

**TPCODL**

TP Central Odisha Distribution Limited

**TPNODL**

TP Northern Odisha Distribution Limited

**TPSODL**

TP Southern Odisha Distribution Limited

**TPWODL**

TP Western Odisha Distribution Limited

**CENTRALIZED CONTRACTS GROUP**

NIT No.: TPCODL/CCG/23-24/014

**Open Tender Notification****for****Rate Contract for Supply of Power Transformer of various rating for TPCODL/TPNODL/TPWODL/TPSODL****Tender Enquiry No.: TPCODL/CCG/23-24/014,  
Due Date for Bid Submission: 22<sup>nd</sup> July 2023 [18:00 Hrs.]****Centralized Contracts Group  
TP Central Odisha Distribution Limited  
(A TATA Power and Odisha Government Joint Venture)  
1<sup>st</sup> Floor, Anuj Building, Plot No.29, Satya Nagar, Bhubaneswar –  
751007**

**CENTRALIZED CONTRACTS GROUP**

NIT No.: TPCODL/CCG/23-24/014

Tender Enquiry No - TPCODL/CCG/23-24/014

Tender Enquiry No.	Work Description	EMD (Rs.) *	Tender Fee (Rs.) **	Last Date and Time for payment of Tender Fee
TPCODL/CCG/23-24/014	Rate Contract for Supply of Power Transformer of various rating for TPCODL/TPNODL/TPWODL/TPSODL	10 Lac	5,000	10.07.23, 17:00Hrs

\* EMD is exempted for MSMEs registered in the State of Odisha.

\*\* MSMEs registered in the State of Odisha shall pay tender fee of Rs. 1,000/- including GST. For details of MSME norms, pls refer "Annexure A" below.

## **INFORMATION TO THE BIDDERS TO PARTICIPATE IN E-OPEN TENDER SYSTEM OF TPCODL**

### **-: Steps for E-tender submission:-**

**Bids are to be submitted only through online e-procurement platform, ARIBA. Any other form of bid submission will not be accepted. Online Link for submission of bid through ARIBA will be sent only after confirmation of payment of tender fee from bidder.**

**Step 1:** The bidder can get primary information about the tender from the Newspaper advertisement / TPCODL/TPWODL/TPNODL/TPSODL website <www.tpcentralodisha.com> and can download the tender document from the above website.

**Step 2:** Non-Refundable Tender Participation Fee, as indicated in tender document, to be submitted before last date of tender fee payment, in the form of direct deposit/NEFT/RTGS in the following bank account.

Account Name: TP Central Odisha Distribution Limited  
Bank Name: State Bank of India,  
IDCO Towers, Bhubaneswar  
Bank Account No. : 10835304915  
IFSC Code : SBIN0007891

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**Step 3:** Eligible and Interested bidder to send an email to TPCODL attaching duly signed and stamped letter on Bidder's letterhead, with following details, expressing their intend to bid against above tender:

SI No	Description	Bidder's Response
i)	Tender Enquiry No.	
ii)	Description of materials / Works Tendered	
iii)	Name and address of the bidding company	
iv)	Name of the authorized contact person	
v)	Contact No. authorized person	
vi)	E-mail Id of the where online ARIBA link to be	
vii)	Tender Fee details (Amount / NEFT-RTGS UTR No	
viii)	GST No.of bidder	
ix)	MSME Certificate, wherever applicable	
x)	Postal address of bidder for return of EMD BG	

E-mail has to be sent to <prashant.gupta@tpcentralodisha.com> with copy to <vipin.chauhan@tpnodl.com> before "Last date and time for payment of Tender Participation Fee".

**Step 4:** On receipt of the document as mentioned in Step 3 above and after due verification of the same, ARIBA link for participation in the tender will be sent to bidder's mail address from ARIBA system.

**Step 5:** In this mail there will be an online link as **Click Here** to participate in the tender.

**Step 6:** Click "**Click Here**" to access this event.

**Step 7:** If bidder is bidding first time for CCG through ARIBA site then please "Sign UP" by creating User Name and password as mentioned in Sign Up page. Please follow the process, as mentioned in the Sign Up page, during creation of User Name and password. Also a simple one-page registration screen will open for first time user. All \* mark mandatory field to be filled in.

