractor should ensure that he has examined the Specifications and Schedules as brought out in this Section as well as other Sections of The Bidding document and has satisfied himself as to all the conditions and circumstances affecting the contract price and fixed his price according to his own views on these matters and acknowledge that no additional allowances except as otherwise provided therein will be levied.
- 3.2.2. The Purchaser shall not be responsible for any misunderstanding or incorrect information obtained by the contractor other than information given to the contractor in writing by the Purchaser.

#### 3.3. Service Conditions

- 3.3.1. The plant and materials supplied shall be suitable for operation under the following climatic and other conditions:
  - a) Peak ambient day temperature in still air : 45°C
  - b) Minimum night temperatures : 0°C
  - c) Reference ambient day temperature : 45°C
  - d) Relative Humidity a) Maximum : 100 %  
b) Minimum : 10 %
  - e) Altitude : Below 1000 M above MSL
  - f) Maximum wind pressure : As per IS: 802 latest code.
  - g) Seismic Intensity : ZONE-V as per IS 1893.

#### 3.4. Conformity with Indian Electricity Rules & Other Local Regulations

- 3.4.1. The Contractor shall note that all substation works shall comply with the latest provisions of Indian Electricity Rules and with any other regulations. Local authorities concerned in the administration of the rules and regulation relating to such works shall be consulted, if necessary, about the rules and regulations that may be applicable.
- 3.4.2. The Contractor shall also comply with the Minimum Wages Act 1948 and the payment of Wages Act (both. of the Government of India and State of Assam) and the rules made there under in respect of any employee or workman employed or engaged by him or his Sub-Contractor.
- 3.4.3. All registration and statutory inspection fees, if any, in respect of his work pursuant to this Contract shall be to the account of the Contractor.

### 3.5. Contractor's Requirement

- 3.5.1. The Contractor should be in possession of a valid E.H.V. Electrical Contractor Licence and Electrical Supervisory Licence issued by the Chief Electrical Inspector, Govt. of Assam, as per the provision of Law. An attested copy of the aforementioned Licence must be handed over to the Owner for his record prior to handing/ taking over of sites.
- 3.5.2. All the works shall also be inspected by the Chief Electrical Inspector, Govt. of Assam or his authorised representatives. It is the responsibility of the Contractor to obtain pre-requisite commissioning clearance of any equipment from the said Inspectorate. The Contractor will pay necessary fees to the Inspectorate, which it may levy.

### 3.6. Type Test Reports

- 3.6.1. **Materials, which have never been tested for critical performance, shall not be accepted. In such cases, a promise or agreement by a bidder to have the equipment tested after award of a contract is not acceptable.**
- 3.6.2. **All Bids must be accompanied by the Type Test Certificates of materials offered (refer Clause 3.6.5 below). Such type test certificates shall be acceptable only if:-**
- (a) Tests are conducted in an independent and well known testing laboratory, or
  - (b) Tests are conducted in manufacturer's own laboratory. In this case (i) the laboratory must have ISO 9000 (or its equivalent) series certification; and (ii) tests have been witnessed by technically qualified representatives of earlier clients or purchaser.
- 3.6.3. Test reports to be acceptable must be related directly to the materials offered. Test reports for higher class of equipment are acceptable with commitment to perform the type tests free of any charge on the particular equipment(s) after the award of contract.
- 3.6.4. **Type Test Reports older than five (5) years on the date of Technical bid opening shall not be accepted.**
- 3.6.5. **Full Type Test Reports of at least the following equipment must be submitted along with the Bid: -**
- 1. 132/33 kV 40 MVA Power Transformer.
  - 2. Tap Changer
  - 3. Transformer Oil
  - 4. Bushings
  - 5. Buchholz Relay
  - 6. Pressure Relief Device
  - 7. Bushing Current Transformer
  - 8. Oil Surge Relay
  - 9. AVR Relay
- 3.6.6. **This clause has reference to bid document Clause 1.1, Appedix-2 of ITB, Section-1, 'Evaluation and Qualification Criteria'.**

### 3.7. Guaranteed Technical Particulars

- 3.7.1. The Guaranteed Technical Particulars of the various items shall be furnished by the Bidders in the prescribed Schedules (Annexure-1, attached at end of this Section) with the Technical Bid. The Bidder shall also furnish any other information's as in their opinion is needed to give full description and details to judge the item(s) offered by them.
- 3.7.2. The data furnished in Guaranteed Technical Particulars should be the minimum or maximum value (as per the requirement of the specification) required. A Bidder may guarantee a value more stringent than the specification requirement. However, for testing purpose or from performance point of view, the material shall be considered performed successfully if it achieves the minimum/maximum value required as per the technical specification. No preference what so ever shall be given to the bidder offering better/more stringent values than those required as per specification except where stated otherwise.

### 3.8. Liquidated Damages and Rejection for Excessive Losses

- 3.8.1. The no-load loss, load loss and auxiliary losses (cooler loss) as well as total losses shall be guaranteed under penalty for each transformer subject to **Clause 3.22.12**. For the purpose of penalty computation, the test figures of the no-load and the total losses of each transformer will be compared with the corresponding guaranteed figures.
- 3.8.2. The no-load losses, load losses and auxiliary losses shall not exceed the values specified in the Technical Data Sheet (**Clause 3.23**). **No positive tolerance on no-load loss, load loss and auxiliary losses as well as total losses will be allowed.** Any change in the figures assigned for transformer losses will not be permitted after opening of bids and evaluation will be carried out on the basis of information made available at the time of bid opening. Bid with higher losses as that of provided in the Technical Data Sheet, bid will be treated as **non-responsive**.
- 3.8.3. Penalties will be applicable if any one or more test loss figures of no-load loss, auxiliary loss and total losses exceed the corresponding guaranteed figures. The penalties will be calculated as follows for each transformer:

- (a) For No-load loss, Penalty (in rupees) =  $\{W_i(t) - W_i(g)\} \times R1$ .
- (b) For load loss, Penalty (in rupees) =  $\{WT(t) - W_i(t) - W_a(t) - W_l(g)\} \times R2$
- (c) For auxiliary loss, Penalty (in rupees) =  $\{W_a(t) - W_a(g)\} \times R3$

Where,

WT (t) = Total loss (test value) in kW.

WT (g) = Total loss (guaranteed value) in kW.

W<sub>i</sub> (t) = No-load loss (test value) in kW.

W<sub>i</sub> (g) = No-load loss (guaranteed value) in kW.

W<sub>a</sub> (t) = Auxiliary loss (test value) in kW.

W<sub>a</sub> (g) = Auxiliary loss (guaranteed value) in kW.

W<sub>l</sub> (g) = Load loss (guaranteed value) in kW. ( Copper loss )

R1 = Rs. 2, 21,118/-

R2 = Rs. 90, 216/-

R3 = Rs. 88, 447/-

- 3.8.4. The loss figures (both guaranteed & test) for the purpose of this clause shall be at rated frequency and voltage and at principal tap and 75° C.



### 3.9. Standards

3.9.1. The Transformer and associated accessories shall conform to the latest issues of the standards as given below, except to the extent explicitly mentioned in this specification.

- |  |                     |
|--|---------------------|
| (i). CBIP manual on Transformers   | :Publication no 317 |
| (ii). Power Transformers   | :IS:2026/IEC 60076  |
| (iii). Fittings and accessories for power transformers                   | :IS:3639            |
| (iv). Insulating oils for transformers and switchgears                   | :IS:335/IEC 60296   |
| (v). Bushings for alternating voltages above 1000 V                      | :IS:2099/IEC 60137  |
| (vi). Gas operated relays  | :IS:3637            |
| (vii). Code of practice for installation and maintenance of transformers | :IS:10028           |
| (viii). Guide for loading of oil immersed transformers                   | :IS:6600/IEC 60354  |
| (ix). Industrial cooling fans.   | :IS: 6272           |
| (x). Colours for ready mix paints.                                       | :IS: 5              |

### 3.10. Technical Specification of Power Transformers

#### 3.10.1. General Operating Requirements

3.10.1.1. Except where otherwise specified or implied herein, the transformers shall comply with the latest edition of Indian Standard 2026 (hereinafter referred to as "IS") and IEC 60076.

3.10.1.2. The Power transformer shall have core type construction, 3-phase, oil immersed and should be suitable for outdoor service in hot and humid, tropical climate.

3.10.1.3. Transformers shall be capable of operating under natural cooled condition up to the specified load. The forced cooling equipment shall come into operation by pre-set contacts of winding temperature indicator and the transformer shall operate as a forced cooling unit as ONAF. Cooling shall be so designed that during total failure of power supply to cooling fans, the transformer shall be able to operate at full load for at least ten (10) minutes without the calculated winding hot spot temperature exceeding 140<sup>o</sup>. Transformers fitted with two coolers, each capable of dissipating 50 per cent of the loss at continuous maximum rating, shall be capable of operating for 20 minutes in the event of failure of one cooler without the calculated winding hot spot temperature exceeding 150<sup>o</sup> C at continuous max rating. The contractor shall submit supporting calculations for the above for Purchaser's approval.

3.10.1.4. The transformers shall be capable of being operated, without danger, on any tapping at the rated MVA with voltage variation of ( $\pm$ ) 10% corresponding to the voltage of the tapping.

3.10.1.5. Subject to **Clause 3.11.7**, the maximum flux density in any part of the core and yokes, of each transformer at normal voltage and frequency shall be such that the flux density in over-voltage condition as per **clause 3.10.1.7** shall not exceed 1.9 Tesla.

3.10.1.6. The transformers and all its accessories shall be designed to withstand without injury, the thermal and mechanical effects of any external short circuit to earth and of short circuits at the terminals of any winding of values and duration specified in IS-2026. **The thermal ability to withstand short circuit shall be demonstrated by calculation.**

3.10.1.7. The transformer shall be suitable for continuous operation with frequency variation of  $\pm$ 3% from normal 50 Hz. Combined voltage and frequency variation should not exceed the rated V/f ratio by 10%.

3.10.1.8. Radio Interference and Noise Level:

- (i). The transformers shall be designed with particular attention to the suppression of harmonic voltage, especially the third and fifth so as to minimize interference with communication circuit.
- (ii). Transformer noise level, when energized at normal voltage and frequency shall not be more than 5 decibels above the NEMA Standard Publication TR-1.

3.10.1.9. The transformers shall be capable of being loaded in accordance with IS 6600/ IEC- 60076-7. There shall be no limitation imposed by bushings, tap changers etc. or any other associated equipment.

3.10.1.10. Transformers shall withstand, without injurious heating, combined voltage and frequency fluctuations which produce the following over fluxing conditions:

- 125% for 1 – minute
- 140% for 5 – seconds

3.10.1.11. The maximum current density in any winding shall not exceed 250A/sq.cm.

3.10.1.12. The transformers shall be designed with particular attention to the suppression of harmonic voltage, especially the third and fifth, so as to eliminate wave form distortion and from any possibility of high frequency disturbances, inductive effect or of circulating currents between the neutral points at different transforming stations reaching such a magnitude so as to cause interference with communication circuits. For achieving this suppression of harmonics, delta connected stabilizing winding should be avoided.

3.10.1.13. The center of gravity of the assembled transformers shall be low and as near to the vertical center line as possible. The transformer shall be stable with or without oil. If the center of gravity is eccentric relating to track either with or without oil, its location shall be shown on the outline drawing.

3.10.1.14. As Assam is under Seismic Zone-V, utmost care shall be taken while in mechanical design to withstand both lateral and longitude force develop during Earth Quake. The conservator tank may have separate mounting structure instead of fitted in tank. Necessary anti vibration measures shall be taken for main tank, core and winding etc. and the detail calculation shall be submitted during engineering for approval.

### 3.10.2. General Construction Requirements

3.10.2.1. All material used shall be of the best quality and of the class most suitable for working under the conditions specified and shall withstand the variations of temperatures and atmospheric conditions arising under working conditions without undue distortion or deterioration or the setting up of undue stresses in any part, and also without affecting the strength and suitability of the various parts for the work which they have to perform.

3.10.2.2. The transformer and accessories shall be designed to facilitate operation, inspection, maintenance and repairs. All apparatus shall also be designed to ensure satisfactory operation under such sudden variations of load and voltage as may be met with under working conditions on the system, including those due to short circuits.

3.10.2.3. Similar parts, particularly removable ones, shall be interchangeable.

3.10.2.4. All outdoor apparatus, including bushing insulators with their mountings, shall be designed so as to avoid pocket in which water can collect.

3.10.2.5. Internal design of transformer shall ensure that air/gas is not trapped in any location.

3.10.2.6. Means shall be provided for the easy lubrication of all bearings and where necessary of any mechanism or moving part, that is not oil immersed.

3.10.2.7. In tank on load tap changers shall be located such that the space above the diverter switch chamber will be free of inter connecting pipes etc. for lifting the diverter switch unit for inspection and maintenance purposes.

3.10.3. **Galvanizing:** Galvanising where specified shall be applied by the hot-dipped process or by electro galvanising process and for all parts other than steel wires shall consist of a thickness of zinc coating equivalent to not less than 610 gm of zinc per square meter of surface. The zinc coating shall be smooth, clean and of uniform thickness and free from defects. The preparation of galvanising and the galvanising itself shall not adversely affect the mechanical properties of the coated material. The quality will be established by tests as per IS: 2633.

All drilling, punching, cutting, bending and welding of parts shall be completed, and all burrs shall be removed before the galvanizing process is applied.

Galvanizing of wires shall be applied by the hot-dipped process and shall meet the requirements of the relevant Indian Standard. The zinc coating shall be smooth, clean and of uniform thickness and free from defects. The preparation for galvanizing itself shall not adversely affect the mechanical properties of the wire.

Surfaces which are in contact with oil shall not be electro galvanised / cadmium plated.

3.10.4. **Bolts and Nuts:** Steel bolts and nuts exposed to atmosphere shall be of following material :

- Size 12 mm or below – stainless steel
- Above 12 mm – steel with suitable finish like electro galvanised with passivation.

All nuts, bolts and pins shall be locked in position with the exception of those external to the transformer, under gasket pressure.

All bolts, nuts and washers exposed to atmosphere and in contact with non-ferrous parts which carry current shall be of phosphor bronze.

Bolts and nuts shall not be less than 8 mm in diameter except when used for small wiring terminals.

If bolts and nuts are placed so that they are inaccessible by means of ordinary spanners, suitable special spanners shall be provided by the supplier.

3.10.5. **Cleaning and Painting:** The surface treatment, painting/finishing details for transformer main tank, pipes, conservator tank, radiator, control cabinet/ marshalling box / oil storage tank etc. shall be as given below. The detailed painting procedure shall also be submitted along with the bid which shall be finalized before award of the contract. The quality of paint such that its colour should not fade during vapour phase drying process and shall be able to withstand temperature up to 120° C

	Surface preparation	Primer coat	Intermediate undercoat	Finish coat	Total dry film thickness(D FT)	Color shade
Main tank pipe, conservator tank ,oil storage tank etc. (external surfaces)	Shot blast cleaning Sa 2 ½ *	Epoxy base zinc primer(30 - 40 µm)	Epoxy high build Micaceous iron oxide (HBMIO 75µm)	Aliphatic polyurethane (minimum 50µm)	Minimum 150µm	RAL 7035
Main tank, Pipes (above 80 NB), conservator tank, oil storage tank etc. (Internal surfaces)	Shot Blast cleaning Sa 2 ½	Hot oil resistant, non-corrosive varnish or paint or epoxy	--	--	Minimum 30µm	Glossy white for paint
Radiator (external surfaces)	Chemical/ Shot Blast cleaning Sa 2½*	Epoxy base Zinc primer (30-40µm)	Epoxy base Zinc primer (30-40µm)	PU paint (Minimum 50µm)	Minimum 100µm	Matching shade of tank/different shade aesthetically matching to tank

3.10.6. **Labels:**

Labels shall be provided for all apparatus such as relays, switches, fuses, contained in any cubicle or marshalling kiosks

Descriptive labels for mounting indoors or inside cubicles and kiosks shall be of material that will ensure permanence of the lettering. A matt or satin finish shall be provided to avoid dazzle from reflected light.

Labels mounted on dark surfaces shall have white lettering on a black background. Danger notices shall have red lettering on a white background.

All plates shall be of in-corrodible material.

Labels shall be attached to panels with brass screws or with stainless steel screws or these can be stuck with suitable adhesive also.

### 3.10.7. Transformer Tank

3.10.7.1. All transformer reactor tanks should generally be of conventional type i.e., tank body with top cover.

3.10.7.2. The transformer tank and cover shall be of welded construction and fabricated from high grade low carbon steel of adequate thickness. Unless otherwise approved, metal plate, bar and sections for fabrication shall comply with IS 2062.

3.10.7.3. All seams and those joints not required to be opened at site shall be factory welded, and wherever possible they shall be double welded. After completion of tank and before painting, dye penetration test shall be carried out on welded parts of jacking bosses, lifting lugs and all load bearing members.

3.10.7.4. Tank stiffeners shall be provided for general rigidity and these shall be designed to prevent retention of water.

3.10.7.5. Each tank shall be provided with:

- (i). Four symmetrically placed lifting lugs shall be provided so that it will be possible to lift the complete transformer when filled with oil without structural damage to any part of the transformer. The factor of safety at any one point shall not be less than 2. The lifting lugs shall be so arranged and located as to be accessible for use when the transformer is loaded on the transport vehicle.
- (ii). A minimum of four jacking pads in accessible position to enable the transformer complete with oil to be raised or lowered using hydraulic jacks. Each jacking pad shall be designed to support with an adequate factor of safety for at least half of the total mass of the transformer filled with oil allowing in addition for maximum possible misalignment of the jacking force to the center of the working surface.
- (iii). Suitable haulage holes shall be provided.

3.10.7.6. The base of each tank shall be so designed that it shall be possible to move the complete transformer unit by skidding in any direction without injury when using plates or rails.

3.10.7.7. The main tank body excluding tap-changing compartments, radiators and coolers shall be capable of withstanding vacuum given below:

- Vacuum Gauge: 100.64 kN/m<sup>2</sup> (760 mm of Hg)

3.10.7.8. The transformer conservator tank shall be equipped with air cell, hence need not be designed for full vacuum but a vacuum-tight valve should be provided in the Buchholz relay pipe connection.

3.10.7.9. Two earthing terminals capable of carrying for 4 seconds the full lower voltage, short circuit current of the transformer. Provision shall be made at positions close to each of the bottom two corners of the tank for bolting the earthing terminals to the tank structure to suit local conditions. The design of earthing terminals shall be as per IS 3639 - Part 3 (Fittings and accessories for Power Transformers Part 3: Earth Terminals).

### 3.10.8. Tank Cover

3.10.8.1. 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 suitably sloped so that it does not retain rainwater.

3.10.8.2. The transformer tank cover and its accessories shall be designed to prevent retention of rain water and shall not distort when lifted. The internal surface of the top cover shall be shaped to ensure efficient collection and direction of free gas to the Buchholz Relay.

3.10.8.3. At least two adequately sized inspection openings one at each end of the tank, shall be provided for easy access to bushings and earth connections. The inspection covers shall not weigh more than 25 kg. Handles shall be provided on the inspection cover to facilitate lifting.

3.10.8.4. The tank covers shall be fitted with pockets at the position of maximum oil temperature at maximum continuous rating for bulbs of oil and winding temperature indicators. It shall be possible to remove these bulbs without lowering the oil in the tank. The thermometer shall be fitted with a captive screw to prevent the ingress of water.

3.10.8.5. Bushing turrets, covers of inspection openings, thermometer pockets etc. shall be designed to prevent ingress of water into or leakage of oil from the tank.

3.10.8.6. All bolted connections shall be fitted with weather proof, hot oil resistant, resilient gasket in between for complete oil tightness. If gasket is compressible, metallic stops/other suitable means shall be provided to prevent over-compression.

All gasket joints shall be designed, manufactured and assembled to ensure long-term leak and maintenance free operation. Groove provided to accommodate round nitrile rubber cord for rectangular openings shall be milled. Details of all gasket joints shall be submitted for approval.

3.10.8.7. The transformer shall be provided with a 100 mm nominal diameter pipe flange with bolted blanking plate, gasket and shall be fitted at the highest point of the transformer tank for maintaining vacuum in the tank.

### 3.10.9. **Axles and Wheels**

3.10.9.1. The transformer shall be mounted on rollers.

3.10.9.2. The roller mounted transformers are to be provided with flanged bi-directional wheels and axles. This set of wheels and axles shall be suitable for fixing to the under carriage of transformer to facilitate its movement on rail track. Suitable locking arrangement along with foundation bolts shall be provided for the wheels to prevent accidental movement of transformer.

3.10.9.3. The rail track gauge shall be 1676 mm.

### 3.10.10. **Foundation and Anti Earthquake Clamping Device**

3.10.10.1. To prevent transformer movement during earthquake, suitable clamping devices shall be provided for fixing the transformer to the foundation.

## 3.11. **Core (Magnetic Circuit)**

3.11.1. The magnetic circuit shall be constructed from high grade cold rolled non-ageing grain oriented silicon steel lamination of **HI-B grade steel of ZDKH class of material of thickness less than 0.23 mm.**

3.11.2. The primary core material is only to be used. The bidder should offer the core for inspection and approval by the purchaser or third party Inspection Agency during the manufacturing stage. Bidder's call notice for the purpose should be accompanied with the following document as applicable as a proof towards use of Prime Core material.