Those who are already having User Name and password for accessing TPCODL events, they can LOGIN using same User Name and password.

If bidder has got User name and password for their other customer, same will not be applicable for TPCODL/TPWODL/TPNODL/TPSODL

**Step 8:** You will be able to see the RFQ

**Step 9:** After review and downloading of all documents click on "**Review Pre-requisites**"

**Step 10:** Review and accept "**Bidder Agreement**".

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**Step 11:** You can see attached pdf tender document against clause no 1.1.1 (Introduction).

**Step 12:** Vendor has to attach pdf version of technical bid in clause no. 2.1 and 2.2. In this field do not attach any price document.

Price schedule is attached in clause no.3.2. Same has to be downloaded and price and tax details to be filled in as per the format given, print to be taken in vendor's letter head and signature and seal to be made by authorised person. PDF version of this price bid to be attached in clause 3.2 For Price Bid put all the unit price and taxes and duties in provided field. Put "0" (ZERO) in not applicable field.

**Step 13:** After successfully putting Techno commercial offer and price part then click on **"Submit Entire Response"**

**Note: Once user ID and password created, bidder can also login to ARIBA site through the following URL:**

<https://service.ariba.com/Sourcing.aw/124997008/aw?awh=r&awssk=oxt0s1BN&dard=1>

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**Annexure-A****Preferential norms for procurement from MSMEs registered in the State of Odisha****1) Tender Fees**

To participate in the tender, MSMEs registered in the State of Odisha shall pay Rs.1,000/- including GST towards cost of tender paper.

**2) Earnest Money Deposit (EMD)**

EMD shall be exempted for MSME registered in the State of Odisha. However, Bidder shall be barred to participate in the tendering process for a period of 2 years in case it backs out post award of the contract.

**3) Qualification Requirement for Open Tenders**

Qualification Requirement of Financial Turnover for MSME registered in the State of Odisha shall be reduced to 20% of the existing criteria.

For past experience, instead of relying on the volumes / value of earlier Supplies / Projects, assessment of the Bidder shall be done on the basis of feedback from Customers. Past performance experience at Tata Power and its Group Companies shall supersede feedback from other Customers.

**4) Reservation for MSME**

It shall be mandatory to procure at least 20% of the total volume of the procurement from MSME registered in the State of Odisha (however, it shall not apply where goods/services are not available with the MSME), subject to matching L1 discovered prices and meeting technical specifications including quality requirements.

**5) Performance Bank Guarantees**

Performance Bank Guarantee for MSME registered in the State of Odisha shall be 25% of the value normally prescribed.

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## CENTRALIZED CONTRACTS GROUP

NIT No.: TPCODL/CCG/23-24/014

### Definition & Introduction of Centralized Contracts Group

The Centralized Contracts Group (CCG) is a shared group of 4 Discom (TPCODL, TPNODL, TPSODL & TPWODL) in Odisha.

#### 1.0 Event Information

##### 1.1. Scope of work

Bids are invited from interested Bidders to award Procurement of Power transformer of below mentioned rating for TPCODL/ TPNODL/TPWODL/TPSODL as mentioned below:

(UOM-EA)

Item Description	TPCODL	TPNODL	TPSODL	TPWODL	Total
POWER TRANSFORMER 1 MVA 3PH 11/.4 KV –CU	5	10	10		25
TRANSFORMER 3.15 MVA 33/11KV CU	7	3	3		13
TRANSFORMER 5 MVA 33/11KV CU	4	10	10	29	53
POWER TRANSFORMER 3PH 8MVA 33/11KV	13	10	10	53	86
POWER TRANSFORMER 3 PH 12.5/16MVA 33/11KV	10	2	2	4	20
33/11kV 20/25 MVA Power Transformer	4				4
Supervision (avg-5 Days/PT)	5X39=195	5x32=160	5x32=160	5x86=430	945

#### 1.2. Availability of Tender Documents

Please refer "Procedure to participate in the e-tender".