- (a) Invoice of supplier,
- (b) Mill's test certificate.
- (c) Packing list,
- (d) Bill of loading,
- (e) Bill of entry certificate to custom

Core material should be directly procured from either the manufacturer or their accredited marketing organisation of repute and not through any agent.

Bidders should have in house numeric controlled Core cutting facility for better control of quality and also to avoid any mixing of Prime Core material with seconds materials. Core cutting machine number and drawings are to be furnished.

3.11.3. The documents, as mentioned against **clause 3.11.2** should be submitted to AEGCL, once the core materials are landed in their works. AEGCL may depute representative for inspection. The following documents are to be made available for scrutiny during inspection.

- a) Purchase order No. & Date.
  - b) No. of packed coils with package Nos.
  - c) Gross weight.
  - d) Net weight
  - e) Port of loading.
  - f) Port of discharge.
  - g) Name of the ocean vessel.
  - h) Grade and thickness of core material.
  - i) Any other information, as mentioned on the body of packed coils
- 3.11.4. 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.
- 3.11.5. The insulation structure for the core to bolts and core to clamp plates shall be such as to withstand a voltage of 2000 V for one minute.
- 3.11.6. The Transformer shall be of **BOLTLESS** core design. The Bidders will furnish documentary evidence with proof of their experience and performance in such type of design.
- 3.11.7. The transformer shall be designed in such a way that the maximum flux density in any part of the core and yoke at rated M.V.A, rated frequency (50 HZ) and rated voltage shall not exceed 1.6 Tesla. The tenderer shall establish this by calculation as per given format.
- 3.11.8. Successful Bidder shall furnish calculation towards maximum peak value of magnetizing in-rush current and shall justify that the transformer will not trip due to this during initial charging and subsequent charging.
- 3.11.9. The completed core and coil shall be so assembled that the axis and the plane of the outer surface of the core stack shall not deviate from the vertical plane by more than 25 mm.
- 3.11.10. All steel sections used for supporting the core shall be thoroughly shot or sand blasted, after cutting, drilling and welding.
- 3.11.11. The finally assembled core with all the clamping structures shall be free from deformation and shall not vibrate during operation.
- 3.11.12. The core clamping structure shall be designed to minimize eddy current loss.
- 3.11.13. The framework and clamping arrangements shall be securely earthed.
- 3.11.14. The core shall be carefully assembled and rigidly clamped to ensure adequate mechanical strength.
- 3.11.15. Oil ducts shall be provided where necessary to ensure adequate cooling. The welding structure and major insulation shall not obstruct the free flow of oil through such ducts.
- 3.11.16. The design of magnetic circuit shall be such as to avoid static discharges, development of short circuit paths within itself or to the earthed clamping structure and production of flux component at right angle to the plane of the lamination which may cause local heating. The supporting frame work 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.
- 3.11.17. The construction is to be of 'core' type. The core shall be provided with lugs suitable for lifting the complete core and coil assembly. The core and coil assembly shall be so fixed in the tank that shifting will not occur during transport or short circuits.
- 3.11.18. The oxide/silicate coating given on the core shall be adequate, however, laminations can be insulated by the manufacturers if considered necessary.
- 3.11.19. In the core building, the laminations are to be arranged adopting Step-lap process.

- 3.11.20. Where the magnetic circuit is divided into pockets by cooling ducts parallel to the planes of laminations or by insulating material above 0.25 mm thick, tinned copper tip bridging pieces shall be inserted to maintain electrical continuity between pockets.
- 3.11.21. All parts of the cores shall be of robust design capable of withstanding any shocks to which they may be subjected during lifting, transport, installation and service.
- 3.11.22. Adequate provision shall be made to prevent movement of the core and winding relative to the tank during transport and installation or while in service.

### 3.12. WINDING

#### 3.12.1. General

- 3.12.1.1. The current density in any part of the windings shall not exceed 250 Amps/Sq. Cm.
- 3.12.1.2. All windings shall be made of electrolytic high conductivity copper and shall be fully insulated as defined in IS: 2026. All neutral points shall be insulated for the voltage specified in IS: 2026. The winding shall be so designed that all coil assemblies of identical voltage, rating shall be interchangeable.
- 3.12.1.3. The windings for system rated voltages of 132 KV shall have graded insulation, as defined in IS-2026. The winding for 33 KV shall be fully insulated.
- 3.12.1.4. The neutral ends of star connected three phase windings shall be connected at points, which are accessible from manholes in the cover and brought out via one bushing.
- 3.12.1.5. **Axial oil cooling ducts shall be provided in all windings.** During detail engineering, winding arrangement drawing shall be submitted showing the axial ducts.
- 3.12.1.6. Power Transformers shall be designed to withstand the impulse test voltages as per IS: 2026.
- 3.12.1.7. The transformer shall withstand the power frequency voltage test as per IS: 2026.
- 3.12.1.8. The short circuit temperature rise should not exceed the limits, fixed as per IS: 2026. **The calculation towards the above for 132 KV and 33 KV windings shall be furnished by the Contractor for approval.**
- 3.12.1.9. The winding shall be designed to reduce to a minimum the out-of balance forces in the transformers at all voltage ratios.
- 3.12.1.10. The insulation of transformer windings and connection shall be free from insulating composition leading to soften ooze out shrink or collapse during service.
- 3.12.1.11. The stacks of windings shall receive adequate shrinkage treatment before final assembly.
- 3.12.1.12. The coil clamping arrangement and the finished dimensions of any oil ducts shall be such as will not impede the free circulation of oil through the ducts.
- 3.12.1.13. The conductors shall be transposed at sufficient intervals in order to minimize eddy current and equalize the distribution of currents and temperature along the windings. **For 33 KV windings, continuously transposed epoxy coated conductors (CTC) are to be used.**
- 3.12.1.14. Threaded connection of all winding shall be provided with locking arrangement. All leads from windings to terminals shall be rigidly supported to prevent injury from vibration. Guide tubes may be used where possible.
- 3.12.1.15. The bolted joints in the windings are not acceptable. This shall be confirmed in the G.T.P of the above Tender.
- 3.12.1.16. The transformer manufacturer should have in house availability of vapour phase Drying (VPD) plant for proper drying of the insulation. **Manufacturer without VPD drying facilities shall not be accepted.**
- 3.12.2. **Bracing of Windings**

- 3.12.2.1. The windings and connections of all transformers shall be braced to withstand shocks, which may occur during transport or due to switching and other transient conditions during service.
- 3.12.2.2. The winding shall be clamped securely in place, so that they will not be displaced or deformed during short circuit. The assembled core and winding shall be vacuum dried and suitably impregnated before removing from the treating tank.
- 3.12.2.3. Coil clamping rings, if provided shall be of steel.
- 3.12.2.4. If the transpose winding is built up of section of disc coils, separated by spacers, the clamping arrangements shall be such that equal pressures are applied to all columns of spacers. All such spacers shall be securely located, shall be of suitable material and shall receive adequate shrinkage treatment before assembly.
- 3.12.2.5. 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.
- 3.12.2.6. 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.
- 3.12.2.7. 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.
- 3.12.2.8. Winding and connections shall be braced to withstand shocks during transport or short circuit.
- 3.12.2.9. 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.
- 3.12.2.10. **Shield caps to be provided on all the bolts in the vicinity of live parts.**
- 3.12.2.11. Terminals of all windings shall be brought out of the tank through bushings for external connections.
- 3.12.2.12. The completed core and coil assembly 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 oven or in the transformer tank.
- 3.12.2.13. 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.
- 3.12.2.14. 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.
- 3.12.2.15. Adequate barriers shall be provided between coils and core and between high and low voltage coil. End turns shall have additional protection against abnormal line disturbances. The Bidder is to submit the process at the time of the bid.
- 3.12.2.16. Tapings 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 the transformer at all voltage ratios.
- 3.12.2.17. Magnitude of impulse surges transferred from HV to LV windings by induction and capacitance coupling shall be limited to B.I.L. of LV winding.

### **3.13. Internal Earthing**

#### **3.13.1. Earthing of Core Clamping Structure**



- i) All internal metal parts of the transformer, with the exception of individual laminations, core bolts and their individual clamping plates shall be earthed.
- ii) 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 of 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 top structure on the same side of the core as the main earth connection to the tank.

### 3.13.2. Earthing of Magnetic Circuit

- (i) 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 dis-connecting link shall be provided on transformer tank to facilitate disconnections from ground for IR measurement purpose.
- ii) Core 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.

### 3.13.3. Size of Earthing Connections

All earthing connections with the exception of those from the individual coil clamping rings shall have a cross-sectional area of not less than 0.8 Sq.cm. Connections inserted between laminations of different sections of core as per **clause 3.11.20** shall have a cross-sectional area of not less than 0.2 cm<sup>2</sup>.

## 3.14. Insulating Oil

- 3.14.1. The insulating oil for the transformers shall be of EHV grade, generally conforming to IS: 335. No inhibitors shall be used in the oil.
- 3.14.2. The insulating oil for the transformers shall be Poly Chlorinated Biphenyls (PCB) free.
- 3.14.3. The bidder shall quote the price of transformer complete with oil.
- 3.14.4. 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.
- 3.14.5. The contractor shall warrant that oil furnished is in accordance with the following specifications.
 

a) <i>Appearance:</i>	<i>The oil shall be clear and transparent and free from suspended matter or sediment</i>
b) <i>Density at 20°C Max:</i>	<i>0.89g/cm<sup>3</sup></i>
c) <i>Kinematic Viscosity at 27°C Max:</i>	<i>27 CST</i>
d) <i>Interfacial at 27°C Min.:</i>	<i>0.03 N/m</i>
e) <i>Flash Point:</i>	<i>140°C</i>
f) <i>Pour Point Max:</i>	<i>-6°C</i>
g) <i>Neutralisation Value:</i>	<i>0.03 mg/KOH/g</i>
<i>(Total Acidity) Max</i>	
h) <i>Electric Strength:</i>	<i>40 kV</i>
<i>(Breakdown Voltage) Min.</i>	
i) <i>Dielectric dissipation factor:</i>	<i>0.05</i>
<i>tan delta at 90°C Max</i>	
j) <i>Minimum specific resistance:</i>	<i>1 x 10<sup>12</sup> ohm cm</i>
<i>(resistivity), at 90°C Min.</i>	

- k) *Oxidation Stability*
  - i) *Neutralisation value after Max:* 0.40 mg/KOH/g
  - ii) *Total sludge after oxidation max:* 0.10% by weight
- l) *Presence of oxidation Inhibitor:* The oil shall not contain anti-oxidant Additives
- m) *Water content Max:* 25 ppm

### 3.15. Accessories & Fittings

#### 3.15.1. Bushings

- 3.15.1.1. All bushings for 132 kV sides of transformer shall be 'OIP' type condenser bushings while 33 kV side and neutral bushings shall be porcelain, oil communicating type and in accordance with IS: 2099.
- 3.15.1.2. Bushings shall be provided with Current Transformers as specified in Technical Data Sheet (**Clause 3.23**).
- 3.15.1.3. All bushings shall be provided with terminal connector suitable for ACSR/AAAC conductors.
- 3.15.1.4. Oil Filled condenser type bushing shall be provided with at least the following fittings:
  - (a) Oil level gauge.
  - (b) Tap for capacitance and tan delta test. Test taps relying on pressure contacts against the outer earth layer of the bushing is not acceptable.
  - (c) Bushing stem shall be of high grade copper.
- 3.15.1.5. Clamps and fittings shall be of hot dip galvanized steel or stainless steel.

#### 3.15.2. Protection & Measuring Devices

##### 3.15.2.1. Conservator Tank

- (i). The conservator tank shall have adequate capacity between highest and lowest visible levels to meet the requirement of the expansion of the total cold oil volume in the transformer and cooling equipment from minimum ambient temperature to 90°C.
- (ii). The conservator tank shall be bolted into position so that it can be removed for cleaning purposes.
- (iii). The conservator tank shall be fitted with magnetic oil level gauge with low-level electrically insulated mercury alarm contact.
- (iv). The conservator tank shall be provided in a position not to obstruct the electrical connections to the transformers.
- (v). The main tank conservator will be fitted with flexi separator, atmospheric seal or similar devices, through which the main tank oil will be completely isolated from the atmosphere.
- (vi). **Provision shall be made for monitoring the integrity of rubber bag and giving an electrical alarm when the bag is damaged.**
- (vii). The space inside the bag is to be connected to ambient air through a removable silica-gel type breather with oil trap and dust filter and mounted about 1400 mm above ground. No valve is to be placed between this breather and the conservator. The moisture absorption, indicated by change in colour of the tinted crystals inside the breather can be easily observed from distance. Minimum quantity of silica gel will be 1 Kg. for every 3500 ltrs. of oil in the tank. The containers for the dehydrating agent shall be of transparent plastics. The quality of plastic material shall be got approved from the purchaser.

- (viii). Separate conservator tank or partition in the main conservator tank may be provided for OLTC. It shall have a prismatic or magnetic oil level gauge. The conservator for OLTC shall at the same height of main tank conservator.
- (ix). Two nos of 8 NB valve with gasketed blanking are to be provided in conservator top in place of air release plug
- (x). One 15 NB valve is to be provided for dry air/Nitrogen injection at the top of the attachment of rubber bag.
- (xi). All bolted connection shall be fitted with weather proof, hot oil resistant gasket in between, for complete oil tightness, however nitrile 'O' ring will be preferred. If gasket is compressible, metallic stoppers shall be provided to prevent over compression. **Contractor shall take prior approval of Purchaser for type and size of gaskets during detail engineering.**

#### 3.15.2.2. **Pressure Relief Device**

Minimum **two** (2) numbers of pressure relief device to be provided at suitable locations which shall be of sufficient size for rapid release of any pressure that may be generated in the main and OLTC and which may result in damage to the equipment. The device shall operate at the static pressure of less than the hydraulic test pressure of transformer tank. It shall be mounted directly on the tank. One set of electrically insulated contacts shall be provided for alarm/tripping along with the recommendations. The micro switch shall have IP55 protection and the fasteners shall be of rust proof material.

An oil splashguard shall be provided to the pressure relief device to restrict spillage of hot oil in the event of operation of the pressure relief device.

#### 3.15.2.3. **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 ungrounded contacts, one for alarm on gas accumulation and the other for tripping on sudden rise of pressure.

A machined surface shall be provided on the top of each relay to facilitate the setting of the relays and to check the mounting angle in the pipe and the cross level of the relay.

#### 3.15.2.4. **Oil Surge Relay**

Reed type Oil Surge Relay shall be provided individually to each tap changer diverter switches and one common OSR at OLTC conservator tank. Valves of required size are to be put before and after of each OSR. For 3-phase OLTC, there shall be two numbers OSR. It is preferable that each oil surge relays has independent indicators. OSR shall have two trip contacts.

#### 3.15.2.5. **Temperature Indicator**

- (i) Oil Temperature Indicator (OTI)

The transformers shall be provided with a 150 mm dial type thermometer for top oil temperature indication. The thermometer shall have adjustable, electrically independent ungrounded 2 sets of each 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. **For remote indication ROTI with sensor to be provided and minimum three (3) sets of 4-20mA output signals to be provided for local SCADA and RTCC panel.**

Accuracy class of ROTI shall not be more than  $\pm 1\%$  or better and should maintain accuracy throughout the range of 0-50° ambient temperature.

(ii) Winding Temperature Indicator (WTI)

A device for measuring the hot spot temperature each of the HV/LV/T winding shall be provided. It shall comprise the following.

- Temperature sensing element
- Image Coil.
- Auxiliary CTS, if required to match the image coil, shall be furnished and mounted in the local control panel. Auxiliary CTS, if required to match the image coil, shall be provided and mounted in the cooler control cabinet. For autotransformers, an additional CT is required in the lead to the primary terminal to give a true image of the temperature in the common/secondary winding. The current transformers shall be of class 1, and the rated primary current shall correspond to the rated current of the related transformer winding. The effective resulting rated secondary current shall be 2A. Matching units between current transformers and thermal replicas shall not be provided.
- 63 mm moving iron ammeter shall be provided in the marshaling kiosk for each WTI for: -
  - (i) Checking the output of the current transformer.
  - (ii) Testing the current transformer and thermal image characteristics.
  - (iii) Disconnecting the bulb heaters from the current transformer secondary circuit to enable the instrument to be used as an oil temperature indicator.
- 150 mm 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, two for high winding temperature alarm and two for trip.
- Calibration device.
- In addition to the above, the following remote indication equipment shall be provided.  
:Signal transmitter

Remote winding temperature indicators for all the windings shall be suitable for flush mounting on remote control panel (RTCC panel) and (This shall not be repeater dial of local WTI). **For remote indication RWTI with sensor to be provided and minimum**

**three (3) sets of 4-20 mA output signals to be provided for local SCADA and RTCC panel.**

Accuracy class of RWTI shall not be more than  $\pm 1\%$  or better and should maintain accuracy throughout the range of 0-50<sup>0</sup> ambient temperature.

### 3.15.2.6. Oil Preservation Equipment

#### (i) 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.

Necessary monitoring relay shall be provided for checking healthiness of diaphragm by generating alarm. Moreover potential free contact shall be provided for monitoring from SAS.

#### (ii) Hydrogen and Moisture measurement

On line Hydrogen & Moisture (ppm) in oil of **GE make** shall be provided and necessary contacts shall be provided for monitoring from Local & Remote SCADA. The instrument (IED) Protocol shall be IEC 61850 and it will be connected to Sub Station Automation System LAN.

#### (ii) Breather

Each conservator vessel shall be fitted with a breather in which silicagel is the dehydrating agent and designed so that:

- 1) The passage of air is through a dust filter & silicagel.
- 2) Silicagel is isolated from atmosphere by an oil seal
- 3) The external atmosphere is not continuously in contact with the silicagel
- 4) The silicagel for the breather shall be of self-regenerating maintenance free type and the make shall be of M/S. Messko / M/S. Qualitrol. The warranty of the maintenance free breather shall be for five (5) years.
- 5) The breathers shall be mounted approximately 1400 mm above the ground level.
- 6) Minimum quantity of silica gel will be 1 Kg. for every 3500 ltrs. of oil in the tank. The containers for the dehydrating agent shall be of transparent plastics. The quality of plastic material shall be got approved from the purchaser.

#### (iii) Thermo-syphon Filter:

**To extract the harmful constituents like water, acids etc. from oil, thermo syphon filter of cylindrical shape with perforated steel trays filled with absorbents such as active alumina should be provided.**

The filter assembly shall be mounted on the transformer as well as ground supported and connected with pipes and shut off valves. Suitable instructions required to be followed for commissioning, dismantlement and maintenance of filter arrangement, re-generation and storage of the absorbent etc. must be included in the instrumentation manual. A detailed drawing showing internal arrangement shall be submitted.

The oil & absorbent capacity required in the thermo-syphon filter is as under.

- |    |                 |   |                             |
|----|-----------------|---|-----------------------------|
| i) | Quantity of oil | - | 1.0% of total oil by weight |
|----|-----------------|---|-----------------------------|

- ii) Quantity of absorbent - 0.2% to 0.25% of total oil by weight

### 3.15.3. RADIATORS & VALVES

#### 3.15.3.1. RADIATORS

- i) Radiators shall be designed so that all painted surface can be thoroughly cleaned by hand and subsequently.
- ii) Radiators shall be designed so as to avoid pockets in which moisture collects and shall withstand the pressure tests. Radiators shall be detachable and shall be provided with machined or ground flanged inlet and outlet branches. Air release plug shall be provided at the top of each radiator for draining and filling.

#### 3.15.3.2. VALVES

- i) Valves shall be of forged carbon steel up to 50 mm size and of gun metal or of cast iron bodies with gun metal fittings for sizes above 50 mm. 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.
- iv) Suitable separate valves with copper pipe to the height of 1400 mm shall be provided to take sample of oil from OLTC chamber during Operation of the transformer.
- v) Oil sampling valves shall have provision to fix copper pipe of 10 mm size to facilitate oil sampling.
- vi) Each transformer shall be provided with following valves on the tank:
- Drain valve so located as to completely drain the tank.
  - Two filter valves on diagonally opposite corners, of 50 mm size.
  - Oil sampling valves not less than 8 mm with adapter for connecting PVC pipe at top and bottom of main tank.
  - 15 mm air release plug as required.
  - Valves between radiators and tank.
  - Valves are to be incorporated **before and after the Buchholz relays**
  - A 100 mm (NW 100) flange for the vacuum control switch tank will be provided on the tank cover provided with vacuum gauge.
  - Tank bottom sludge drain valves of adequate size
  - Four nos. Nitrogen injection valve & one oil drain valve for N<sub>2</sub> Fire fighting system.

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

### 3.16. Cooling Equipment for ONAN/ONAF Type of Cooling

#### 3.16.1. General

3.16.1.1. The cooler shall be designed using 2 x 50% radiator banks mounted on each HV & LV sides of transformer tank & coolers shall withstand pressure conditions specified for tanks. All coolers shall be attached and mounted on the transformer tank. Each bank shall have one standby fan.