#### 1.3. Calendar of Events

(a)	Date of availability of tender documents from TPCODL Website	01.07.2023
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(b)	Last date and time of Payment of Tender Fee	10.07.2023, 17:00 Hours
(c)	Last Date of receipt of pre-bid queries, if any	14.07.2023, 17:00 Hours
(d)	Last Date of Posting Consolidated replies to all the pre-bid queries as received	18.07.2023, 17:00 Hours
(e)	Last date and time of receipt of Bids	22.07.2023, 18:00 Hours

**Note:** In the event of last date specified for submission of bids and date of opening of bids is declared as a closed holiday for TPCODL's office, the last date of submission of bids and date of opening of bids will be the day following working day at appointed times.

**1.4 Mandatory documents required along with the Bid**

- 1.4.1 EMD of requisite value and validity
- 1.4.2 Tender Fee.
- 1.4.3 Requisite Documents for compliance to Qualification Criteria mentioned in Clause 1.7.
- 1.4.4 Acceptance of Specification, drawing with filled in GTP as per Annexure II.
- 1.4.5 Duly signed and stamped 'Schedule of Deviations' as per Annexure III on bidder's letter head.
- 1.4.6 Duly signed and stamped 'Schedule of Commercial Specifications' as per Annexure IV on bidder's letter head.
- 1.4.7 Duly filled in Annexure V and VI.
- 1.4.8 Proper authorization letter/ Power of Attorney to sign the tender on the behalf of bidder.
- 1.4.9 Copy of PAN, GST registration (In case any of these documents is not available with the bidder, same to be explicitly mentioned in the 'Schedule of Deviations')

**Please note that in absence of any of the above documents, the bid submitted by a bidder shall be liable for rejection.**

**1.5. Deviation from Tender**

Normally, the deviations to tender terms are not admissible and the bids with deviation are liable for rejection. Hence, the bidders are advised to refrain from taking any deviations on this Tender. Still in case of any deviations, all such deviations shall be set out by the Bidders, clause by clause in the 'Annexure III - Schedule of Deviations' and same shall be submitted as a part of the Technical Bid.

**1.6. Right of Acceptance/Rejection**

Bids are liable for rejection in absence of following documents:

- i. EMD of requisite value and validity.
- ii. Tender fee of requisite value.
- iii. Price Bid as per the Price Schedule mentioned in Annexure I (BOQ)
- iv. Necessary documents against compliance to Qualification Requirements mentioned at Clause 1.7 of this Tender Document.
- v. Filled in Schedule of Deviations as per Annexure III.



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- vi. Filled in Schedule of Commercial Specifications as per Annexure IV.
- vii. Signed and filled in Specification and GTP as per Annexure II.
- viii. Duly filled and signed Annexure V and VI.
- ix. Receipt of Bid within the due date and time.

CCG reserves the right to accept/reject any or all the bids without assigning any reason thereof.