3.16.1.2. **Each radiator bank shall have its own cooling fans**, shut off valves at the top and bottom (80 mm size), lifting lugs, top and bottom oil filling valves, air release plug at the top, a drain and sampling valve and thermometer pocket fitted with captive screw cap on the inlet and outlet.

3.16.1.3. Cooling fans shall not be directly mounted on radiator bank which may cause undue vibration. These shall be located so as to prevent ingress of rain water. Each fan shall be suitably protected by galvanised wire guard. The exhaust air flow from cooling fan shall not be directed towards the main tank in any case.

3.16.1.4. Cooling fans shall be suitable for operation from 415 volts, three phase 50 Hz power supply and shall conform to IS: 325. Fan Group A and B shall have Single Phasing Preventer at the point of supply to cooling fan and spare potential free contacts are to be provided to local SCADA for monitoring. Each cooling fan provided with starter thermal overload and short circuit protection. The motor winding insulation shall be conventional class 'B' type. Motors shall have hose proof enclosure equivalent to IP: 55 as per IS:4691.

3.16.1.5. The cooler and its accessories shall preferably be hot dip galvanized or corrosion resistant paint (as per **clause 3.10.5**) should be applied to it.

3.16.1.6. Expansion joint shall be provided, one each on top and bottom cooler pipe connections. Air release device and oil plug shall be provided on oil pipe connections. Drain valves shall be provided in order that each section of pipe work can be drained independently.

#### 3.16.2. Cooling Equipment Control (ONAN/ONAF COOLING)

3.16.2.1. Automatic operation control of fans/pumps shall be provided (with temperature change) from contacts of winding temperature indicator. The Contractor shall recommend the setting of WTI for automatic changeover of cooler control from ONAN to ONAF. The setting shall be such that hunting i.e. frequent start-up operations for small temperature differential do not occur.

3.16.2.2. Suitable manual control facility for cooler fans and oil pumps shall be provided.

3.16.2.3. The changeover to standby oil pump in case of failure of service oil pump shall be automatic.

3.16.2.4. Selector switches and push buttons, shall also be provided in the cooler control cabinet to disconnect the automatic control and start/stop the fans and pump manually.

3.16.2.5. Cooler equipment shall be protected through required MCCBs/MCB and the status shall be monitored through SAS, as such necessary potential free contacts shall be provided.

#### 3.16.3. Indicating Devices

3.16.3.1. Following lamp indications shall be provided in cooler control cabinet:

- a) Control Supply failure.
- b) Control supply single phasing for Group A & Group B
- c) Cooling Fan in operation and Fan Groups operation status
- d) Cooling fan failure for each bank.
- e) Stand-by Fan is operating.
- f) Common thermal overload trip.

One potential free initiating contact for all the above conditions shall be wired independently to the terminal blocks of cooler control cabinet.

#### 3.16.4. Valves

- 3.16.4.1. All valves upto and including 100 mm shall be of gun metal or of cast steel/cast iron. Larger valves may be of gun metal or may have cast iron bodies. They shall be of full way type with internal screw and shall open when turned counter clock wise when facing the hand wheel.
- 3.16.4.2. Suitable means shall be provided for locking the valves in the open and close positions. Provision is not required for locking individual radiator valves.
- 3.16.4.3. Each valve shall be provided with the indicator to show clearly the position of the valve.
- 3.16.4.4. All valves flanges shall have machined faces.
- 3.16.4.5. All valves in oil line shall be suitable for continuous operation with transformer oil at 115°C.
- 3.16.4.6. The oil sampling point for main tank shall have two identical valves to be put in series .Oil sampling valve shall have provision to fix rubber hose of 10 mm size to facilitate oil sampling.
- 3.16.4.7. Suitable small bore (8 mm copper) piping with an appropriate valve shall be provided to take sample of oil from the OLTC chamber by the user while at ground.
- 3.16.4.8. After testing, inside surface of all cast iron valves coming in contact with oil shall be applied with one coat of oil resisting paint/varnish with two coats of red oxide zinc chromate primer followed by two coats of fully glossy finishing paint conforming to IS: 2932. Outside surface except gasket setting surface of butterfly valves shall be painted with two coats of red oxide zinc chromate conforming to IS: 2074 followed by two coats of fully glossy finishing paint.
- 3.16.4.9. All hardware used shall be cadmium plated/electro galvanised/stainless steel.
- 3.16.5. The cooling fans and motors shall be provided with thermal overload and short circuit protection and also single phasing preventer.

### **3.17. Tap Changing Equipment**

- 3.17.1. OLTC shall be motor operated for local as well as remote operation. An external handle shall be provided for local manual operation. This handle shall be suitable for operation by a man standing at ground level.
- 3.17.2. Each Transformer shall be provided with a, bi-directional "on load "tap changing equipment for varying its effective ratio of transformation without producing phase displacement. The Transformer shall give full load output on all taps.
- 3.17.3. On load tap changing equipment shall be designed for remote control operation from switch board in control room in addition to being capable of manual as well as local electrical operation. The tap changer shall be capable of permitting parallel operation with other Transformers of the same type. The pairs of Transformers specified will be operated in parallel under all normal conditions.
- 3.17.4. Equipment for local and remote electrical and local manual operation shall comply with following conditions :-
  - a) It shall not be possible to operate the electric drive when the manual operating gear is in use.
  - b) It shall not be possible for any two electric controls to be used in operation at the same time.
  - c) Operation from the local or the remote control switch shall cause one tap movement only until the control switch is returned to the off position between successive operation.
  - d) All electrical control switches and the local operating gear shall be clearly labelled in a suitable manner to indicate the direction of tap changing.
- 3.17.5. In addition of independent control of the tap changer when Transformers are in independent service, following provision shall be made for parallel operation of the pairs Transformers.



- a) Suitable **lockable** selector switch shall be provided so that any one Transformer of the group can at any time be selected as “master”, “follower” or ‘independent’.
  - b) Necessary interlock, blocking independent control when the units are in parallel, shall be provided.
  - c) The scheme shall be such that only one Transformer of a group can be selected as “master”
  - d) An out-of-step device shall be provided for each Transformer, which shall be arranged to prevent further tap changing when Transformers in a group operating in “parallel control” are one out-of-step.
- 3.17.6. During operation, tap change i.e. raise/lower operation shall be performed from Bay Controller Unit as well as from SAS. As such, necessary potential free contacts shall be provided to make a logic in such a way:
- a) Must ensure that transformers are in ‘Master’ & ‘Follower’ state.
  - b) Must ensure that motor drive of OLTC is in healthy condition.
- 3.17.7. The tap changing switches shall be mounted in the top cover of main tank of transformer. Suitable mechanical apparatus shall be provided to give indication locally, of the number of the tapings in use on each Transformer.
- 3.17.8. The supplier of Transformers shall supply individual remote control panel for each Transformer for remote operation of on load tap changing gears. The panel shall be suitable for addition of more Transformers to the Transformer in future. Following accessories and indication shall be mounted in remote control panel complete with all internal wiring etc :-
- i) Raise and lower push button switch.
  - ii) Remote tap position indicator.
  - iii) Transformer voltage ratio indicator.
  - iv) Illumination signal when Transformers are out-of-step (Under parallel operation.)
  - v) Indicating lamp showing tap change in progress.
  - vi) Illumination signal when tap change is in complete. (With separate contacts for audible alarm in the main communication panel of Sub-Station)
  - vii) Remote electrical winding temperature indicator (Dial type)
  - viii) A five digit counter to indicate the number of operation completed by the equipment.
  - ix) “Master’, “ follower” and “ independent” lockable selector switch.
  - x) All the above points i.e. from i) to x), signals shall be extended to local SCADA, for control, and status indications as such necessary provisions shall have to be considered.
  - x) Any other item manufacturer considered necessary.

The complete particulars of tap changing gears including all accessories shall be furnished with the tender.

3.17.9. **CONTROL CIRCUITS:-**

The control circuits shall comply with following conditions:-

- (a) An interlock to cut off electrical control automatically upon recourse being taken to the manual control.
- (b) Re-reinforcement of the initiating impulse for a tap changer, ensuring a positive completion, once initiated to the next (higher or lower) tap.
- (c) "Step-by-step" operation ensuring only one tap change from each tap changing impulse and a lockout of the mechanism if the control switch (or push button) remains in the "operation" position.
- (d) An interlock to cut out electrical control when it tends to operate the gear beyond either of the extreme tap positions.
- (e) An electrical interlock to cut-off a counter impulse for reverse step change being initiated during a progressing tap change and until the mechanism comes to rest and resets circuits for the new position.
- (f) Tap change in progress indication shall be provided by means of an indicating lamp at the purchaser's control panel. Necessary contacts for this and for remote tap position indicator at purchaser's control panel shall be provided by the Bidder.
- (g) Protective apparatus, considered essential by the Bidder according to specialties of the gear.

#### 3.17.10. **INDICATIONS: -**

Apparatus of an approved type shall be provided on each transformer:-

- (a) To give indication mechanically at the transformer and electrically at the remote control point of the number of the tapping in use.
- (b) To give electrical indication, separate from that specified above, of tap position at the remote supervisory point. Suitable tap position transducer to be incorporated for indication.
- (c) To give indication at the remote control point and at the supervisory control point that a tap change is in progress, this indication to continue until the tap change is complete.
- (d) To give indication at the remote control point and at the supervisory control point when transformers operating in parallel are out of step.
- (e) To indicate at the tap change mechanism the number of operations, completed by the equipment. A six digit counter should be provided for this.

#### 3.17.11. **AUTOMATIC VOLTAGE CONTROL:-**

- (a) Automatic control shall be suitable for control of transformers in parallel.
- (b) In addition to the methods of control covered above, the following methods shall also be provided: -
  - (i) Automatic Independent: - It shall be possible to select automatic independent control for each transformer irrespective of the method of control, selected for any other of the associated transformers.
  - (ii) Automatic parallel: - It shall be possible to select any transformer for master or follower control.
  - (iii) Automatic control by AVR shall only be possible if HV circuit breaker is closed.
  - (iv) It must not be possible to operate any tap changer by supervisory, remote or local, electrical, manual control while the equipment is selected for automatic operation.

#### 3.17.12. **VOLTAGE REGULATING RELAYS**

- 3.17.12.1. Automatic voltage control shall be initiated by a voltage regulating relay of IEC 61850 compliant and suitable for flush mounting. The relay shall operate from the nominal reference voltage, derived from a circuit mounted LV voltage transformer having class B accuracy to BS: 3941 and the relay voltage reference balance point shall be adjustable at the Remote location.

- 3.17.12.2. The relay bandwidth shall preferably be adjustable to any value between 1.5 times and 2.5 times the transformer tap step percentage, the nominal setting being twice the transformer tap step percentage.
- 3.17.12.3. The relay shall be insensitive to frequency variation between the limits of 47HZ and 51.5HZ. The relay shall be complete with a time delay element, adjustable between 10 and 120 seconds. The relay shall also incorporate an under voltage blocking facility which renders the control inoperative if the reference voltage falls below 80 percent of the nominal value with automatic restoration of control when the reference voltage rises to 85 percent of nominal value.
- 3.17.12.4. The voltage control relay shall include an adjustable line drop compensation element, supplied from a current transformer, accommodated within the transformer bushing.
- 3.17.12.5. On each transformer, the voltage transformer supply to the voltage-regulating relay shall be monitored for partial or complete failure. The specified indicating lamp and alarm will be inoperative when the circuit breaker, controlling the lower voltage side of the transformer is open and also when the tap changer is on control other than automatic control.
- 3.17.12.6. The relay shall be put to Station LAN through Transformer BCU, as such 10/100/1000 Base Ethernet ports and time synchronization under SNTP & IRIG-B shall be accommodated. The relay shall have minimum 500 time stamped event log facilities with self-watchdog facilities.
- 3.17.12.7. The relay manufacturer should provide necessary ICD file for configuration in IEC 61850 LAN.

### 3.18. Marshalling box

- 3.18.1. Sheet steel (min. 3.15 mm thick) vermin proof, force ventilated and weather proof marshalling box with water-tight hinged and padlocked door, outdoor type of a suitable construction shall be provided for the transformer ancillary apparatus. The box shall have slopping roof and the interior and exterior painting shall be in accordance with the specification as per **Clause No 3.10.5**. Padlock along with duplicate keys shall be supplied for marshalling box. The degree of protection shall be **IP-55**.
- 3.18.2. The cooler control cabinet shall have two (2) sections. One section shall have the control equipment, exclusively meant for cooler control. The other section shall house the temperature indicators, auxiliary CTs. and the terminal boards, meant for termination of various alarm and trip contacts as well as various bushing CT Secondaries. Alternatively, the two sections may be provided as two separate panels, depending on the standard practices of the supplier.
- 3.18.3. The schematic diagram of the circuitry marked with indelible ink inside the marshalling box be prepared and fixed inside the door under a prospone sheet.
- 3.18.4. The marshalling box shall accommodate the following equipment:
- a) Temperature indicators
  - b) Control & Protection equipment for the cooling plant
  - c) Terminal blocks and gland plates for incoming and outgoing cables.

All the above equipment 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.

- 3.18.5. To prevent internal condensation, an approved type of metal clad heater with thermostat shall be provided, 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.

- 3.18.6. 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.

### 3.19. Fittings and Accessories

- 3.19.1. The following fittings shall be provided with each transformer covered in this specification:
- (i). Conservator for main tank with oil filling hole and cap, air cell with faulty alarm, isolating valves, drain valve, magnetic oil level gauge with low level alarm contacts and dehydrating silicagel breather, buchholz relay for aircell, two numbers 15NB valve at the top of the conservator for oil bleeding.
  - (ii). Conservator for OLTC with drain valve, oil surge Relay, filling hole with cap, prismatic oil level gauge and silica gel breather.
  - (iii). Oil preservation equipment, Thermosyphon filter with valves.
  - (iv). Two numbers Pressure relief devices with alarm/trip contacts, splash guard etc.
  - (v). Buchholz relay double float/reed type with isolating valves on both sides, bleeding pipe with pet cock at the end to collect gases and alarm and trip contacts.
  - (vi). Air release plug.
  - (vii). Inspection openings and covers.
  - (viii). Bushing with metal parts and gaskets to suit the termination arrangement.
  - (ix). Winding temperature indicators for local and remote mounting. One remote winding temperature indicator with a four point selector switch shall be provided for the three windings for three phase unit to have selection of any of the three windings. Winding temperature indicators shall be for each winding (HV/LV/Tertiary) along with ammeter for each WTI are to be mounted locally. Similarly, RWTI for each windings to be indicated in RTCC panel and SAS.
  - (x). Cover lifting eyes, transformer lifting lugs, jacking pads, haulage lugs, towing holes and core and winding lifting lugs.
  - (xi). Protected type mercury or alcohol in glass thermometer.
  - (xii). Bottom and top filter valves with threaded male adaptors, bottom sampling valve and drain valve.
  - (xiii). Rating and diagram plates on transformers and auxiliary apparatus.
  - (xiv). Flanged bi-directional wheels/Trolley for movement
  - (xv). Cooler control cabinet.
  - (xvi). On load tap changing gear, with OSRs, PRD and separate oil sampling valves.
  - (xvii). Cooling equipment.
  - (xviii). Bushing current transformers.
  - (xix). Oil flow indicator.
  - (xx). Drain valves/plugs shall be provided in order that each section of pipe work can be drained independently.
  - (xxi). Terminal marking plates.
  - (xxii). Valves schedule plates.
  - (xxiii). Ladder to climb up to the transformer tank cover with suitable locking arrangement to prevent climbing during charged condition.

- (xxiv). Oil temperature indicators for local and remote mounting.
  - (xxv). Online Hydrogen & Moisture monitoring of Oil
  - (xxvi). Marshalling box
  - (xxvii). Suitable **stainless steel tray** for cabling on main tank for better aesthetics.
  - (xxviii). One set of hand tools of reputed make packed in a carry bag/box broadly comprising of double ended spanners (open jaws, cranked ring, tubular with Tommy bar each of sizes 9mm to 24mm, one set each), adjustable wrenches (8 & 12 inch one set), gasket punches (of different sizes as used in the reactor one set), pliers (flat nose, round nose & side cutting one of each type), hammer with handle (one), files with handle (two), knife with handle (one), adjustable hacksaw (one), and cold chisel (one) shall be supplied per Substation.
  - (xxix). Suitable terminal connectors for both 132 and 33 kV sides on bushings shall be provided as follows:
    - a) For 132 kV side: For ACSR 'PANTHER' conductor for UNIVERSAL take off.
    - b) For 33 kV side: For twin ACSR 'MOOSE' conductor for universal take off. "
- 3.19.2. The fittings listed above are only indicative and other fittings which generally are required for satisfactory operation of the transformer are deemed to be included.

### **3.20. Name Plate ( Rating, Diagram and Valve Plates)**

- 3.20.1. Transformer rating plate shall contain the information as given in clause 15 of IS-2026 (Part-I). The details on rating plate shall be finalised during the detailed engineering.

### **3.21. Terminal Connectors**

- 3.21.1. Bushing terminals shall be provided with terminal connectors of approved type and size for connection to external parts. Terminal connectors, offered shall conform to IS: 5561.
- 3.21.2. All castings shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off. The aluminum alloy castings, if used, shall conform to designation A6 of IS: 617.
- 3.21.3. No part of clamp shall be less than 12 mm. Thick.
- 3.21.4. All ferrous parts shall be hot dip galvanised conforming to IS: 2633. Spring washers and H.T. bolts shall be electro galvanised conforming to IS: 1573.
- 3.21.5. For bimetallic clamp, copper alloy linear of minimum thickness of 2 mm shall be cast integral with aluminium body.
- 3.21.6. Flexible connectors shall be made from tinned copper sheets.
- 3.21.7. Size of terminal/conductor for which the clamp is suitable and rated current under site conditions shall be embossed/punched on each component of the clamp, except hardware.
- 3.21.8. All current carrying parts shall be designed and manufactured to have minimum contact resistance.
- 3.21.9. The short time rating of terminal connector shall not be less than the short time rating of respective bushing.
- 3.21.10. Terminal connectors shall be subject to all routine and acceptance tests as per IS: 5561 (latest).
- 3.21.11. Malleable cast iron for terminal connectors or any of its parts and accessories shall not be acceptable.
- 3.21.12. Bolts and Nuts used shall be of stainless steel or galvanized steel.

3.21.13. The terminal connectors to be supplied for both H.V. and L.V. side shall be universal type suitable for both horizontal and / or vertical takeoff.

3.21.14. The type of terminal connector, size of connector, material, and type of installation shall be approved by the Purchaser, as per installation requirement while approving the equipment drawings.

### 3.22. Inspection and Testing

3.22.1. ***The Contractor shall carry out a comprehensive stage inspection and testing program during manufacture of the transformer as per QAP (Schedule-4). An indicative of inspection is given under Clause No. 3.22.5. This is, however, not intended to form a comprehensive program as it is contractor's responsibility to draw up and carry out such a program duly approved by the Purchaser.*** The inspection and testing shall consist of following:

- (i). Inspection and testing at different stages of manufacture.
- (ii). All routine and other tests as specified on the transformers and accessories.
- (iii). Pre shipment checks as specified.
- (iv). Site tests are as listed in hereunder.

3.22.2. Certified test reports and oscillograms shall be furnished to the Purchaser for evaluation. The Contractor shall also evaluate the test results and subject to **Clause 3.22.12**, Contractor shall rectify the defects in the equipment based on his and the Purchaser's evaluations of the tests without any extra charges to the Purchaser. Manufacturer's Test Certificates in respect of all associated auxiliary and ancillary equipment shall be furnished.

3.22.3. 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.

3.22.4. **Full details of the proposed methods of testing including connection diagrams shall be submitted by the Contractor for approval at least one month before testing. All tests will be witnessed by the Purchaser.**

### 3.22.5. Stage Inspection

#### a) Tank and Conservator

- (i). Inspection of major weld.
- (ii). Crack detection of major strength weld seams by dye penetration test.
- (iii). Check correct dimensions between wheels, demonstrate turning of wheels, through 90° and further dimensional check
- (iv). Leakage test of the conservator.
- (v). Measurement of film thickness of :
  - Oil insoluble varnish.
  - Zinc chromate paint.
  - Finished coat.
- (vi). Tank pressure test
- (vii). Vacuum test

- b) Core
  - (i). Sample testing of core materials for checking specific loss properties, magnetisation characteristics and thickness.
  - (ii). Check on the quality of varnish if used on the stampings.
  - (iii). Check on the amount of burrs.
  - (iv). Visual and dimensional check during assembly stage.
  - (v). Check on completed core for measurement of iron loss.
  - (vi). Visual and dimensional checks for straightness and roundness of core, thickness of limbs and suitability of clamps.
  - (vii). High voltage test (2 kV for one minute) between core and clamps.
- c) Insulating Material
  - (i). Sample check for physical properties of materials.
  - (ii). Check for dielectric strength
  - (iii). Check for the reaction of hot oil on insulating materials.
- d) Winding
  - (i). Sample check on winding conductor for mechanical and electrical conductivity.
  - (ii). Dimensional check on winding conductor used, without insulation and with insulation.
  - (iii). OD & ID measurement of windings and measurement of weight of copper and insulation considering data on (ii) above.
  - (iv). Visual and dimensional checks on conductor for scratches, dentmark etc.
  - (v). Sample check on insulating paper for PH value, electric strength.
  - (vi). Check for the bonding of the insulating paper with conductor.
  - (vii). Check for the reaction of hot oil and insulating paper.
  - (viii). Check and ensure that physical condition of all materials taken for windings is satisfactory and free of dust.
  - (ix). Check for brazed joints wherever applicable.
  - (x). Check for absence of short circuit between parallel strands.
- e) Checks Before Drying Process
  - (i). Check condition of insulation on the conductor and between the windings.
  - (ii). Check insulation distance between high voltage connections, between high voltage connection cables and earth and other live parts.
  - (iii). Check insulating distances between low voltage connections and earth and other parts.
  - (iv). Insulating test for core earthing.
- f) Checks During Drying Process

- (i). Measurement and recording of temperature and drying time during vacuum treatment.
  - (ii). Check for completeness of drying.
- g) Assembled Transformer
- (i). Check completed transformer against approved outline drawing, provision for all fittings, finish level etc.
  - (ii). Jacking test on the assembled Transformer.
- h) Oil: All standard test in accordance with IS: 335 shall be carried out on Transformer oil sample before filling in the transformer.
- i) Test Reports for bought out items

The contractor shall submit the test reports as per CBIP guide lines for all bought out/sub contracted items for approval.

#### **Bucholz relay**

Sudden pressure rise relay in OLTC

Winding temperature indicators.

Oil temperature indicators.

Bushings

Bushing current transformers in neutral (if provided)

Pressure relief device

All type of RTDs

Air cell

Marshalling box

Fans/Air Blowers

On Load Tap changer

Oil storage tank

Any other item required to complete the works.

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 equipment are purchased by the contractor on a sub-contract, he shall have them tested to comply with these requirements.

#### 3.22.6. **Factory Tests**

##### **A. Routine Tests**

- i) All standards routine tests in accordance IS: 2026 and IEC 60076 shall be carried out.
- ii) Following additional tests shall also be carried out on each transformer as routine test:
  - a) Magnetic Circuit Test
    - Each core shall be tested for 1 minute at 2000 volts.
  - b) Measurement of zero-sequence impedances



- c) Measurement of capacitance and tan delta to determine capacitance between winding and earth. Value of Tan ( $\delta$ ) should not be more than **0.5% at 20°C**.
- d) Measurement of acoustic noise level clause 16.12 of IS: 2026.
- e) Measurement of the harmonics of the no-load current
- f) Oil leakage test on transformer
- g) Lighting Impulse test on each phase
- h) Measurement of power taken by fans.
- i) Frequency Response Analysis (FRA)
- j) Operation and dielectric testing of OLTC shall be carried out as per IS 2026.
- k) Magnetic balance test
- l) Measurement of magnetization current at low voltage
- m) Partial discharge measurement at the time of Induced over voltage test.
- n) Temperature rise test as per IS: 2026 (Part-I) on transformer of each rating.
- o) Measurement of power taken by fans.
- p) Marshalling box shall be tested for IP: 55 protection in accordance with IS : 2147.

#### 3.22.7. **Tank Tests**

Following tests shall be carried out as **Routine 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 for oil and one hour for air and during that time no leak shall occur.

- b) Pressure Test

Where required by the Purchaser, 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.

#### 3.22.8. **Routine Tests on Bushings**

The following tests shall be conducted on bushings:

- (i) Test for leakage on internal fillings.
- (ii) Measurement of creepage distance, dielectric dissipation factor and capacitance.
- (iii) Dry power frequency test on terminal and tapping.
- (iv) Partial discharge test followed by dielectric dissipation factor and capacitance measurement.

#### 3.22.9. **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, fans, control cubicle connecting pipes & conservator etc.
- ii) Check for proper provision of bracing to arrest the movement of core and winding assembly inside the tank.
- iii) Dew point measurement before dispatch.
- iv) Gas tightness test to conform tightness.

#### 3.22.10. **Inspection at Site**

The contractor 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 Purchaser is given below. This is however not intended to form a comprehensive program as it is contractor's responsibility to draw up and carry out such a program.

##### **(a) Receipt and Storage Checks**

- (i) Check and record condition 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. Measure and record the dew point of dry air/nitrogen in the transformer tank.
- (iii) Visual check of core and coils before filling up with oil and also check condition of core and winding in general.

##### **(b) Installation Checks**

- i) Inspection and performance testing of accessories like tap changers, cooling fans, etc.
- ii) Visual check for wedging of core and coils before filling up with oil and also check conditions of core and winding in general.
- iii) Capacitance and tan delta measurement of bushing before fixing/connecting to the winding, bidder shall furnish these values for site reference.
- iv) Measure and record the dew point of nitrogen/dry air in the main tank before assembly. Manufacturer shall submit dew point acceptable limits along with temperature correction factor and shall form part of instruction manual. In case dew point values are not within permissible limit suitable drying out process shall be applied for dry out of active part in consultation with the transformer manufacturer and approval from the Purchaser.
- v) Oil impregnation or drying under vacuum at site shall be done with the transformer and oil at a temperature not exceeding 70 deg C.
- vi) The duration of the vacuum treatment shall be demonstrated as adequate by means of water measurement with a cold trap or other suitable method but shall generally not be less than 72 hours. The vacuum shall be measured on the top of the transformer tank and should be less than 1mbar.
- vii) Vacuum shall not be broken until the transformer is oil filled up to the Buchholz relay. Whenever the active insulation or any paper insulated HV connections, especially those from the windings to the bushings are exposed, these shall be re-impregnated

under vacuum along with the complete transformer. For this purpose the transformer shall first be drained to expose all insulation material.

- viii) The minimum safe level of oil filling (if different from the Buchholz level) to which the transformer shall be oil filled under vacuum, shall be indicated in the manual.
- ix) Procedures for site drying, oil purification, oil filling etc shall be submitted for approval and complete instructions shall form part of the manual.
- x) The Ultra High Vacuum type oil treatment plant of suitable capacity (preferably 6000 to 8000 litres per hour) suitable for treatment of oil in EHV class transformer shall be used in order to achieve properties of treated oil.
- xi) 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.
- xii) Check the whole assembly for tightness, general appearance etc.
- xiii) Oil leakage tests.

#### 3.22.11. **Pre-Commissioning Tests**

- (a) Check the colour of silicagel in silicagel breather.
- (b) Check the oil level in the breather housing, conservator tanks, cooling system, condenser bushing etc.
- (c) Check the bushing for conformity of connection to the lines etc.
- (d) Check for correct operation of all protection devices and alarms :
  - i) Buchholz relay.
  - ii) Excessive winding temperature.
  - iii) Excessive oil temperature.
  - iv) Low oil flow.
  - v) Low oil level indication.
  - vi) Fan and pump failure protection.
- (e) Check for the adequate protection on the electric circuit supplying the accessories.
- (f) Check resistance of all windings on all steps of the tap changer.
- (g) Insulation resistance measurement for the following:
  - i) Control wiring.
  - ii) Cooling system motor and control.
  - iii) Main windings.
  - iv) Tap changer motor and control.
- (h) Check for cleanliness of the transformer and the surroundings.
- (i) Continuously observe the transformer operation at no load for 24 hours.
- (j) Gradually put the transformer on load, check and measure increase in temperature in relation to the load and check the operation with respect to temperature rise and noise level etc.
- (k) Phase out and vector group test.
- (l) Ratio test on all taps.
- (m) Magnetising current test.
- (n) Capacitance and Tan delta measurement of winding and bushing.
- (o) DGA of oil just before commissioning and after 24 hours energisation at site.

- (p) Frequency Response Analysis.
- (q) Contractor shall prepare a comprehensive commissioning report including all commissioning test results and forward to Purchaser for future record.

### 3.22.12. REJECTION

3.22.12.1. The Purchaser may reject any transformer if during tests or service any of the following conditions arise:

- i) No load loss exceeds the guaranteed value by 10%.
- ii) Load loss exceeds the guaranteed value by 10%.
- iii) No negative tolerance in guaranteed Impedance value.
- iv) The difference in impedance values of any two phases during single phase short circuit impedance test exceeds 2% of the average value guaranteed by the vendor.
- v) Oil or winding temperature rise exceeds the specified value.
- vi) Transformer fails on impulse test.
- vii) Transformer fails on power frequency voltage withstand test.
- viii) Transformer is proved to have been manufactured not in accordance with the agreed specification.

### 3.23. TECHNICAL DATA SHEET

#### 3.23.1. System Data

SL NO	DESCRIPTION	VOLTAGE CLASS	
		132 kV	33 kV
1.	System operating voltage, kV	132	33
2.	Maximum system operating voltage (rms),kV	145	36
3.	Rated frequency, Hz	50	50
4.	No. of phase	3	3
5.	Rated Insulation levels		
	Full wave impulse withstand voltage(1.2/50micro sec.), kVp	650	170
	One minute power frequency dry and wet withstand voltage, kV (rms)	275	70
6.	Minimum creepage distance, mm	3625	900
7.	Rated short circuit current for 1 sec. duration, kA	31.5	25
8.	System neutral earthing	Effectively earthed	Effectively earthed

#### 3.23.2. Transformer Parameters

SL. NO	DESCRIPTION	40 MVA, 132/33 kV
1.	<b>Continuous MVA ratings</b>	
	(a) With ONAN cooling	32
	(b) With ONAF cooling	40
	(c) With OFAF cooling	NA
2.	<b>Number of phases</b>	3
3.	<b>Rated voltage kV</b>	
	i) Primary (HV)	132
	ii) Secondary (LV)	33

SL. NO	DESCRIPTION	40 MVA, 132/33 kV
4.	<b>Highest System Voltage, kV</b>	
	i) Primary (HV)	145
	ii) Secondary (LV)	36
5.	Rated frequency, Hz.	50
6.	Connection of HV & LV	Star with neutral solidly earthed
7.	Method of system earthing	Solidly earthed
8.	Vector group	YNyn0
9.	Thermal Short Circuit Current & duration	40KA for 3 sec
10.	Insulation Level:	
	i) PF withstand voltage, kV (rms.): HV	230
	ii) PF withstand voltage, kV (rms.): IV/LV	70
	iii) Lightning impulse voltage, kV (peak) HV	650
	iv) Lightning impulse voltage, kV (peak) IV/LV	170
11.	Percentage Impedance at 75°C and at principal	12.50%
12.	Maximum flux density in any part of the core and yoke at rated MVA, System voltage and rated frequency [In Tesla].	1.6
13.	No-Load Loss in KW shall not exceed the value given in this Data Sheet. & No positive tolerance is allowed	14.5
14.	Load Loss in KW at 75°C shall not exceed the value given in this Data Sheet. & No positive tolerance is allowed	150
15.	Auxiliary Loss in KW	1.5
16.	Method of cooling	ONAN / ONAF
17.	Type of tap changer	On Load
18.	Number of taps	(+ )5% to (-)15% in 16 steps of 1.25%
19.	Tap design	Constant flux voltage variation type as per Cl.6.2 of IEC 60076 Part-I
20.	Tap Control	Full capacity OLTC suitable for group /independent, remote/local electrical and local manual operation and bi-directional power flow.
21.	Clearance of air, mm	
	a) phase to phase, HV / LV	1430 / 350
	b) phase to earth, HV / LV	1270 / 320
22.	Maximum current density	250 Amp / sq. cm
23.	Temperature Rise, °C	
	(i) Winding (measured by resistance.	55
	(ii) Top Oil (measured by thermometer)	50

SL. NO	DESCRIPTION	40 MVA, 132/33 kV
24.	Bushings:	
	1. Rated voltage in kV	
	1.1 HV bushing	145
	1.2 IV/LV bushing	36
	1.3 Neutral bushing	36
	2. Rated current in Ampere	
	2.1 HV bushing	1250
	2.2 LV bushing	2000
	2.3 Neutral bushing	2000
	1. Rated impulse withstand voltage in kV rms.	
	3.1 HV bushing	650
	3.2 LV bushing	170
	3.3 Neutral bushing	170
	2. One-minute power frequency withstand test in kV (rms.)	
	4.1 HV bushing	275
	4.2 IV/LV bushing	70
	4.3 Neutral bushings	70
	3. Creepage distance in mm	
	5.1 HV bushing	3625
	5.2 IV/LV bushing	900
	5.3 Neutral	900
25.	Partial Discharge	100 pC (max) at 1.5pu
26.	Polarisation index for H.V. to Earth, L.V. to Earth and H.V to L.V	$\geq 2.0$ or $\leq 5$
27.	Zero Sequence Impedance	Shall be 80% or more of the positive seq. value
28.	Core Assembly	Boltless type

### 3.23.3. Bushing current Transformer

#### 3.23.3.1. Current Transformer Parameters for 40 MVA, 132/33 kV Transformers:

Parameter	HV Bushing	LV Bushing	HV Neutral Bushing	LV Neutral Bushing
(a) Ratio	200/1-1-1	800/1-1-1	200/1-1	800/1-1
(b) Accuracy Class				
Core-I	0.5, (ISF $\leq$ 5)	0.2, (ISF $\leq$ 5)	PS	PS
Core-II	PS	PS	PS	PS
Core-III	PS	PS		
(c) Min. Knee Point Voltage V <sub>k</sub>				
Core-I	-	-	1200 V	600 V
Core-II	1200 V	600 V	1200 V	600 V
Core-III	1200 V	600 V		
(d) Maximum CT Resistance				
Core-I	-	-	3 $\Omega$	3 $\Omega$
Core-II	3 $\Omega$	3 $\Omega$	3 $\Omega$	3 $\Omega$
Core-III	3 $\Omega$	3 $\Omega$		

(e) Maximum magnetization current at $V_k/4$				
Core-I	-	-	30 mA	15 mA
Core-II	30 mA	15 mA	30 mA	15 mA
Core-III	30 mA	15 mA		
(f) Application				
Core-I	Metering	Metering	REF	REF
Core-II	30 mA	15 mA	REF	REF
Core-III	30 mA	15 mA		

#### 3.23.4. Current Transformer WTI & LDC:

Parameter	HV Bushing	LV Bushing
(a) WTI CT	205.8/2.0,2.2,2.3	699.8/2.0,2.2,2.3
(b) Accuracy Class Core-I	2.0 (15 VA)	2.0
(c) LDC CT		699.8/1
Accuracy Class	-	2.0 (7.5VA)

### 3.24. Transportation of Transformer

- 3.24.1. The Contractor shall dispatch the transformers filled with oil or in an atmosphere of nitrogen or dry air at positive pressure. In the former case, the contractor shall take care of the weight limitation on transport and handling facility at site. In the latter case, necessary arrangement shall be ensured by the contractor to take care of pressure drop of nitrogen or dry air during transit and storage till completion of oil filling during erection. The nitrogen or dry air cylinder provided to maintain positive pressure can be taken back by the contractor after oil filling. A gas pressure testing valve with necessary pressure gauge and adapter valve shall be provided. Transformer shall also be fitted with at least one Electronic impact recorder (on returnable basis) during transportation to measure the magnitude and duration of the impact in all three directions. The acceptance criteria and limits of impact in all three directions which can be withstood by the equipment during transportation and handling shall be submitted by the contractor during detailed engineering. The recording shall commence in the factory before dispatch and must continue till the unit is installed on its foundation. The data of electronic impact recorder(s) shall be down loaded at site and a soft copy of it shall be handed over to Engineer-in-charge. Further, within three weeks the contractor shall communicate the interpretation of the data. In the unlikely event of impact recorder output not available at site, the equipment shall be thoroughly internally inspected by the manufacturer's representative before erection at site to ensure healthiness of the equipment. Contractor shall mount Vehicle tracking system (GPRS/ GPS/ GSM based) to track the exact position of the vehicle on which the transformer is being loaded for transportation and during detailed engineering take approval for the equipment installed.

### 3.25. Oil Storage Tank

#### 3.25.1. General

This specification is for oil storage tank of capacity mentioned in BPS. The tank shall be supplied along with complete accessories.

#### 3.25.2. Standard

The oil storage tank shall be designed and fabricated as per relevant Indian Standards e.g. IS: 803 or other internationally acceptable standards.

#### 3.25.3. Specifications

- 3.25.3.1. Transformer oil storage tanks shall be towable on pneumatic tyres and rested on manual screw jacks of adequate quantity & size. The tank shall be cylindrical in shape and mounted horizontally and made of mild steel plate of adequate thickness. Size of the storage tank shall be as follows:

Diameter : 2.0 meter  
Minimum Capacity : 20 Cu M.

The tank shall be designed for storage of oil at a temperature of 100°C.

- 3.25.3.2. The Bidder may further note that maximum height of any part of the complete assembly of the storage tank shall not exceed 4.0 metres above road top.
- 3.25.3.3. The tank shall have adequate number of jacking pad so that it can be kept on jack while completely filled with oil. The tank shall be provided with suitable saddles so that tank can be rested on ground after removing the pneumatic tyres.
- 3.25.3.4. The tank shall also fitted with manhole, outside & inside access ladder, silicagel breather assembly, inlet & outlet valve, oil sampling valve with suitable adopter, oil drainage valve, air vent etc. Pulling hook on both ends of the tank shall be provided so that the tank can be pulled from either end while completely filled with oil. Bidder shall indicate the engine capacity in horse power to pull one tank completely fitted with oil. Oil level indicator shall be provided with calibration in terms of litre so that at any time operator can have an idea of oil in the tank. Suitable arrangement shall also be provided to prevent overflow in the tank.
- 3.25.3.5. The following accessories shall also form part of supply along with each Oil storage tank.
- (a) Four numbers of suitable nominal bore rubber hoses for transformer oil application up to temperature of 100°C, full vacuum and pressure up to 2.5 Kg/ cm<sup>2</sup> with couplers and unions each not less than 10 metre long shall be provided.
  - (b) Two numbers of suitable nominal bore vacuum hoses, suitable for full vacuum without collapsing and kinking, with couplers and unions each not less than 10 metre long shall also be provided.
  - (c) One number of digital vacuum gauge with sensor capable of reading up to 0.001 torr, operating on 240V 50Hz AC supply shall be supplied. Couplers and unions for sensor should block oil flow in the sensor. Sensor shall be provided with atleast 8 meter cable so as to suitably place the Vacuum gauge at ground level.
- 3.25.3.6. The painting of oil storage tank and its control panel shall be as per **clause no. 3.10.5**.
- 3.25.3.7. The tank shall contain a self-mounted centrifugal oil pump with inlet and outlet valves, with couplers - suitable for flexible rubber hoses and necessary switchgear for its control. There shall be no rigid connection to the pump. The pump shall be electric motor driven, and shall have a discharge of not less than 6.0 kl/hr. with a discharge head of 8.0 m. The pump motor and the control cabinet shall be enclosed in a cubical with IP-55 enclosure.

### **3.26. Oil Sampling Bottle**

- 3.26.1. Oil sampling bottles shall be suitable for collecting oil samples from transformers and shunt reactors, for Dissolved Gas Analysis. Bottles shall be robust enough, so that no damage occurs during frequent transportation of samples from site to laboratory.
- 3.26.2. Oil sampling bottles shall be made of stainless steel having a capacity of one litre.
- 3.26.3. Oil Sampling bottles shall be capable of being sealed gas-tight and shall be fitted with cocks on both ends.
- 3.26.4. The design of bottle & seal shall be such that loss of hydrogen shall not exceed 5% per week.
- 3.26.5. An impermeable oil-proof, transparent plastic or rubber tube of about 5 mm diameter, and of sufficient length shall also be provided with each bottle along with suitable connectors to fit the tube on to the oil sampling valve of the equipment and the oil collecting bottles respectively.

### **3.27. Bushing Current Transformers**

- 3.27.1. Current Transformers shall comply with IEC 60044-I



- 3.27.2. It shall be possible to remove the turret mounted current transformers from the Transformer tank without removing the tank cover. Necessary precautions shall be taken to minimize eddy currents and local heat generated in the turret.
- 3.27.3. Current transformer secondary leads shall be brought out to a weatherproof terminal box near each bushing. These terminals shall be wired out to cooler control cabinet/marshalling box using separate cables for each core.
- 3.27.4. Bushing Current transformer parameters indicated in this specification (Data Sheet) are tentative and liable to change within reasonable limits. The Contractor shall obtain Purchaser's approval before proceeding with the design of bushing current transformers.
- 3.27.5. The CT's used for REF protection must have the identical parameters in order to limit the circulating current under normal condition for stability of protection.
- 3.27.6. **To facilitate the site testing of BCT, 2 nos. of CT Test Terminals to be taken out at Epoxy Terminal board meant for CT secondary lead terminations. One of the Test terminals should be kept grounded. The same should be reflected in rating and diagram plate.**

### **3.28. NITROGEN INJECTION TYPE FIRE PREVENTION & EXTINGUISHING SYSTEM**

- 3.28.1. Nitrogen Injection Type Fire Protection System (NIFPS) shall be designed to prevent explosion of transformer tank and the fire during internal faults resulting from arc and also to extinguish the external oil fires on transformer/ reactor due to tank explosion and/or external failures like bushing fires, OLTC fires and fire from surrounding equipments, etc.