**1.7 Qualification Criteria**

- a) The average annual turnover requirement of the bidder shall be a minimum of Rs. 40.0 Crs (average of best three Financial year out of five Financial year shall be considered - FY 18-19 ,FY 19-20, FY 20-21, FY 21-22 & FY22-23). Copy of audited Balance Sheet and P&L Account to be submitted in this regard.
- b) Bidder must be a BEE Certified OEM of same or Higher Ratings with manufacturing facility / assembly in India. The bidder should have oil filling machine under vacuum for Transformer as applicable. TPCODL reserves the right to inspect the said manufacturing facility as a proof of compliance to this parameter. The bidder has to furnish the Self-undertaking in this regard.
- c) The bidder should have valid BEE certification with successful Type Test Report (TTR) conducted from CPRI / ERDA/ International Accredited Laboratory and shall furnish the same as a part of the Technical Bid. The type tests should have been conducted on the equipment / material of the same design. The type tests should have been conducted within 5 years prior to the date of bid opening. Time period for type test can be extended by another 5 years as a special case, if there is no change in design / material of construction (MOC). In case the type test reports furnished are not for the quoted equipment / material but for the equipment / material with higher voltage class and/or different capacity, then type test shall be carried out for the offered equipment /material from CPRI/ERDA / International Accredited Lab without any cost implication to the owner and the Type Test reports and relevant drawings duly approved by the Type Testing agency shall be furnished within 3 months from the date issue of RC.
- d)
- e) The bidder should have successfully executed either 25% of the total tender qty during last five years; or single order of 15% of the total tender qty during last three years; or 2 orders of 10% each of the total tender qty during last 5 years. Last day of previous month prior to date of bid submission shall be counted for purpose of years calculation. Copy of work order / completion certificate to be submitted in this regard. The bidder should have In-house routine and acceptance testing facilities for acceptance as per relevant IS/IEC. Self-undertaking to be submitted in this regard. TPCODL/TPNODL/TPWODL/TPSODL reserves the right to inspect the said manufacturing facility as a proof of compliance to this parameter.
- f)
- g) The bidder should have performance certificate from at least 2 reputed companies for satisfactory performance of the conductors. The work against the issued certificates should have been completed within 7 years from the bidding date. In case the bidder has got previous association with Tata Power or TPCODL/TPNODL/TPWODL/TPSODL for supply of similar product, performance feedback of the same will be solely considered irrespective of the performance certificate issued by bidder's other customers

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- h) The bidder must have all statutory compliance like valid PAN no, GSTN etc. The bidder must submit the copy of all these registrations.

**1.8. Marketing Integrity**

We have a fair and competitive marketplace. The rules for bidders are outlined in the General Condition of Contracts. Bidders must agree to these rules prior to participating. In addition to other remedies available, CCG reserves the right to exclude a bidder from participating in future markets due to the bidder's violation of any of the rules or obligations contained in the General Condition of Contracts. A bidder who violates the market place rules or engages in behavior that disrupts the fair execution of the marketplace, may result in restriction of a bidder from further participation in the marketplace for a length of time, depending upon the seriousness of the violation. Examples of violations include, but are not limited to:

- Failure to honor prices submitted to the marketplace
- Breach of terms as published in TENDER/NIT

**1.9. Supplier Confidentiality**

All information contained in this tender is confidential and shall not be disclosed, published or advertised in any manner without written authorization from TPCODL/TPWODL/TPNODL/TPSODL. This includes all bidding information submitted to TPCODL/TPWODL/TPNODL/TPSODL. All tender documents remain the property of TPCODL/TPWODL/TPNODL/TPSODL and all suppliers are required to return these documents to TPCODL upon request. Suppliers who do not honor these confidentiality provisions will be excluded from participating in future bidding events.

**2.0 Evaluation Criteria**

- The bids will be evaluated technically and on qualifying criteria of tender terms and conditions.
- The bids will be evaluated commercially on individual item basis (all-inclusive lowest cost at item level) for the complete tender as calculated in Schedule of Items [Annexure I].
- Bidder has to mandatorily quote against each item of Schedule of Items [Annexure I]. Failing to do so, TPCODL may reject the bids.

**NOTE:** In case a new bidder is not registered with TPCODL/TPWODL/TPNODL/TPSODL, factory inspection and evaluation shall be carried out to ascertain bidder's manufacturing capability and quality procedures. However, TPCODL/TPWODL/TPNODL/TPSODL reserves the right to carry out factory inspection and evaluation for any bidder prior to technical qualification.

In case a bidder is found as Disqualified in the factory evaluation, their bid shall not be evaluated any further and shall be summarily rejected. The decision of TPCODL/TPWODL/TPNODL/TPSODL shall be final and binding on the bidder in this regard.

**2.1 Price Basis:** Price will be fixed and firm during the contractual period.

**3.0 Submission of Bid Documents****3.1 Bid Submission**

Bidders are requested to submit their offer in line with this Tender document through e-tendering process.

**TPCODL**

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Please note all future correspondence regarding the tender, bid submission, bid submission date extension, Pre-bid query etc. will happen only through TPCODL E-Tender system (Ariba).

No e-mail or verbal correspondence will be responded. All communication will be done strictly with the bidder who have done the above step to participate in the Tender.