The system shall work on the principle of Drain & stir. On activation, it shall drain a predetermined quantity of oil from the tank top through drain valve to reduce the tank pressure, isolate conservator tank oil and inject nitrogen gas at high pressure from the bottom side of the tank through inlet valves to create stirring action and reduce the temperature of oil below flash point to extinguish the fire. On operation, the quantity of oil removed from the tank shall be such that adequate amount of oil shall remain to cover active part (i.e. core coil assembly).

Electrical isolation of transformer shall be an essential pre-condition for activating the system.

#### **3.28.2. Operational Controls**

The system operation shall be fully automatic and activate from the required fire and other trip signals. In addition to automatic operation, remote operation from control room/ remote centre and local manual control in the fire extinguishing cubicle shall also be provided. System shall operate on following situations:

#### **3.28.3. Prevention of transformer from explosion and fire**

To prevent transformer from explosion and fire in case of an internal fault, signals given by operation of Electrical protection relays and tripping of circuit breaker of transformer and operation of either Buchholz relay or pressure relief valve (PRV) shall be used to activate the system. The exact logic for system activation shall be finalized during detailed engineering.

#### **3.28.4. Prevention of transformer from fire**

In case of fire, sensed by fire detectors, the system shall be activated only after electrical isolation of the transformer, confirmed by breaker trip. If the fire detection is not associated with any other fault, the

system activation shall be only manual. Manual operation switch shall be provided in the control room with a cover to avoid accidental operation of it.

#### 3.28.5. **Operation of System**

On receiving activation signal, the following shall take place:

- i) Open the quick opening drain valve to drain the top layer oil
- ii) Shut off the conservator isolation valve to prevent flow of oil from the Conservator tank to the main tank
- iii) Open the Nitrogen regulator valve to inject Nitrogen into the transformer tank to create stirring of oil.

There shall be interlock to prevent activation of the system if the transformer is not electrically isolated.

There shall also be provision for isolating the system during maintenance and/or testing of the transformer.

#### 3.28.6. **Technical Particulars**

The contractor shall be responsible for the design of the complete system and shall submit the drawings and design calculations for the number of fire detectors, pipe sizing of drain pipe and Nitrogen injection pipe, Nitrogen cylinder capacity, number of injection points, etc. and get approval from AEGCL.

Facility shall be provided to test the system when the transformer is in service, without actually draining the oil and injecting Nitrogen.

The Nitrogen regulator valve shall be designed in such a way that the Nitrogen shall not enter the transformer tank even in case of passing/ leakage of valve.

Owner shall provide two distinct station auxiliary DC feeders for control purposes. The system shall work on station DC supply with voltage variation defined in Data Sheet .The control box of fire protection system shall have facility to receive these feeders for auto changeover of supply. It shall be the contractor's responsibility to further distribute power to the required locations. In case auxiliary DC power supply requirement is different than station auxiliary DC supply, then all necessary DC-DC converters shall be provided by the Contractor.

Following minimum indications and alarms shall be provided in the local cubicle as well as in the control box:-

- Nitrogen cylinder pressure indication - manometer with sufficient number of adjustable NO contacts

- Nitrogen cylinder pressure low
- Fire in Transformer/ Reactor
- Oil drain started
- Conservator oil isolation valve closed
- Nitrogen injection started
- DC supply fail
- Oil drain valve closed
- Gas inlet valve closed

3.28.7. **Details of Supply of System Equipment and Other Related Activities:**

The scope of supply shall include the following items and any other items required for safe and trouble free operation of the system.

- i) Fire extinguishing cubicle with base frame and containing at least the following:
  - Nitrogen gas cylinder of sufficient capacity with pressure regulator and manometer with sufficient number of adjustable NO contacts.
  - Oil Drain Assembly including oil drain pipe extension of suitable size for connecting pipes to oil pit
  - Mechanical release device for oil drain and nitrogen release
  - Limit switches for monitoring of the systems
  - Panel lighting
  - Flanges on top of the panel for connecting oil drain and nitrogen injection pipes for transformer
  - Back up pressure switch to operate nitrogen gas valve
  - Pressure indicators for Nitrogen pressure of the cylinder and actual injection through Nitrogen regulator
- ii) Control box to be installed in the control room of the station for monitoring system operation, automatic control and remote operation, with alarms, indications, switches, push buttons, audio signal, suitable for tripping and signalling.

- iii) Required number of fire detectors to be located in strategic locations to be finalized during detailed engineering.
- iv) All controls, alarms, panels, cables, cable trays (if required), junction boxes etc.

3.28.8. **Under Ground Oil Storage Tank**

Each transformer unit shall be provided with an underground oil storage tank. The oil storage tank shall have Non Corrosive, water proof, epoxy coated (from Inside) mild steel (minimum thickness 6 mm) to store drained out oil on operation of NIFPS. The tank shall be painted from outside as per **Clause 3.10.5**. The total capacity of storage tank shall be at least 10% of transformer tank oil to avoid overflowing of oil considering that drained oil volume shall be around 10% of transformer tank oil. Necessary arrangement shall be made on underground storage tank so as to take out the drained oil from the tank for further processing and use. All the pipe and physical connection from transformer to oil pit shall be in the scope of contractor.

This storage tank shall be placed in the pit made of brick walls with PCC (1:2:4) flooring with suitable cover plates to avoid ingress of rain water. The design of tank and pit shall be finalized during detailed engineering.

3.28.9. Installation and pre-commissioning test

After installation the system pre-commissioning tests shall be carried out jointly with the Owner's representative before the system is put in service.

## Schedule – 1

### Guaranteed and Other Technical Particulars

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

S. No	Description	Particulars
1.0	Manufacturer's Name & Address of manufacturing plant	
2.0	Standard applicable	
3.0	Rating (MVA)	
4.0	Voltage ratio (kV)	
5.0	Winding connection	
6.0	Vector group	
7.0	Number of phases	
8.0	Frequency (Hz)	
9.0	Type of cooling	
10.0	<b>Rating available at any tapping with ONAN cooling</b>	
	(i). HV (MVA)	
	(ii). IV (MVA)	
	(iii). LV (MVA)	
11.0	<b>Rating available at any tapping with ONAF cooling</b>	
	(i). HV (MVA)	
	(ii). IV (MVA)	
	(iii). LV (MVA)	
12.0	<b>Rating available at any tapping with OFAF cooling</b>	
	(i). HV (MVA)	
	(ii). IV (MVA)	
	(iii). LV (MVA)	
13.0	<b>Permissible overload</b>	
14.0	<b>Impedance Data</b>	
14.1	Ohmic impedance at 75 <sup>0</sup> C and rated frequency based on rated power on HV winding (%)	
	(i). HV/IV	
	➤ Principal tap	
	➤ Maximum tap	
	➤ Minimum tap	
	(ii). HV/LV	

S. No	Description	Particulars
	➤ Principal tap	
	➤ Maximum tap	
	➤ Minimum tap	
	(iii). IV/LV	
	➤ Principal tap	
	➤ Maximum tap	
	➤ Minimum tap	
14.2	Tolerance applicable to above impedance	
	(i). HV/IV	
	➤ Principal tap	
	➤ Maximum tap	
	➤ Minimum tap	
	(ii). HV/LV	
	➤ Principal tap	
	➤ Maximum tap	
	➤ Minimum tap	
	(iii). IV/LV	
	➤ Principal tap	
	➤ Maximum tap	
	➤ Minimum tap	
14.3	Zero sequence impedance (%)	
	(i). HV/IV	
	➤ Principal tap	
	➤ Maximum tap	
	➤ Minimum tap	
	(ii). HV/Neutral	
	➤ Principal tap	
	➤ Maximum tap	
	➤ Minimum tap	
	(iii). IV/ Neutral	
	➤ Principal tap	
	➤ Maximum tap	
	➤ Minimum tap	
14.4	Minimum Air core impedance (%)	
<b>15.0</b>	<b>Guaranteed Losses&amp; Tolerances</b>	
15.1	<b>Guaranteed Losses</b>	

S. No	Description	Particulars
	a) No load loss on principal tap at rated voltage and frequency (KW)	
	b) Load loss (Copper Loss) at rated HV and IV load without LV loading at principal tap at 75°C (KW)	
	c) Cooler loss (KW)	
	d) Total loss (a+b+c) (KW)	
15.2	<b>Tolerances if applicable on above losses</b>	
	a) No load loss on principal tap at rated voltage and frequency (KW)	
	b) Load loss (Copper Loss) at rated HV and IV load without LV loading at principal tap at 75°C (KW)	
	c) Cooler loss (K/W)	
	d) Total loss (a+b+c), (KW)	
<b>16.0</b>	<b>Cooling Equipment Details</b>	
16.1	Number of radiator bank and its rating as % of transformer cooling	
16.2	Radiator	
	a) Type of mounting	
	b) Material	
	c) Thickness	
16.3	Number of fans per radiator bank	
16.4	Temperature range for which setting is adjustable	
<b>17.0</b>	<b>Thermal Data</b>	
17.1	Temperature rise in top oil over an ambient of 50° C. (°C)	
17.2	Temperature rise in winding by resistance measurement method over an ambient of 50° C. (°C)	
17.3	Winding hotspot temperature over an ambient of 50° C. (°C)	
17.4	Core hotspot temperature over an ambient of 50° C. (°C)	
17.5	Position of core hotspot	
17.6	Thermal time constant (Hours)	
<b>18.0</b>	<b>Maximum noise level at</b>	
18.1	ONAN cooling (dBA)	
18.2	Full load with 100% cooling (dBA)	

S. No	Description	Particulars
19.0	<b>Maximum partial discharge level at 1.5 pu (pC)</b>	
20.0	<b>Core</b>	
20.1	Manufacturer of core material	
20.2	Type of construction (core/shell)	
20.3	Diameter of the core (mm)	
20.4	Core area (mm <sup>2</sup> )	
	a) Yoke	
	b) Wound limb	
	c) Unwound limb	
20.5	Core material and grade used	
20.6	Type of joint between core and yoke	
20.7	Thickness of stamping (mm)	
20.8	Percentage silicon content (%)	
20.9	Maximum flux density in core at rated frequency and at	
	a) 90% voltage (wb/sq.m)	
	b) 100% voltage (wb/sq.m)	
	c) 110% voltage (wb/sq.m)	
21.0	<b>Over excitation withstand time (secs.).</b>	
21.1	1.05 Um	
21.2	1.25 Um	
21.3	1.50 Um	
22.0	<b>Winding</b>	
22.1	Type of winding	
	a) HV	
	b) IV	
	c) LV	
	d) Regulating	
22.2	Current density at rated load	
	a) HV	
	b) IV	
	c) LV	
22.3	Conductor area	
22.4	a) HV	
22.5	b) IV	
22.6	c) LV	



S. No	Description	Particulars
22.7	Maximum current density under short circuit	
22.8	a) HV	
22.9	b) IV	
22.10	c) LV	
22.11	Magnetizing inrush current (Amps)	
22.12	No load current (Amps) at rated frequency and at	
	a) 90% voltage	
	b) 100% voltage	
	c) 110% voltage	
22.13	Voltage per turn for maximum flux density	
	a) HV (Volts)	
	b) IV (Volts)	
	c) LV (Volts)	
22.14	Resistance	
	a) HV (Ohms)	
	b) IV (Ohms)	
	c) LV (Ohms)	
22.15	Number of turns in	
	a) HV	
	b) IV	
	c) LV	
	d) Regulating	
22.16	Position of winding from the core(Enclose a sketch)	
	a) HV	
	b) IV	
	c) LV	
	d) Regulating	
22.17	Type of Conductor	
	a) HV	
	b) IV	
	c) LV	
	d) Regulating	
22.18	Maximum average radial compressive stress in the winding	

S. No	Description	Particulars		
	a) For CTC/epoxy bonded conductor (N/sq.mm)			
	b) For paper insulated conductor (N/sq.mm)			
22.19	Insulation system			
	Min <sup>m</sup> density of press board (gm/cc)			
	Min <sup>m</sup> Density of paper ( gm/cc)			
<b>23.0</b>	<b>Insulation Level of Winding</b>	HV	IV	LV
23.1	Lightning impulse withstand voltage (kVp)			
23.2	Switching Surge withstand voltage (kVp)			-
23.3	Power Frequency withstand voltage (kV rms)	-		
23.4	Maximum transferred surge voltage due to rated LI/SI voltage on HV & IV. (kV peak)	-	-	
<b>24.0</b>	<b>Short circuit withstand current &amp; duration</b>			
24.1	Short circuit current for which transformer is designed to withstand in p.u of rated rms current			
	(i). HV			
	(ii). IV			
	(iii). LV			
24.2	Withstand time for three phase short circuit at terminals (secs.)			
<b>25.0</b>	<b>Capacitance Values</b>			
25.1	HV to earth(pF)			
25.2	IV to earth(pF)			
25.3	LV to earth(pF)			
<b>26.0</b>	<b>Tank</b>			
26.1	Type of Tank cover (Conventional / Bell)			
26.2	Material			
26.3	Approximate thickness of			
	(i). Sides (mm)			
	(ii). Bottom (mm)			
	(iii). Cover (mm)			
26.4	Type of Tank cover joint			
<b>27.0</b>	<b>Vacuum withstand capability of</b>			
27.1	Main tank (torr)			
27.2	Radiators and accessories (torr)			
<b>28.0</b>	<b>Pressure withstanding capability of</b>			
28.1	Main tank (torr)			

S. No	Description	Particulars			
28.2	Radiators and accessories (torr)				
<b>29.0</b>	<b>Gasket</b>				
29.1	Material				
29.2	Temperature withstand capability (°C)				
<b>30.0</b>	<b>Size of oil filter hose (mm)</b>				
<b>31.0</b>	<b>Bushings</b>	HV	IV	LV	Neutral
31.1	Name of Manufacturer				
31.2	Rated Voltage (kV)				
31.3	Rated current (Amps)				
31.4	Total creepage distance (mm)				
31.5	Protected creepage distance (mm)				
31.6	Insulation Level				
	a) Lightning impulse withstand voltage (kVp)				
	b) Switching Surge withstand voltage (kVp)				
	c) Power Frequency withstand voltage (kV rms)				
31.7	Colour of porcelain				
31.8	Mounting				
<b>32.0</b>	<b>Bushing Current Transformer on Auto Transformer</b>				
32.1	<b>HV Side</b>				
	(i). Type or voltage class				
	(ii). Ratio				
	(iii). Accuracy class				
	(iv). Burden (VA)				
	(v). Accuracy limit factor				
	(vi). Knee point voltage (Volts) (minimum)				
	(vii). Maximum resistance of secondary winding				
	(viii). Maximum exciting (mA) current				
32.2	<b>IV Side</b>				
	(i). Type or voltage class				
	(ii). Ratio				
	(iii). Accuracy class				
	(iv). Burden (VA)				
	(v). Accuracy limit factor				
	(vi). Knee point voltage (Volts) (minimum)				

S. No	Description	Particulars
	(vii). Maximum resistance of secondary winding	
	(viii). Maximum exciting (mA) current	
32.3	<b>Neutral Side</b>	
	(i). Type or voltage class	
	(ii). Ratio	
	(iii). Accuracy class	
	(iv). Burden (VA)	
	(v). Accuracy limit factor	
	(vi). Knee point voltage (Volts) (minimum)	
	(vii). Maximum resistance of secondary winding	
	(viii). Maximum exciting (mA) current	
<b>33.0</b>	<b>Clearances</b>	
33.1	Minimum clearance between phases and phase to earth	
	(i). In oil (mm)	
	(ii). In air (mm)	
33.2	Minimum clearance of HV winding to tank in oil (mm)	
33.3	Minimum clearance of HV winding to earth in oil (mm)	
33.4	Clearance between Core and Coil (mm)	
33.5	Clearance between coils (mm)	
33.6	Clearance between neutral to ground in air (mm)	
<b>34.0</b>	<b>Tap changing Equipment rating</b>	
34.1	Manufacturer & type designation	
34.2	Voltage class & current	
34.3	Number of steps	
34.4	Range	
34.5	Step voltage	
34.6	Electrical location of tapping (HV/IV/Neutral)	
34.7	Rated voltage of drive motor (volts)	
34.8	No. of revolutions to complete one step	
34.9	Time to complete one step on manual/auto operation (secs.)	
34.10	Power required (kW)	

S. No	Description	Particulars	
34.11	Insulation level of tap changer		
34.12	Short circuit withstand current		
34.13	Value of tie-in-resistor and connection m) arrangement (if provided)		
34.14	No load voltage appearing on		
	(i). Principal tap		
	(ii). Maximum tap		
	(iii). Minimum tap		
<b>35.0</b>	<b>Conservator</b>		
35.1	Total volume (Litres)		
35.2	Volume between highest and lowest levels		
<b>36.0</b>	<b>Air Cell (oil preservation)</b>		
36.1	Material of air cell		
36.2	Continuous temp. withstand capability of the air cell		
<b>37.0</b>	<b>Pressure Relief Device</b>		
37.1	Manufacturer & type designation		
37.2	No. of pressure relief device provided		
37.3	Operating pressure of pressure relief device		
<b>38.0</b>	<b>Insulating Oil</b>		
38.1	Manufacturer of the Oil		
38.2	Standards applicable		
38.3	Type of oil (Non inhibited / inhibited)		
38.4	Moisture Content (ppm)	Before first filling	Before commissioning
38.5	Max. tan-delta value (at 90 deg. C.)		
38.6	Resistivity (ohm-cm)		
38.7	Breakdown Strength (kV)		
38.8	Interfacial tension at 20°C (min.)		
<b>39.0</b>	<b>Temperature Indicators</b>		
39.1	Oil Temperature Indicator		
	(i). Name of Manufacturer		
	(ii). Range		
	(iii). Accuracy		
39.2	Winding Temperature Indicator		
	(i). Name of Manufacturer		
	(ii). Range		

S. No	Description	Particulars
	(iii). Accuracy	
39.3	RWTI	
	(i). Name of Manufacturer	
	(ii). Range	
	(iii). Accuracy	
	(iv). Auxiliary supply used	
<b>40.0</b>	<b>On line oil drying system</b>	
40.1	Name of Manufacturer & type designation	
40.2	Number & Capacity of drying element for each transformer	
40.3	Moisture absorption capacity	
<b>41.0</b>	<b>On line dissolved hydrogen gas &amp; moisture monitoring system</b>	
41.1	Name of Manufacturer & type designation	
41.2	Name of gases monitored	
41.3	Nos. of Potential free contacts for monitoring, Alarm, equipment healthiness etc	
<b>42.0</b>	<b>Buchholz Relay</b>	
42.1	Name of Manufacturer & type designation	
<b>43.0</b>	<b>Furnish details of processing of core coil assembly including drying method, temperature, vacuum level, clamping pressure etc.</b>	
<b>44.0</b>	<b>Approximate dimensions</b>	
44.1	Tank (L x B x H) (mm)	
44.2	Overall dimensions with coolers (L x B x H) (mm)	
44.3	Shipping dimensions (L x B x H) (mm)	
44.4	Height for un-tanking (mm)	
44.5	Dimensions of largest package (L x B x H) (mm)	
<b>45.0</b>	<b>Weights of Transformer Components</b>	
45.1	Core (kg)	
45.2	Windings (Kg)	
45.3	Core & winding assembly (kg)	
45.4	Insulation (Kg)	
45.5	Tank and fittings (Kg)	
45.6	Oil (Kg)	

S. No	Description	Particulars
45.7	Untanking weight (heaviest piece) (Kg)	
45.8	Total weight (Kg)	
45.9	Weight of heaviest package (Kg)	
45.10	Total shipping weight (Kg )	
45.11	Parts detached for transport (furnish list)	
<b>46.0</b>	<b>Proposed filling medium for transportation from works to site</b>	
<b>47.0</b>	<b>Minimum draw bar pull required to move the transformer on level track (kg)</b>	
<b>48.0</b>	<b>Bimetallic Connections</b>	
48.1	Normal current rating (A)	
48.2	Short time current rating (A)	
48.3	Tensile strength (Kg)	
48.4	Maximum temperature limit	
48.5	Dimensional sketch enclosed indicating tolerances (Yes/No)	
48.6	Minimum clearance (mm)	
	- Phase to Phase	
	- Phase to Earth	

## Schedule - 2

### Maximum Flux Density and Core Weight Calculation

(To be filled in by the Bidder)

Step No	Width of steps [mm]	Stack Thickness [mm]	Gross Iron Area [mm <sup>2</sup> ]
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
----			
----			
----			
----			
----			

$$B_{\max} = E / (4.44 \times f \times A_i \times N)$$

Where E = L.V. winding phase voltage / phase

f = Rated frequency = 50 HZ.

$B_{\max}$  = Maximum flux density in Tesla.

$A_i$  = Net iron area in sq.m = Gross iron area x stacking factor in sq.m

N = Number of L.V. winding, turns/phase

Stacking Factor = 0.97 maximum

#### **Core weight calculation:-**

Core dia [in mm] =

Window height [in mm] =

Limb center [in mm] =

Weight of core = [3 x window height + 4 x limb centre + 2 x max. width] x Net iron area x Density of core

NB: - 1 Specific loss vs. flux density graph for the type of core lamination to be used has to be furnished.