Bids shall be submitted in 3(Three) parts:

**FIRST PART: "EMD"** as applicable shall be submitted. The EMD shall be valid for 210 days from the due date of bid submission in the form of Bank Guarantee / Bank Draft / Bankers Pay Order (issued from a Scheduled Bank) online NEFT/ RTGS transfer favoring 'TP Central Odisha Distribution Limited' payable at Bhubaneswar. The EMD BG has to be strictly in the format as mentioned in General Condition of Contract, failing which it shall not be accepted by CCG and the bid as submitted shall be liable for rejection. A separate non-refundable tender fee of stipulated amount also needs to be transferred online through NEFT/ RTGS in case the tender document is downloaded from our website.

TPCODL Bank Details for transferring Tender Fee and EMD is as below:

**Account Name: TP CENTRAL ODISHA DISTRIBUTION LIMITED**

**Bank Name: SBI, IDCO Towers, Bhubaneswar**

**Bank Account No.: 10835304915**

**IFSC Code: SBIN0007891**

**Note-** EMD is preferred in form of Bank Guarantee and to be delivered at the following address. However, in view of present situation if Bidder is finding it difficult to make and submit BG for EMD amount, they can do online transfer of EMD amount in the above mentioned Account and submit proof of the same as part of Bid Submission.

Please note that in such case, Tender Fee and EMD should be strictly 2 separate transactions.

Please note as return of EMD from Bank Account is non-standard practice and the same may take more time than return of EMD BG.

**EMD Original Hard Copy shall be delivered at the following address in Envelope clearly indicating Tender Reference/ Enquiry Number, Name of Tender and Bidder Name**

**Chief –Centralized Contracts Group**

**TP Central Odisha Distribution Limited**

**1<sup>st</sup> Floor, Anuj Building, Plot No. 29, Satya Nagar, Bhubaneswar- 751007**

EMD shall be exempted for MSME registered in the State of Odisha. However, Bidder shall be barred to participate in the tendering process for a period of 2 years in case it backs out post award of the contract.

**SECOND PART: "TECHNICAL BID"** shall contain the following documents:

- i) Requisite Documents for compliance to Qualification Criteria mentioned in Clause 1.7 and clause no. 1.4.
- ii) Type Test Certificate of Lightning Arrester of same or higher rating.
- iii) Acceptance of Specification as per Annexure II.
- iv) Duly signed and stamped 'Schedule of Deviations' as per Annexure III on bidder's letter head.

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- iv) Duly signed and stamped 'Schedule of Commercial Specifications' as per Annexure IV on bidder's letter head.
- v) Duly filled in Annexure V and VI.
- vi) Proper authorization letter/ Power of Attorney to sign the tender on the behalf of bidder.
- vii) Copy of PAN, GST registration (In case any of these documents is not available with the bidder, same to be explicitly mentioned in the 'Schedule of Deviations')

**The technical bid shall be properly indexed and is to be submitted through CCG/TPCODL E-tender System (Ariba) only. Hard Copy of Technical Bids need not be submitted**

**THIRD PART: "PRICE BID"** shall contain only the price details and strictly in format as mentioned in Annexure I along with explicit break up of basic prices and Taxes & duties etc. In case any discrepancy is observed between the item description stated in Schedule of Items mentioned in the tender and the price bid submitted by the bidder, the item description as mentioned in the tender document (to the extent modified through Corrigendum issued if any) shall prevail.

**Price Bid is to be submitted in soft copy through CCG/TPCODL E-Tendering system (Ariba) only. Hard copy of Price Bid not be submitted**

The EMD in the form of Bank Draft / BG / Bankers Pay Order shall be submitted in original hard copy and then placed in sealed envelope which shall be clearly marked as below:

**EMD****"RC for Supply of Power Transformer for TPCODL/TPNODL/TPWODL/TPSODL"**

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

**SIGNING OF BID DOCUMENTS:**

The bid must contain the name, residence and place of business of the person or persons making the bid and must be signed and sealed by the Bidder with his usual signature. The names of all persons signing should also be typed or printed below the signature.