2. VA/Kg. Vs flux density graph for the core lamination to be used has to be furnished.

3. Any other factor assumed for above calculation to be explained with reasons.

N.B.:- The bidder may use its own method of calculation towards determination of maximum flux density and weight of the core. But the same shall be supported with proper explanation and justification.

Place:

Date:

Signature of Bidder  
with seal of Company.



## Schedule - 3

### Details of Loss Calculation

(To be filled in by the Bidder)

Sl. No	Particulars	Values
1.	Flux density at	
	(i) 145/36 kV & 50 Hz, Tesla	
	(ii) 132/33 kV & 48.5 Hz, Tesla	
2.	Core Data	
	(i) Core weight in Kg.	
	(ii) Gross core area [mm <sup>2</sup> ]	
	(iii) Stacking factor.	
3.	Net core iron area [mm <sup>2</sup> ] [ii x iii]	
	Specific losses [W/Kg.]	
	(i) At maximum flux density corresponding to 145/36 KV and 48.5 HZ.	
	(ii) At maximum flux density corresponding to 132/33 KV and 50Hz.	
4.	Volt ampere/Kg	
	(i) At maximum flux density corresponding to 145/36 KV and 48.5 HZ.	
	(ii) At maximum flux density corresponding to 132/33 KV and 50Hz.	
5.	Calculated/guaranteed iron loss in KW at:	
	(i) Rated voltage and rated frequency	
	(ii) Rated voltage and rated frequency	
6.	Current density [A/Sq. mm] for	
	(i) HV	
	(ii) LV	
7.	Conductor size [in mm <sup>2</sup> ]	
	(i) HV winding	
	a) Bare	
	b) Insulated	
	c) No of conductors in parallel	
	(ii) LV winding	
	a) Bare	
	b) Insulated	
c) No of conductors in parallel		
8.	Copper weight	
	(i) H.V. windings	
	(ii) LV windings	
	(iii) For Tap connections,	
	(iv) Total copper weight [i]+[ii]+[iii]	

Sl. No	Particulars	Values
9.	L.V. winding resistance in ohms at 75°C/Phase.	
10.	H.V. winding resistance in ohms at 75°C/Phase.	
	(i) At normal tap position	
	(ii) At maximum tap position	
11.	Stray losses and eddy current losses [in KW] at 75°C	
	(i) At normal tap position	
	(ii) At maximum tap position	
12.	Resistivity of copper to be used for winding	
	(i) At normal tap position	
	(ii) At maximum tap position	
13.	I <sup>2</sup> R loss at 75°C	
	(i) At normal tap position	
	(ii) At maximum tap position	
14.	Calculated guaranteed copper losses [in KW] at 75°C [I <sup>2</sup> R loss + stray losses]	
	(i) At normal tap position	
	(ii) At maximum tap position	
15.	Guaranteed Auxiliary loss	
	(i) At normal tap position	
	(ii) At maximum tap position	
16.	Computed/guaranteed total loss in KW at rated voltage and rated frequency [Copper loss + Iron loss + Aux. loss]	
	(i) At normal tap position	
	(ii) At maximum tap position	
17.		
	(i) At normal tap position	
	(ii) At maximum tap position	

NB: - 1 Approximate values in weight and losses etc. are not allowed.

2 Tolerance of + 5% in weights may be quoted without any approximation

Place:

Date

Bidder's name:  
Signature, designation, seal

## Schedule - 4

### Manufacturer Quality Plan

Sl No.	Component	Characteristics	Type of Inspection	Quantum of Inspection	Ref Doc & Acceptable Norm	Form of Record	Inspection Agency	Remarks
<b>1.0</b>	<b>MATERIAL</b>							
<b>1.1</b>	<b>Copper Conductor</b>							
1.1.1		Sample check on winding conductor for electrical conductivity	Testing	Sampling/lot	TM Spec	Insp.rec ord	Vendor/TM QC	CHP at Vendor end
1.1.2		Dimensions Width & Thickness ( Bare ) & Visual for scratches,dentmarks	Measurement	-Do-	TM Spec	-Do-	-Do-	CHP at Vendor end
1.1.3		Sample check on insulating paper for pH value, electric strength	Testing	-Do-	TM Spec	-Do-	-Do-	TC Review
1.1.4		check for bonding of the insulating paper with conductor	Visual	-Do-	TM Spec	-Do-	-Do-	CHP at Vendor end
1.1.5		Check for the reaction of hot oil and insulating paper	Testing	-Do-	TM Spec	-Do-	-Do-	TC Review
1.1.6		Check & ensure that physical condition of all materials taken for winding is satisfactory and dust free.	Visual	-Do-	TM Spec	-Do-	-Do-	CHP at Vendor end
<b>1.2</b>	<b>Core Material</b>							
1.2.1		Sample testing of core materials for checking specific core loss properties, magnetisation characteristics & Thickness	Testing	Sampling/lot	TM Spec	Insp.rec ord	Vendor/TM QC	CHP at Vendor end
1.2.2		Amount of burr	Measurement	-Do-	-Do-	-Do-	-Do-	CHP at Vendor end
<b>1.3</b>	<b>Insulating Material</b>							
1.3.1		Physical Properties	Testing	Sampling/lot	TM Spec	Insp.rec ord	Vendor/TM QC	TC Review

Sl No.	Component	Characteristics	Type of Inspection	Quantum of Inspection	Ref Doc & Acceptable Norm	Form of Record	Inspection Agency	Remarks
1.3.2		Dielectric Strength	Testing	Sampling/lot	TM Spec	Insp. record	Vendor/TM QC	TC Review
1.3.3		Reaction of hot oil on insulating materials	Testing	Sampling/lot	TM Spec	Insp. record	Vendor/TM QC	TC Review
<b>1.4</b>	<b>OIL</b>							
1.4.1		Appearance	Visual	Sampling	IS 335/TM Spec	Insp Record	Vendor/TM QC	CHP at Vendor end
1.4.2		Density	Testing	-Do-	-Do-	-Do-	-Do-	
1.4.3		Viscosity	Testing	-Do-	-Do-	-Do-	-Do-	
1.4.4		Interfacial tension	Testing	-Do-	-Do-	-Do-	-Do-	
1.4.5		Neutralisation Value	Testing	-Do-	-Do-	-Do-	-Do-	
1.4.6		Dielectric strength	Testing	-Do-	-Do-	-Do-	-Do-	
1.4.7		Tan Delta	Testing	-Do-	-Do-	-Do-	-Do-	
1.4.8		Specific Resistance	Testing	-Do-	-Do-	-Do-	-Do-	
1.4.9		Water content	Testing	-Do-	-Do-	-Do-	-Do-	
1.4.10		Flash point	Testing	-Do-	-Do-	-Do-	-Do-	
1.4.11		Pour point	Testing	-Do-	-Do-	-Do-	-Do-	
1.4.12		Corrosive sulphur	Testing	-Do-	-Do-	-Do-	-Do-	
1.4.13		Oxidation stability (a)Neutralisation after oxidation (b)Total sludge after Oxidation	Testing	-Do-	-Do-	-Do-	-Do-	
1.4.14		Ageing characteristics after accelerated ageing	Testing	-Do-	-Do-	-Do-	-Do-	
1.4.15		Presence of oxidation Inhibitor	Testing	-Do-	-Do-	-Do-	-Do-	
1.4.16		SK value	Testing	-Do-	-Do-	-Do-	-Do-	
<b>2.0</b>	<b>FITTINGS AND ACCESSORIES</b>							
<b>2.1</b>	Tank & Conservator Raw material							
2.1.1		Type of material	TC Verif	Sampling	TM Spec	Insp Record	Vendor/TM QC	
2.1.2		Thickness	Testing	-Do-	-Do-	-Do-	-Do-	CHP at Vendor end
<b>2.2</b>	<b>Tank &amp; conservator Assembly</b>							
2.2.1		Inspection of major welds.	Visual	Each Unit	TM Spec	Insp Record	Vendor/TM QC	CHP at Vendor end
2.2.2		NDT for load bearing(Jacking	Testing	Each Unit	TM Spec	Insp Record	Vendor/TM QC	CHP at Vendor

Sl No.	Component	Characteristics	Type of Inspection	Quantum of Inspection	Ref Doc & Acceptable Norm	Form of Record	Inspection Agency	Remarks
		pad, lifting bollard) Welds(DP test)						end
2.2.3		dimensions between wheels, demonstrate turning of wheels through 90 deg. & further dimensional check	Testing	Each Unit	TM Spec	Insp Record	Vendor/TM QC	CHP at Vendor end
2.2.4		Leakage Test of conservator	Testing	Each Unit	TM Spec	Insp Record	Vendor/TM QC	CHP at Vendor end
2.2.5		Measurement of film thickness of	Testing	Each Unit	TM Spec	Insp Record	Vendor/TM QC	<b>CHP at TM for total DFT measurement during final inspection</b>
		(i) Zinc chromate paint	Meas	-Do-	-Do-	-Do-	-Do-	
		(ii) Finished coat	Meas	-Do-	-Do-	-Do-	-Do-	
2.2.6		-Pressure & Vacuum test	One unit/Rating	-Do-	-Do-	-Do-	-Do-	CHP at Vendor end
<b>2.3</b>	<b>Radiator</b>							
2.3.1		Visual & Dimension	Meas	Each Unit	TM Spec	Insp Record	Vendor/TM QC	
2.3.2		Pressure test & leakage test	Testing	-Do-	-Do-	-Do-	-Do-	
2.3.3		Paint thickness	Meas	-Do-	-Do-	-Do-	-Do-	
<b>2.4</b>	<b>Marshalling box &amp; RTCC</b>							
2.4.1		Dimension( WxDxH of panel)	Measurement	Each Unit	TM Spec	Insp Record	Vendor/TM QC	
2.4.2		Meas. of 2 kV dielectric test	Testing	-Do-	-Do-	-Do-	-Do-	CHP
2.4.3		Component make & Rating	Visual	-Do-	-Do-	-Do-	-Do-	
2.4.4		Completeness, label Fixing & finishing	Visual	-Do-	-Do-	-Do-	-Do-	
2.4.5		Functional test	Visual	-Do-	-Do-	-Do-	-Do-	
2.4.6		IP:55 test for M. Box	Testing	1 unit/rating	IS 2147	-Do-	-Do-	CHP
<b>2.5</b>	<b>Temperature indicators (OTI,WTI)</b>							
2.5.1		Type	Visual	Each Unit	TM Spec	Insp Record	Vendor/TM's QC	
2.5.2		Continuity check	Manual	-Do-	-Do-	-Do-	-Do-	
2.5.3		Switch setting & calibration	-Do-	-Do-	-Do-	-Do-	-Do-	
<b>2.6</b>	<b>Buchholz Relay</b>							
2.6.1		Type/Model	Visual	-Do-	-Do-	-Do-	-Do-	
2.6.2		Continuity of Contacts	Manual Check	-Do-	-Do-	-Do-	-Do-	
2.6.3		Operation of contacts	Manual Check	-Do-	-Do-	-Do-	-Do-	
<b>2.7</b>	<b>Bushings</b>							

Sl No.	Component	Characteristics	Type of Inspection	Quantum of Inspection	Ref Doc & Acceptable Norm	Form of Record	Inspection Agency	Remarks
2.7.1		Test for leakage on internal fillings (Tightness test)	TC Verif	Each Unit	IS 2099/TM Spec	Insp Record	Vendor/TM's QC	
2.7.2		Dry power frequency test on terminal & tapping	TC Verif	Each Unit	IS 2099/TM Spec	Insp Record	Vendor/TM's QC	
2.7.3		Measurement of dielectric dissipation factor & capacitance	TC Verif	Each Unit	IS 2099/TM Spec	Insp Record	Vendor/TM's QC	
2.7.4		Partial discharge test followed by dielectric dissipation factor & capacitance measurement for condenser bushings & creepage distance measurement.	Testing	Each Unit	IS 2099/TM Spec	Insp Record	Vendor/TM's QC	CHP at Vendor end
<b>2.8</b>	<b>Current Transformers</b>							
2.8.1		Type & finish	Visual	Each lot	TM's Spec	Insp Record	Vendor/TM's QC	
2.8.2		Dimensions (OD, ID & H)	Measur	Each Unit	-Do-	-Do-	-Do-	
2.8.3		Verification of Terminal Marking & Polarity	Testing	Each Unit	-Do-	-Do-	-Do-	
2.8.4		P.F.dry withstand test	-Do-	-Do-	-Do-	-Do-	-Do-	
2.8.5		Overvoltage interturn test	-Do-	-Do-	-Do-	-Do-	-Do-	
2.8.6		Determination of errors	-Do-	-Do-	-Do-	-Do-	-Do-	
<b>2.9</b>	<b>Pressure relief Valve/Sudden pressure relay</b>							
2.9.1		Type/ Model	Visual	Each Unit	TMs Spec	Insp Record	Vendor/TM's QC	
2.9.2		Manual operation of Switch contacts	Manual Check	-Do-	-Do-	-Do-	-Do-	
2.9.3		Operating pressure	Testing	-Do-	-Do-	-Do-	-Do-	
<b>2.10</b>	<b>MOLG</b>							
2.10.1		Type/ Model	Visual	Each Unit	TMs Spec	Insp Record	Vendor/TM's QC	
2.10.2		Dial Calibration	TC Verif	-Do-	-Do-	-Do-	-Do-	
2.10.3		Switch Continuity	Manual Check	-Do-	-Do-	-Do-	-Do-	
<b>2.11</b>	<b>Valves</b>							
2.11.1		Type & Size	Visual	Each Unit	Customer Spec	Insp Record	Vendor/TM's QC	
2.11.2		Open & shut marking	-Do-	-Do-	-Do-	-Do-	-Do-	
2.11.3		Leakage test	TC Varif					
<b>2.12</b>	<b>Silica gel breather</b>							
2.12.1		Type/ Model	Visual	Each Unit	TMs Spec	Insp Record	Vendor/TM's QC	
<b>2.13</b>	<b>Online H<sub>2</sub> &amp; Moisture monitoring</b>							

Sl No.	Component	Characteristics	Type of Inspection	Quantum of Inspection	Ref Doc & Acceptable Norm	Form of Record	Inspection Agency	Remarks
2.13.1		Type / Model	Visual	Each Unit	TMs Spec	Insp Record	Vendor/TM's QC	
<b>2.14</b>	<b>Tap changer</b>							
2.14.1		Type & Rating	Visual	Each Unit	TMs Spec	Insp Record	Vendor/TM's QC	
2.14.2		Physical condition	Visual	Each Unit	TMs Spec	Insp Record	Vendor/TM's QC	
2.14.3		Mechanical Operation Check	Testing	Each Unit	TMs Spec	Insp Record	Vendor/TM's QC	
2.14.4		Insulation Resistance Test	Testing	Each Unit	TMs Spec	Insp Record	Vendor/TM's QC	
<b>2.15</b>	<b>Cooling fan</b>							
2.15.1		HV test	Testing	Each Unit	IS 2312	Insp Record	Vendor/TM's QC	
2.15.2		Insulation Resistance Test	-Do-	-Do-	-Do-	-Do-	-Do-	
2.15.3		Performance Test	-Do-	-Do-	-Do-	-Do-	-Do-	
2.15.4		DFT of Galvanization on Fan guard	-Do-	-Do-	TM's Spec	-Do-	-Do-	
<b>3.0</b>	<b>MANUFACTURING</b>							
<b>3.1</b>	<b>Assembled Core</b>							
3.1.1		Visual & dimensional check during assembly stage	Visual/Meas	Each Assembly	TM's Spec	Insp Record	Vendor/TM's QC	CHP at TM's Works
3.1.2		Check on completed core for measurement of iron loss	Meas/Testing	Each Assembly	Customer Spec	Insp Record	Vendor/TM's QC	CHP at TM's Works
3.1.3		2KV H.V.test (Core insulation test) between Core & clamps for one minute And Insulation resistance test of core & clamps (clamps)	Testing	Each Assembly	Customer Spec	Insp Record	Vendor/TM's QC	CHP at TM's Works
3.1.4		Visual & dimensional checks for straightness & roundness of core, thickness of limbs and suitability of clamps	Visual	-Do-	-Do-	-Do-	-Do-	CHP at TM's Works
<b>3.2</b>	<b>Wound Coils</b>							
3.2.1		Visual check for brazed joints wherever applicable	Visual	Sampling/Lot	TM's Spec	Insp Record	Vendor/TM's QC	CHP at TM's Works
3.2.2		Visual check of insulation on the conductors & between the windings	Visual	Sampling/Lot	TM's Spec	Insp Record	Vendor/TM's QC	CHP at TM's Works

Sl No.	Component	Characteristics	Type of Inspection	Quantum of Inspection	Ref Doc & Acceptable Norm	Form of Record	Inspection Agency	Remarks
3.2.3		Check for the absence of short circuit between parallel strands of PICC	Testing	-Do-	-Do-	-Do-	-Do-	CHP at TM's Works
<b>3.3</b>	<b>Coil &amp; Core assembled</b>							
3.3.1		Active part before drying						
		(i) Visual check	Visual	Each Unit	TM's Spec	Insp Record	Vendor/TM's QC	CHP at TM's Works
		(ii) Check insulation distance between high voltage connections, between high voltage connection cables & earth and other live parts	Meas	-Do-	-Do-	-Do-	-Do-	CHP at TM's Works
		(iii) Check insulating distance between low voltage connections and earth and other parts	Meas	-Do-	-Do-	-Do-	-Do-	CHP at TM's Works
		(iv) 2KV core insulation test	Testing	-Do-	-Do-	-Do-	-Do-	CHP at TM's Works
3.3.2	Active part after drying							
		(i) Measurement & recording of temperature & drying time during vacuum treatment	VPD Data	Each Unit	TM's Spec	Insp Record	TM's testing/TM's QC	In process check card review by Customer
		(ii) Check for completeness of drying	VPD Data	Each Unit	TM's Spec	Insp Record	TM's testing/TM's QC	In process check card review by Customer
<b>3.4</b>	<b>Assembled Transformer</b>							
3.4.1		Check Completed transformer against approved outline drawing, provision for all fittings, finish levels etc.	Visual	One Transformer of each rating	Approved GA drawing	Insp Record	TM's testing/TM's QC	CHP at TM's Works
3.4.2		Jacking test	Visual	-Do-	-Do-	-Do-	-Do-	CHP at TM's Works
<b>3.5</b>	<b>Final Testing</b>							



Sl No.	Component	Characteristics	Type of Inspection	Quantum of Inspection	Ref Doc & Acceptable Norm	Form of Record	Inspection Agency	Remarks
3.5.1	<b>Routine Tests</b>							
3.5.1.1		Winding resistance test	Testing	Each Unit	IS 2026/IEC 60076	Insp Record	Customer/ TM	<b>CHP at TM's Works</b>
3.5.1.2		Turn ratio, Polarity						
3.5.1.3		Vector group test and Phase vector relationship test						
3.5.1.4		Load loss & impedance voltage						
3.5.1.5		No-load loss and current measurement						
3.5.1.6		Measurement of magnetization current at low voltage.						
3.5.1.7		Insulation Resistance measurement						<b>CHP at TM's Works</b>
3.5.1.8		Separate source voltage withstand test for all windings (1 Minute)						
3.5.1.9		Induced over-voltage withstand test for 60 Sec. @ 100 Hz						
3.5.1.10		Full wave lightning impulse on three phases						
3.5.1.11		Measurement of partial discharge at the time of induced over voltage test						
3.5.1.12		Frequency response analysis (FRA)						
3.5.1.13		Measurement of zero sequence impedance of three phase transformers.						
3.5.1.14		Measurement of acoustic noise level						
3.5.1.15		Measurement of the harmonics of the no-load current						
3.5.1.16		Measurement of capacitance and $\tan \delta$ to determine capacitance between winding and earth. Value of $\tan \delta$ should not be more than 0.5% at 20°C						

Sl No.	Component	Characteristics	Type of Inspection	Quantum of Inspection	Ref Doc & Acceptable Norm	Form of Record	Inspection Agency	Remarks
3.5.1.17		Oil leakage test on transformer tank as per CBIP						
3.5.1.18		Test on OLTC						
3.5.1.19		Magnetic balance test						
3.5.2	<b>Type Test</b>							
3.5.2.1		Temperature-rise test with 2 x 50% radiator banks including DGA test after & before temp rise test	Testing	One Unit on each rating	IS 2026/IEC 60076	Insp Record	Customer/ TM	CHP at TM's Works
3.5.2.2		Measurement of the power taken by the fans						CHP at TM's Works
3.5.2.3		Pressure & Vacuum test on transformer tank as per CBIP						
3.6	<b>Pre-shipment check</b>							
3.6.1		Detach accessories for despatch	Visual	Each unit	TM's spec	Insp Record	TM	
3.6.2		Blanking of openings	-Do-	-Do-	-Do-	-Do-	-Do-	
3.6.3		Adjustment of oil Level/ Draining of oil	-Do-	-Do-	-Do-	-Do-	-Do-	
3.6.4		Finishing, cleaning & painting touch up	-Do-	-Do-	-Do-	-Do-	-Do-	
3.6.5		Dew point measurement before despatch	Testing	-Do-	-Do-	-Do-	-Do-	Reqd for only Transformer despatch without oil
3.6.6		Gas tightness test to confirm tightness	Testing	-Do-	-Do-	-Do-	-Do-	
3.6.7		Check for proper packing of detached accessories for dispatch & Check for proper provision of bracing to arrest the movement of core & winding assembly inside the tank	Testing	-Do-	-Do-	-Do-	-Do-	

**Note:**

1. TM – Transformer Manufacturer
2. CHP – Customer Hold Point

## **Schedule - 5**

### **Short Circuit Stress Withstand Capability**

**(Bidder shall furnish with the Technical Bid, the calculations to show thermal ability of the transformers to withstand short circuit shall be demonstrated by calculation as per IS: 2026)**

## Annexure - 1

### Form of Completion Certificate

Contract: [ . . . *insert name of contract and contract identification details* . . . ]

Date: .....

Certificate No.: .....

To: [ . . . *insert name and address of Contractor* . . . ]

Dear Ladies and/or Gentlemen,

Pursuant to SCC Clause 5.6.0 of the Special Conditions of the Contract entered into between yourselves and Assam State Electricity Grid Corporation Limited dated [ . . . *insert date* . . . ], relating to the [ . . . *brief description of the Facilities* . . . ], we hereby notify you that the following Works were complete on the date specified below, and that, in accordance with the terms of the Contract, the Purchaser hereby takes over the said works, together with the responsibility for care and custody and the risk of loss thereof on the date mentioned below.

1. Description of the Facilities or part thereof: [ . . . *description* . . . ]
2. Date of Completion: [ . . . *date* . . . ]

However, you are required to complete the outstanding items listed in the attachment hereto as soon as practicable.

This letter does not relieve you of your obligation to complete the execution of the Works in accordance with the Contract nor of your obligations during the Defect Liability Period.

Very truly yours,

[ . . . *Signature* . . . ]

Assam Electricity Grid Corporation Limited

## **Section - 4**

# **General Conditions of Supply and Erection, 2009 of AEGCL**

***This Section 'General Conditions of Supply and Erection of AEGCL' is supplied separately and supplementary to Section -5 'Special conditions of Contract' of this document. Whenever there is a conflict, the provisions in SCC or the other Sections of this document shall prevail over those in the 'General Conditions of Supply and Erection of AEGCL'.***

## **Section - 5**

# **Special Conditions of Contract**

## Section 5 - Special Conditions of Contract

*This Section 'SCC' is supplementary to Section -4 'General Conditions of Supply and Erection of ASEB'.*

*Whenever there is a conflict, the provisions in this Section shall prevail over those in the 'General Conditions of Supply and Erection of ASEB'.*

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## Section - 5

### Special Conditions of Contract

#### 5.1.0 DEFINITION OF TERMS

“Contract” means the Contract Agreement entered into between the Purchaser and the Contractor, together with the Contract Documents referred to therein; they shall constitute the Contract, and the term “the Contract” shall in all such documents be construed accordingly.

“Contract Documents” means the documents listed in Article 1.1 (Contract Document) of the Contract Agreement (including any amendments thereto).

“Day” means calendar day

“Year” means 365 days.

“Month” means calendar month.

“Party” means the “Purchaser” or the “Contractor”, as the context requires.

“Purchaser” means the Assam Electricity Grid Corporation Limited (in short AEGCL) and its assignees.

The “Contractor” shall mean the tenderer / bidder whose tender/ bid has been accepted by the “Purchaser” and shall include the bidder’s legal representatives, successors and assignees.

“Purchaser’s Representative” / “Project Manager” / “Engineer” means the person appointed by the Purchaser in the manner provided in SCC Sub-Clause 5.11.1.1 (*Purchaser’s Representative*) hereof and named as such in the SCC to perform the duties delegated by the Purchaser.

The “Sub-Contractor” shall mean the personnel named in the contract of any part of the work or any person to whom any part of the contract has been sublet with the consent in writing of the “Purchaser/ Purchaser” and the legal representatives, successors and assignees of such person.

“Contractor’s Representative” means any person nominated by the Contractor and approved by the Purchaser in the manner provided in SCC Sub-Clause 5.11.2.1 (*Contractor’s Representative and Construction Manager*) hereof to perform the duties delegated by the Contractor.

“Construction Manager” means the person appointed by the Contractor’s Representative in the manner provided in SCC Sub-Clause 5.11.2.3.

“Works” means the Plant to be supplied and installed, as well as all the Installation Services to be carried out by the Contractor under the Contract.

“Plant” means permanent plant, equipment, machinery, apparatus, articles and things of all kinds to be provided and incorporated in the “Works” by the Contractor under the Contract (including the spare parts to be supplied by the Contractor, but does not include Contractor’s Equipment.

“Installation Services” means all those services ancillary to the supply of the Plant for the Works, to be provided by the Contractor under the Contract, such as transportation and provision of marine or other similar insurance, inspection, expediting, site preparation works (including the provision and use of Contractor’s Equipment and the supply of all construction materials required), installation, testing, pre-commissioning, commissioning, operations, maintenance, the provision of operations and maintenance manuals, training, etc. as the case may require.

“Contractor’s Equipment” means all facilities, equipment, machinery, tools, apparatus, appliances or things of every kind required in or for installation, completion and maintenance of the “Works” that are to be provided by the Contractor, but does not include Plant, or other things intended to form or forming part of the Works.

“Site” means the land and other places upon which the Works are to be installed, and such other land or places as may be specified in the Contract as forming part of the Site.

The “Contract period” means the period from the contract commencement date to the date (the warranty period is effective). Date of signing of the ‘Contract Agreement’ shall be treated as the “date of commencement of contract”.

The “Specification” shall mean the “Purchaser’s Requirements”.

## 5.2.0 CONTRACT DOCUMENTS

5.2.1. Subject to Article 1.2 (Order of Precedence) of the Contract Agreement, all documents forming part of the Contract (and all parts thereof) are intended to be correlative, complementary and mutually explanatory. The Contract shall be read as a whole.

## 5.3.0 LEGAL JURISDICTION

5.3.1. For any litigation arising out of the contract which cannot be resolve through mutual agreement or through Arbitration the honorable Guwahati High Court will have sole jurisdiction of all settlement.

## 5.4.0 LANGUAGE

5.4.1. The ruling language of the Contract shall be English.

## 5.5.0 SCOPE OF WORKS

5.5.1. Unless otherwise expressly limited in the **Purchaser’s Requirements**, the Contractor’s obligations cover the provision of all Plant and the performance of all Installation Services required for the design, the manufacture (including procurement, quality assurance, construction, installation, associated civil works, Pre-commissioning and delivery) of the Plant and the installation, completion and commissioning of the Works in accordance with the plans, procedures, specifications, drawings, codes and any other documents as specified in the Section, ‘**Purchaser’s Requirements**’. Such specifications include, but are not limited to, the provision of supervision and engineering services; the supply of labor, materials, equipment, spare parts and accessories; Contractor’s Equipment; construction utilities and supplies; temporary materials, structures and facilities; transportation (including, without limitation, unloading and hauling to, from and at the Site); and storage, except for those supplies, works and services that will be provided or performed by the Purchaser, as specifically provided in the **Purchaser’s Requirements**.

5.5.2. The Contractor shall, unless specifically excluded in the Contract, perform all such work and/or supply all such items and materials not specifically mentioned in the Contract but that can be reasonably inferred from the Contract as being required for attaining Completion of the Works as if such work and/or items and materials were expressly mentioned in the Contract.

## 5.6.0 TIME FOR COMMENCEMENT AND COMPLETION

5.6.1. For the purpose of determining the completion time of the Works, the date falling on fifteenth day from issue of LoA, shall be taken as Commencement Date of the contract.

5.6.2. The Contractor shall attain Completion of the Works (or of a part where a separate time for Completion of such part is specified in the Bidding Document), within the time stated in the **Article 3** of the Contract Agreement (Contract Forms) or within such extended time to which the Contractor shall be entitled under **SCC Clause 5.21.0** hereof.

5.6.3. As soon as the Works, in the opinion of the Contractor, been completed as per requirements of the specification/contract, the Contractor shall so notify the Purchaser’s Representative in writing.

5.6.4. The Purchaser’s Representative shall, within thirty (30) days after receipt of the Contractor’s notice under **Sub-Clause 5.6.3**, either issue a Completion Certificate in the form specified by the Purchaser’s Representative, stating that the Works thereof have reached Completion as of the date of the Contractor’s notice under **Sub-Clause 5.6.3**, or notify the Contractor in writing of any defects and/or deficiencies.

5.6.5. If the Purchaser’s Representative notifies the Contractor of any defects and/or deficiencies, the Contractor shall then correct such defects and/or deficiencies, and shall repeat the procedure described in **Sub-Clause 5.6.3**.

- 5.6.6. If the Purchaser's Representative is satisfied that the Works have reached Completion, the Purchaser's Representative shall, within fifteen (15) days after receipt of the Contractor's repeated notice, issue a Completion Certificate stating that the Works have reached Completion as of the date of the Contractor's repeated notice.
- 5.6.7. If the Purchaser's Representative is not so satisfied, then it shall notify the Contractor in writing of any defects and/or deficiencies within fifteen (15) days after receipt of the Contractor's repeated notice, and the above procedure shall be repeated.
- 5.6.8. If the Purchaser's Representative fails to issue the Completion Certificate and fails to inform the Contractor of any defects and/or deficiencies within thirty (30) days after receipt of the Contractor's notice under Sub-Clause 5.6.4 or within fifteen (15) days after receipt of the Contractor's repeated notice under Sub-Clause 5.6.6, then the supplies/works shall be deemed to have reached Completion as of the date of the Contractor's notice or repeated notice, as the case may be.

### 5.7.0 CONTRACT PRICE

- 5.7.1. The Contract Price shall be as specified in **Article 2 (Contract Price)** of the Contract Agreement.
- 5.7.2. Unless an escalation clause is provided for in the **Article 2 (Contract Price)**, the Contract Price shall be a firm shall not subject to any alteration, except in the event of a Change in the Works or as otherwise provided in the Contract.
- 5.7.3. In the event of changes in rates of statutory taxes, the contract price is subject to amendment only if such taxes are specifically quoted in designated column of price schedule or mentioned in remarks column.
- 5.7.4. In the event of implementation of new tax/taxes such as GST, the contract price is subject to amendment as per the tax applicable and guidelines by statutory tax authority.

### 5.8.0 TERMS OF PAYMENT

- 5.8.1. The Contract Price shall be paid as specified in subsequent sub-clauses, if not provided in Contract Forms, Section-6.
- 5.8.2. Payment against supply items (Price Schedule 1) shall be made as follows:-

100% payment would be admissible within six (6) weeks from the date of receipt of the plants/materials /equipment at site in full and good condition less deduction of Retention Money (as per **SCC Clause 5.10.0**) and advance (if and as applicable as per **SCC Clause 5.8.6**) and as per terms and conditions stipulated in the Contract Agreement.

Payments as above will be made under following conditions:-

- a. Advance copy of bills in duplicate and following documents are received sufficiently in advance:
- Contractors invoice showing LOA reference , Goods description, quantity dispatched, unit price, total amount (6 Copies);
  - Packing List;
  - Railway receipt/ LR;
  - Manufacturer's guarantee certificate of Quality;
  - Material inspection Clearance Certificate for dispatch issued by Purchaser;
  - Insurance certificate;
  - Physical verification certificate of material received at site by Purchaser/Purchaser's site representative.
- b. Any charges on account of late intimation and/or delivery of documents by the Bank are to be borne by the Contractor.

- c. The supplier should intimate the dispatch of each and every consignment to the "Purchaser" and the Consignee.
- d. All Bank charges are to be borne by the Contractor.

5.8.3. Payment against Installation and Other Services (Price Schedule 2) shall be made as follows:-

Payment up to 100% of erection items will be made against progressive monthly bills within six (6) weeks from the date of submission of bills less deduction of Retention Money (as per **SCC Clause 5.10.0**) and advance (if and as applicable as per **SCC Clause 5.8.6**) and as per terms and conditions stipulated in the Contract Agreement.

5.8.4. Taxes and Duties (Schedule-1): Sales Taxes & Duties in respect of transaction between Purchaser and the Contractor and other taxes such as octroi/entry tax as applicable for destination site on all items of supply including bought-out finished items (as identified in the Contract), which shall be dispatched directly from the sub-vendor's works to the Purchaser's site (sale-in-transit) will be paid after each shipment against documentary evidence. This payment shall be released by Purchaser directly to the Contractor against invoices to be submitted by the Contractor.

**Note: Only those taxes shall be paid/ reimbursed which are quoted by the bidder or mentioned as payable by the purchaser.**

5.8.5. Taxes and Duties (Schedule-2, 2A): Installation and other Services shall be quoted separately (Schedule No. 2 & 2A) and shall include rates or prices for freight & insurance and other services incidental to delivery of the plant & equipment, all labor, contractor's equipment, temporary works, construction materials, consumables and all matters and things of whatsoever nature, including operations and maintenance services, the provision of operations and maintenance manuals, training, etc., where identified in the Bidding Document, as necessary for the proper execution of the installation and other services, including all taxes, duties, levies and charges applicable.

Purchaser will not bear any liability on account of any taxes applicable on the Services. Purchaser shall, however, deduct such taxes at source as per the rules if applicable, and issue necessary Certificate to the Contractor.

**Note: Only those taxes shall be paid/ reimbursed which are quoted by the bidder or mentioned as payable by the purchaser.**

5.8.6. ADVANCE PAYMENT

No advance payment is applicable for this contract.

**5.9.0 PERFORMANCE SECURITY DEPOSIT**

5.9.1. The Contractor shall have to deposit to the extent of 10% (ten percent) of the total value of the order as performance security (Bank Guarantee), within 10 (ten) days of from issue of notification of award, duly pledged in favor of the Purchaser and such security deposits shall be valid up to 30 days beyond the warranty period.

5.9.2. If the Contractor fails or neglects to observe, perform any of his obligations under the contract, it will be lawful for the "Purchaser" to forfeit either in full or in part at his absolute discretion, the security deposit furnished by the supplier.

5.9.3. No interest shall be payable on such deposits.

**5.10.0 RETENTION MONEY**

- 5.10.1. In addition to above Performance Security deposit, 10%(Ten Percent) value of each progressive bill will be retained by the Purchaser as 'Retention Money'. The amount will be held by the Purchaser till the work under the contract is completed and the completion certificate is issued in pursuance to **SCC Clause 5.6.0**.
- 5.10.2. No interest shall be payable on such retentions.

### 5.11.0 REPRESENTATIVES

#### 5.11.1. Purchaser's Representative

- 5.11.1.1. The Managing Director, AEGCL shall act as Purchaser's Representative for purpose of this Contract. The Purchaser's Representative, represent and act for the Purchaser at all times during the performance of the Contract. All notices, instructions, orders, certificates, approvals and all other communications under the Contract shall be given by the Purchaser's Representative, except as herein otherwise provided.

All notices, instructions, information and other communications given by the Contractor to the Purchaser under the Contract shall be given to the Purchaser's Representative, except as herein otherwise provided.

- 5.11.1.2. The Purchaser's Representative time to time, during performance of the contract may depute other person (s) to act on behalf of him on certain or whole of his responsibilities and will notify the Contractor accordingly.

#### 5.11.2. Contractor's Representative & Construction Manager

- 5.11.2.1. Within seven (7) days of signing of the Contract, the Contractor with approval of the Purchaser shall appoint the Contractor's Representative.

- 5.11.2.2. The Contractor's Representative shall represent and act for the Contractor at all times during the performance of the Contract and shall give to the Project Manager all the Contractor's notices, instructions, information and all other communications under the Contract.

All notices, instructions, information and all other communications given by the Purchaser or the Project Manager to the Contractor under the Contract shall be given to the Contractor's Representative or, in its absence, its deputy, except as herein otherwise provided.

The Contractor shall not revoke the appointment of the Contractor's Representative without the Purchaser's prior written consent. If the Purchaser consents thereto, the Contractor shall appoint some other person as the Contractor's Representative, pursuant to the procedure set out in SCC Sub-Clause 5.11.2.1.

- 5.11.2.3. From the commencement of Works at the Site until Completion, the Contractor's Representative shall appoint a suitable person as the Construction Manager. The Construction Manager shall supervise all work done at the Site by the Contractor and shall be present at the Site throughout normal working hours except when on leave, sick or absent for reasons connected with the proper performance of the Contract. Whenever the Construction Manager is absent from the Site, the Contractor's Representative or the Construction Manager shall appoint a suitable person to act as the Construction Manager's deputy.

- 5.11.2.4. The Purchaser may by notice to the Contractor object to any representative or person employed by the Contractor in the execution of the Contract who, in the reasonable opinion of the Purchaser, may behave inappropriately, may be incompetent or negligent, or may commit a serious breach of the Site regulations provided under the Contract. The Purchaser shall provide evidence of the same, whereupon the Contractor shall remove such person from the Site.

- 5.11.2.5. If any representative or person employed by the Contractor is removed in accordance with SCC Sub-**Clause 5.11.2.4**, the Contractor shall, where required, promptly appoint a replacement.

### 5.12.0 WARRANTY

- 5.12.1. The Contractor warrants that the works or any part thereof shall be free from defects in the design, engineering, materials and workmanship of the Plant and equipment supplied and of the work executed.

- 5.12.2. The term "Period of Warranty" shall mean the period of **thirty six (36) months** from the date of completion mentioned in Completion Certificate issued in pursuance to **SCC Clause 5.6.0**.

- 5.12.3. If during the Period Warranty any defect should be found in the design, engineering, materials and workmanship of the plant and equipment supplied or of the work executed by the Contractor, the Contractor shall promptly, in consultation and agreement with the Purchaser regarding appropriate remedying of the

defects, and at Contractor's cost, repair, replace or otherwise make good as the Contractor shall determine at its discretion, such defect as well as any damage to the facilities caused by such defect.

- 5.12.4. If the Contractor fails to commence the work necessary to remedy such defect or any damage to the Facilities caused by such defect within a reasonable time (which shall in no event be considered to be less than fifteen (15) days), the Purchaser may, following notice to the Contractor, proceed to do such work, and the reasonable costs incurred by the Purchaser in connection therewith shall be paid to the Purchaser by the Contractor or may be deducted by the Purchaser from any monies due the Contractor or claimed under the Performance Security.

### **5.13.0 CONTRACTOR'S DRAWINGS**

- 5.13.1. All working drawings shall preferably be prepared in Autocad 2000 software or its later version. The contractor shall also submit the soft copies of all working drawings.

- 5.13.2. Within 30 days from the date of acceptance of notification of award of contract, the contractor shall send to the Purchaser a preliminary list of all the drawings with their respective identification numbers, titles and expected date of submission. This list shall be amended or extended by the contractors as and when necessary during the progress of the work under the contract.

- 5.13.3. All titles, notes and inscriptions on the drawings shall be in English.

- 5.13.4. All drawings which the contractor shall send to the Purchaser for approval shall be approved or rejected or returned for modification within 30 days of receipt by the Purchaser.

- 5.13.5. Upon approval by the Engineer, the drawings shall become the contract drawings and thereafter, the contractor shall not depart from them in anyway whatsoever except with the written permission of the Purchaser.

### **5.13.6. FINAL AS-BUILT DRAWINGS**

In the final stages of the contract, the contractor shall submit to the Purchaser hard copies as well soft copies of complete set of built up drawings.

### **5.13.7. MISTAKES/ ERRORS IN DRAWINGS**

- 5.13.7.1. The contractor shall be responsible and liable for any alterations of the work due to any discrepancies, errors, or omissions in the drawings or other particulars which have arisen due to inaccurate information or particulars furnished by the contractor, even though approved by the "Purchaser".

- 5.13.7.2. However, the "Purchaser" shall be responsible for drawings and information supplied by him. The "Purchaser" shall compensate for any alterations of the work necessitated by the reason of inaccurate information supplied by him to the contractor.

### **5.14.0 COPY RIGHT ETC**

- 5.14.1. The contractor shall indemnify the purchaser against all claims actions, suits and proceedings for the infringement or alleged infringement of any patent, design or copyright protected either in the country of origin or in India by the use of any equipment supplied by the contractor but such indemnity shall not cost any use of the equipment other than for the purposes indicated by or reasonably to be inferred from the specification.

### **5.15.0 SUBLETTING CONTRACT**

- 5.15.1. The "Contractor" shall not, without the consent in writing of the "Purchaser" assign or sublet his contract, or any substantial part thereof, or interest therein or benefit or advantage whatsoever, other than for raw materials or for minor details or for any part of the work of which the sub-contractors are named in the tender provided any such consent shall not relieve the "contractor" from any obligation, duty or responsibility under the contract.

### **5.16.0 QUANTITY VARIATION**

- 5.16.1. "Purchaser" shall have the right to increase the ordered quantity by 20% within 50 days of the period of completion of the Works and the same shall be carried out at the same rates /prices and terms and conditions stipulated in the order except in regard to completion schedule, which shall be mutually agreed upon in case of enhancement of the ordered quantity.

#### **5.17.0 CO-OPERATION WITH OTHER MANUFACTURERS**

- 5.17.1. The "Contractor" shall agree to co-operate with the Purchaser's other contractors for associated supplies and freely exchange with them such technical information as is necessary to obtain the most efficient and economical design and to avoid unnecessary duplication. No remuneration shall come from the "Purchaser" for such technical co-operation.

#### **5.18.0 INSPECTION AND TESTING**

- 5.18.1. The Contractor shall at its own expense carry out at the place of manufacture and/or on the Site all such tests and/or inspections of the plant & equipment and any part of the works as are specified in the Contract.
- 5.18.2. The Purchaser and the Purchaser's Representative or their designated representatives shall be entitled to attend the aforesaid test and/or inspection, provided that the Purchaser shall bear all costs and expenses incurred in connection with such attendance including, but not limited to, all traveling and board and lodging expenses.
- 5.18.3. Whenever the Contractor is ready to carry out any such test and/or inspection, the Contractor shall give a reasonable advance notice (not less than 30 days) of such test and/or inspection and of the place and time thereof to the Purchaser's Representative. The Contractor shall obtain from any relevant third party or manufacturer any necessary permission or consent to enable the Purchaser and the Purchaser's Representative or their designated representatives to attend the test and/or inspection.
- 5.18.4. The Contractor shall provide the Purchaser's Representative with a certified report of the results of any such test and/or inspection.
- 5.18.5. If it is agreed between the Purchaser and the Contractor that the Purchaser and the Purchaser's Representative or their designated representatives shall not attend the test and/or inspection, then the Contractor may proceed with the test and/or inspection in the absence of such persons, and may provide the Project Manager with a certified report of the results thereof.

#### **5.19.0 INSURANCE**

- 5.19.1. The "Contractor" shall, have, unless, otherwise specified by the Purchaser, insure the materials through their underwrites at their cost and shall keep it insured against any loss/ damaged/ pilferage in transit, destruction or damage by fire/ flood, without exposure to vagaries of weather or through riot, civil commotion, war or rebellion, for the full value of the materials until the materials are received at the purchaser's destination store.
- 5.19.2. The "Contractor" shall be responsible for safe arrival at destination, unloading and receipt of the materials by the consignee. The Purchaser will discharge consignee's responsibilities only and shall not be responsible for any damage/ loss/ pilferage/ non-delivery by the carriers.
- 5.19.3. In case of any loss/ damage/ pilferage/ non-delivery/ short delivery by carriers etc.; the supplier shall replace free of cost missing / damaged / lost materials within 30 (thirty) days from the receipt of report thereof from the consignee(s) without waiting for settlement of their claims with their carriers / under-writers. Normally, such reports from the consignee(s) to the supplier shall be initiated within a period of 30 (thirty) days from the date of receipt of each consignment by him /them.
- 5.19.4. If it is considered necessary that the damaged equipment either in part or in full to be sent back to the manufacturer's works for repair, the manufacturers/ suppliers will furnish the Bank Guarantee for the full value of equipment needing repairs and such Bank Guarantee shall remain valid till such time, the equipment are repaired and returned to the consignee in good condition. The to and fro freight, handling and insurance charges in such cases will be borne by the Contractor.

- 5.19.5. Unless, otherwise mutually agreed upon, in case of failure by the supplier to replenish /make good of the loss /damage /short supplied quantities, within the stipulated period, the purchaser reserves the right to forfeit the security deposit and/ or adjust any outstanding payment to the “Contractor” with the Purchaser or take any other appropriate action.
- 5.19.6. All materials will be dispatched against clear door delivery basis unless otherwise agreed by the “Purchaser”

#### **5.20.0 FORCE MAJEURE**

- 5.20.1. “Force Majeure” shall mean any event beyond the reasonable control of the Purchaser or of the Contractor, as the case may be, and which is unavoidable notwithstanding the reasonable care of the party affected, and shall include, without limitation, the following:
- (a) war, hostilities or warlike operations whether a state of war be declared or not, invasion, act of foreign enemy and civil war
  - (b) rebellion, revolution, insurrection, mutiny, usurpation of civil or military government, conspiracy, riot, civil commotion and terrorist acts
  - (c) confiscation, nationalization, mobilization, commandeering or requisition by or under the order of any government or de jure or de facto authority or ruler or any other act or failure to act of any local state or national government authority
  - (d) strike, sabotage, lockout, embargo, import restriction, port congestion, lack of usual means of public transportation and communication, industrial dispute, shipwreck, shortage or restriction of power supply, epidemics, quarantine and plague
  - (e) earthquake, landslide, volcanic activity, fire, flood or inundation, tidal wave, typhoon or cyclone, hurricane, storm, lightning, or other inclement weather condition, nuclear and pressure waves or other natural or physical disaster
  - (f) shortage of labor, materials or utilities where caused by circumstances that are themselves Force Majeure.
- 5.20.2. If either party is prevented, hindered or delayed from or in performing any of its obligations under the Contract by an event of Force Majeure, then it shall notify the other in writing of the occurrence of such event and the circumstances thereof within fourteen (14) days after the occurrence of such event.
- 5.20.3. The party who has given such notice shall be excused from the performance or punctual performance of its obligations under the Contract for so long as the relevant event of Force Majeure continues and to the extent that such party’s performance is prevented, hindered or delayed. The Time for Completion shall be extended in accordance with **SCC Clause 5.21.0**.

#### **5.21.0 EXTENSION OF TIME FOR COMPLETION**

- 5.21.1. The Time(s) for Completion specified in the Article 3 of the Contract Agreement (Contract Forms) shall be extended if the Contractor is delayed or impeded in the performance of any of its obligations under the Contract by reason of any of the following:
- (a) any Change in the scope of works by the Purchaser; which justifies extension of completion time as provided in **SCC Clause 5.16.0**; and
  - (b) any occurrence of Force Majeure as provided in **SCC Clause 5.20.0**.
- 5.21.2. Except where otherwise specifically provided in the Contract, the Contractor shall submit to the Purchaser’s Representative a notice of a claim for an extension of the Time for Completion, together with particulars of the event or circumstance justifying such extension as soon as reasonably practicable after the commencement of such event or circumstance. As soon as reasonably practicable after receipt of such notice and supporting particulars of the claim, the Purchaser and the Contractor shall agree upon the period of such extension. In the event that the Contractor does not accept the Purchaser’s estimate of a fair and reasonable time extension, the Contractor shall be entitled to refer the matter to a Dispute Board, pursuant to **SCC Sub-Clause 5.24.0**.

#### **5.22.0 LIQUIDATED DAMAGE**



- 5.22.1. The Contractor guarantees that it shall attain Completion of the Works within the Time for Completion specified in the Contract Agreement pursuant to **SCC Sub-Clause 5.6.2**, or within such extended time to which the Contractor shall be entitled under **SCC Clause 5.21.0** hereof.
- 5.22.2. If the Contractor fails to attain Completion of the Works within the Time for Completion or any extension thereof under **SCC Clause 5.21.0**, the Contractor shall pay to the Purchaser liquidated damages at the rate of **1 % (one percent)** of the total Contract Price per week or part thereof delay. The aggregate amount of such liquidated damages shall in no event exceed **10% (five percent)** of the total contract price.
- However, the payment of liquidated damages shall not in any way relieve the Contractor from any of its obligations to complete the Works or from any other obligations and liabilities of the Contractor under the Contract.
- 5.22.3. Once the aggregated "Liquidated damage" reaches 5% of the total contract price, the Purchaser may consider following actions:
- (a) Procure the undelivered material/ equipment and/or complete the balance works from elsewhere giving notice to the supplier and to recover any extra expenditure incurred thereby for having to procure these materials and works at higher price, at the risk and responsibility of the contractor; or
  - (b) Cancel the contract wholly or in part and to complete the works at the full risk and cost of the Contractor and forfeit the security deposit.
  - (c) Declare it as a "Contractual Failure" and act in accordance with **SCC Clause 5.23.0**.

#### **5.23.0 CONTRACTUAL FAILURE**

- 5.23.1. In the event of contractual failure of any respect on the part of the Contractor, the Purchaser shall be entitled to operate security deposit or any deposit or any payment due to supplier irrespective of whether his default relates to the particular orders or not towards the Purchaser's claim for damages arising out of the failure. In addition, the Purchaser may black-list or bans the "Contractor" or pending enquiry, suspend him or take any other steps considered suitable.

#### **5.24.0 ARBITRATION**

- 5.24.1. If at any time, any question, disputes or differences whatsoever shall rise between the Purchaser and the Contractor, upon or in relation to or in connection with the contract, either party may forthwith give notice to the other in writing of the existence of such question of dispute or difference and the same shall be referred to the adjudication of three Arbitrators, one to be nominated by the Purchaser the other by the Contractor and the third by the President of the Institution of Engineers, India/ Retired or Sitting Judge not below the status of a retired Judge of High Court of India. If either of the parties fail to appoint its arbitrators within 60(sixty) days after receipt of notice of the appointment of arbitrators then the President of the Institution of Engineers /retired or sitting Judge of India, as the case may be, shall have the power at request of either of the parties, to appoint an Arbitrator. A certified copy of the "President" making such an appointment shall be furnished to both parties
- 5.24.2. The arbitration shall be conducted as per provisions of the Indian Arbitration Act, shall be held at Guwahati or any other place as may be decided by the Purchaser. The decision of the majority of Arbitrators shall be final & binding upon the parties and the expenses of the arbitration shall be paid as may be determined by the Arbitrator. However, any dispute arising out of this contract will first be discussed and settled bilaterally between Purchaser and the Contractor.

## **Section - 6**

### **Contract Forms**

**(This Section contains the Letter of Acceptance, the Contract Agreement and Appendices to the Contract Agreement which, once completed, will form the Contract along with the Section 4 and Section 5. The Bidder should note that this Section shall be completed fully at the time of Contract signing)**

## Section 6 - Contract Forms

This Section contains the Letter of Acceptance, the Contract Agreement and Appendices to the Contract Agreement which, once completed, will form the Contract along with the Section 4 and Section 5. The Bidder should note that this Section shall be completed fully at the time of Contract signing.

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**1. Notification of Award**

[AEGCL's letter head]

**Letter of Acceptance****Supply of 40 MVA, 132/33 kV Power Transformers and Related Services for Srikona and Sipajhar Grid Substations in Assam**

[ date ]

To: [ Name and address of the Contractor ]

This is to notify you that your Bid dated [date] for execution of the [ name of the Contract and identification number, as given in the Contract Data ] for the Contract Price in the aggregate of [ amounts in numbers and words ] [ name of currency ] (as per Price Schedule-1, 2 and 2A), as corrected and modified in accordance with the Instructions to Bidders is hereby accepted, and it is decided to award on you the 'Supply and related services contract' covering inter-alia Ex-works supply of all equipment and materials and related services specified in bidding document.

You are requested to furnish the Performance Security within ten (10) days in accordance with the Conditions of Contract, using for that purpose one of the Performance Security Forms included in Section 6 (Contract Forms) of the Bidding Document

[ Authorized Signature ]  
[ Name and Title of Signatory ]  
Assam Electricity Grid Corporation Limited

Attachment: 1) Price schedule ( with correction if any)  
2) Draft Contract agreement

## 2. Contract Agreement (Supply Contract)

THIS AGREEMENT made the \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_,

BETWEEN

**Assam Electricity Grid Corporation Limited (herein after referred to as AEGCL)**, a corporation incorporated under the laws of Company Act, 1956 and having its registered office at First Floor, Bijuli Bhawan, Paltanbazar, Guwahati-781001, Assam and **[name of Contractor]**, a firm/company incorporated under the laws of Company Act, 1956 and having its principal place of business at **[address of Contractor]** (hereinafter called "the Contractor"). **[in case of JV insert name and address of the Lead Partner as well as other Partners]**

WHEREAS AEGCL desires to engage the Contractor to the 'Ex-works Supply Contract' (also referred to as the 'First Contract') covering inter-alia supply of all equipment and materials for the complete execution of '**Supply of 40 MVA, 132/33 kV Power Transformer and Related Services for 132/33kV Substations, [name of SS to be inserted here]**' as detailed in the Contract Document ("the Facilities"), and the Contractor has agreed to such engagement upon and subject to the terms and conditions hereinafter appearing.

NOW IT IS HEREBY AGREED as follows:

### Article 1 Contract Documents

- 1.1 **Contract Documents** (Reference SCC Clause 5.2.0)  
The following documents shall constitute the Contract between the Purchaser and the Contractor, and each shall be read and construed as an integral part of the Contract:
- (a) This Contract Agreement and the Appendices hereto
  - (b) Letter of Price Bid and Price Schedules submitted by the Contractor
  - (c) Letter of Technical Bid and Technical Proposal submitted by the Contractor
  - (d) Special Conditions of Contract
  - (e) General Conditions of Supply and Erection.
  - (f) Specification(Purchaser's Requirements)
  - (g) Drawings (Purchaser's Requirements)
  - (h) Other completed Bidding Forms submitted with the Letters of Technical and Price Bids
  - (i) Guaranteed and other Technical Particulars (as submitted with the Bid).
  - (j) Any other documents shall be added here
- 1.2 **Order of Precedence** (Reference SCC Clause 5.2.0)  
In the event of any ambiguity or conflict between the Contract Documents listed above, the order of precedence shall be the order in which the Contract Documents are listed in Article 1.1 (Contract Documents) above.
- 1.3 **Definitions** (Reference SCC Clause 5.1.0)  
Capitalized words and phrases used herein shall have the same meanings as are ascribed to them in the SCC.

### Article 2 Contract Price and Terms of Payment

- 2.1 **Contract Price** (Reference SCC Clause 5.7.0)  
The Purchaser hereby agrees to pay to the Contractor the Contract Price in consideration of the performance by the Contractor of its obligations hereunder. The Contract Price shall [. . . **amounts in rupees in words** . . . ], [. . . **amounts in figures** . . . ] as specified in Price Schedule No. 3 (Grand Summary).

**The Contract Price is fixed.**

- 2.2 **Terms of Payment** (Reference SCC Clause 5.8.0)  
The terms and procedures of payment according to which the Purchaser will pay the Contractor are given in the Appendix (Terms and Procedures of Payment) hereto.
- Article 3**  
**Commencement Date and Completion Time**
- 3.1 **Commencement Date** (Reference SCC Clause 5.6.1)  
The Commencement Date upon which the period until the Time for Completion of the Works shall be counted from is the date when this Contract Document is signed.
- 3.2 **Completion Time** (Reference SCC Clause 5.6.2)  
The whole works under the scope of this Contract shall be completed within **Six (06)** months from Contract Commencement Date with following schedule:
- (i) Supply of Reactors along with all accessories and spares shall be completed within **Five (05)** months from contract signing.
  - (ii) Erection, testing at site and commissioning shall be completed in the next **One (01)** month.
- Article 5. Appendices**
- 4.1 The Appendices listed in the attached List of Appendices shall be deemed to form an integral part of this Contract Agreement.
- 4.2 Reference in the Contract to any Appendix shall mean the Appendices attached hereto, and the Contract shall be read and construed accordingly.

IN WITNESS WHEREOF the Purchaser and the Contractor have caused this Agreement to be duly executed by their duly authorized representatives the day and year first above written.

Signed by, for and on behalf of the Purchaser

[ **Signature** ]

[ **Title** ]

in the presence of

[ **Signature** ]

[ **Title** ]

Signed by, for and on behalf of the Contractor

[ **Signature** ]

[ **Title** ]

in the presence of

[**Signature** ]

[**Title** ]

## APPENDICES

- Appendix 1 - Terms and Procedures of Payment
- Appendix 2 - Time Schedule
- Appendix 3 - List of Major Items of Plant and services and List of Approved Subcontractors
- Appendix 4 - Performance Security.
- Appendix 5 – Price Schedules.
- Appendix 6 – Guaranteed and Other Technical Particulars.

## Appendix 1 – Terms and Procedure of Payment

In accordance with the provisions of GCC Clause 5.8.0 (Terms of Payment), the Purchaser shall pay the Contractor in the following manner and at the following times, on the basis of the Price Breakdown given in the section on Price Schedules.

### (A) Terms of Payment

#### Schedule No. 1–Payment for Plant and Equipment Supplied

100% payment would be admissible within six (6) weeks from the date of receipt of the plants/ materials /equipment at site in full and good condition less deduction of Retention Money (as per **SCC Clause 5.10.0**) and advance (if and as applicable as per **SCC Clause 5.8.6**) and as per terms and conditions stipulated in the Contract Agreement.

#### Schedule No. 2 - Installation and other Services

Payment up to 100% of erection items will be made against progressive monthly bills within six (6) weeks from the date of submission of bills less deduction of Retention Money (as per *SCC Clause 5.10.0*) and advance (if and as applicable as per *SCC Clause 5.8.6*).

### (B) Payment Procedures

The procedures to be followed in applying for certification and making payments shall be as follows:

#### 1. Progressive Payment for Plant and Equipment (EXW plus ED value):

Application for interim payment may be made subject to that the invoice is raised for 1 unit of transformer with transformer oil and related accessories.

##### (A) Plant and Equipment supplied (Schedule-1):

Upon receipt of plants and equipment at site, the Contractor shall notify the Purchaser and submit the following documents in advance:

- (i) Application for payment
- (ii) Contractors invoice showing LOA reference , Goods description, quantity dispatched , unit price, total amount (6 Copies)
- (iii) Packing List
- (iv) Railway receipt/ LR
- (v) Manufacturer's guarantee certificate of Quality
- (vi) Material inspection Clearance Certificate for dispatch issued by Purchaser
- (vii) Insurance certificate.
- (viii) Physical verification certificate of material received at site by Purchaser/Purchaser's site representative

The above documents shall be received by the Purchaser before arrival of the Goods and if not, the contractors will be responsible for any consequent expenses.”

#### 2. Installation and other Services (Schedule-2, 2A):

Application for interim payment may be made subject to that the invoice is raised for either freight 1 unit of transformer with transformer oil and related accessories or supervision of commissioning for 1 unit of transformer.

##### (A) Progressive Payment for Installation Service (Schedule-2):



The Contract price shall be paid progressively on pro-rata basis on receipt of Payment Application and on certification by the Purchaser/ his site representative, on quantum of work done successfully.

**(B) Installation and other Services (2A, Local Transportation & Insurance):**

Inland transportation and insurance charges shall be paid to the Contractor on pro-rata basis, as per the unit rates indicated in the Contract Agreement, after receipt of materials/items at site and on presentation of the invoices along with supporting documents by the Contractor. However, these charges will be subject to a limitation that the aggregate of all invoices does not exceed the total amount indicated in the Contract Agreement. Payment shall be released within six (6) weeks of receipt of Payment Application.

## Appendix 2 - Time Schedule

(Bidders shall furnish with bids a construction schedule in form of bar chart. The time schedule should match with the completion time mentioned elsewhere in the Bidding Document)

**Appendix 3 - List of Major Items of Plant and Services and List of Approved Subcontractors**

A list of major items of plant and services is provided below.

The following Subcontractors and/or manufacturers are approved for carrying out the item of the facilities indicated. Where more than one Subcontractor is listed, the Contractor is free to choose between them, but it must notify the Purchaser of its choice in good time prior to appointing any selected Subcontractor. In accordance with GCC Sub-Clause 19.1, the Contractor is free to submit proposals for Subcontractors for additional items from time to time. No Subcontracts shall be placed with any such Subcontractors for additional items until the Subcontractors have been approved in writing by the Purchaser and their names have been added to this list of Approved Subcontractors.

<b>Major Items of Plant and Services</b>	<b>Approved Subcontractors/Manufacturers</b>	<b>Nationality</b>

**Appendix 4 - Form of Performance Security****Bank Guarantee**

(To be stamped in accordance with Stamp Act)

To: \_\_\_\_\_ *[name of Purchaser]*  
 \_\_\_\_\_ *[address of Purchaser]*

WHEREAS \_\_\_\_\_ *[name and address of Contractor]* (hereinafter called "the Contractor") has undertaken, in pursuance of Contract No. \_\_\_\_\_ dated \_\_\_\_\_ to execute \_\_\_\_\_ *[name of Contract and brief description of Works]* (hereinafter called "the Contract");

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized/scheduled bank for the sum specified therein as security for compliance with its obligations in accordance with the Contract;

AND WHEREAS we have agreed to give the Consultant such a Bank Guarantee;

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, up to a total of \_\_\_\_\_ *[amount of Guarantee]*<sup>1</sup> \_\_\_\_\_ *[in words]*, such sum being payable in the currencies in which the Contract Price is payable, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of \_\_\_\_\_ *[amount of Guarantee]* as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed thereunder or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee shall be valid until the date, 30 days beyond the Warranty Period as per the Contract.

Signature and Seal of the Guarantor \_\_\_\_\_  
 Name of Bank \_\_\_\_\_  
 Address \_\_\_\_\_  
 Date \_\_\_\_\_

\_\_\_\_\_

<sup>1</sup> An amount is to be inserted by the Guarantor, representing the percentage of the Contract Price specified in the Contract.