The Bid being submitted must be signed by a person holding a Power of Attorney authorizing him to do so, certified copies of which shall be enclosed.

The Bid submitted on behalf of companies registered with the Indian Companies Act, for the time being in force, shall be signed by persons duly authorized to submit the Bid on behalf of the Company and shall be accompanied by certified true copies of the resolutions, extracts of Articles of Association, special or general Power of Attorney etc. to show clearly the title, authority and designation of persons signing the Bid on behalf of the Company. Satisfactory evidence of authority of the person signing on behalf of the Bidder shall be furnished with bid.

A bid by a person who affixes to his signature the word 'President', 'Managing Director', 'Secretary', 'Agent' or other designation without disclosing his principal will be rejected.

The Bidder's name stated on the Proposal shall be the exact legal name of the firm.

**3.2 Contact Information**

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All the bidders are requested to send their pre-bid queries (if any) against this tender through e-mail within the stipulated timelines. The consolidated reply to all the queries received shall be posted on TPCODL website by the stipulated timelines as detailed in calendar of events.

**Communication Details:**Handling Executive for this Tender:

Name: Prashant Gupta  
Contact No.: 9634077589  
E-Mail ID: prashant.gupta@tpcentralodisha.com

Escalation:Head -CCG:

Name: Mr. Vipin Chauhan  
Contact No.: 9717393121  
E-Mail ID: Vipin.Chauhan@tpnodl.com

**3.3 Bid Prices**

Bidders need to quote for all items as per the Price schedule attached in Annexure I. The bidder shall complete the appropriate Price Schedules included herein, stating the Unit Price for each item & total price with taxes, duties & freight up to destination at various sites of TPCODL/TPWODL/TPNODL/TPSODL. The all-inclusive prices offered shall be inclusive of all costs as well as Duties, Taxes and Levies paid or payable during the execution of the supply work, breakup of price constituents.

**Applicable GST to be specified clearly.**

The quantity break up shown else-where other than Price Schedule is tentative. The bidder shall ascertain himself regarding material required for completeness of the entire work. Any items not indicated in the price schedule but which are required to complete the job as per the Technical Specifications/ Scope of Work/ SLA mentioned in the tender, shall be deemed to be included in prices quoted.

**3.4 Bid Currencies**

Prices shall be quoted in Indian Rupees Only.

**3.5 Period of Validity of Bids**

Bids shall remain valid for 180 days from the due date of submission of the bid.

Notwithstanding clause above, the TPCODL/TPWODL/TPNODL/TPSODL may solicit the Bidder's consent to an extension of the Period of Bid Validity. The request and responses thereto shall be made in writing.

**3.6 Alternative Bids**

Bidders shall submit Bids, which comply with the Bidding documents. Alternative bids will not be considered. The attention of Bidders is drawn to the provisions regarding the rejection of Bids in the terms and conditions, which are not substantially responsive to the requirements of the bidding documents.

**3.7 Modifications and Withdrawal of Bids**

The bidder is not allowed to modify or withdraw its bid after the Bid's submission. The EMD as submitted along with the bid shall be liable for forfeiture in such event.

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**3.8 Earnest Money Deposit (EMD)**

The bidder shall furnish, as part of its bid, an EMD amounting as specified in the tender. The EMD is required to protect TPCODL against the risk of bidder's conduct which would warrant forfeiture.

The EMD shall be denominated in any of the following form:

- Banker's Cheque/ Demand Draft/ Pay order drawn in favor of TP Central Odisha Distribution Limited payable at Bhubaneswar.
- Online transfer of requisite amount through NEFT/ RTGS.
- Bank Guarantee valid for 210 days after due date of submission.

**The EMD shall be forfeited in case:**

a) The bidder withdraws its bid during the period of specified bid validity.

**Or**

- b) The successful Bidder does not
- a) accept the Purchase Order, or
  - b) furnish the required Performance Security Bank Guarantee

**3.9 Type Tests (if applicable)**

The type tests specified in TPCODL/TPNODL/TPSODL/TPWODL specifications should have been carried out within five years prior to the date of opening of technical bids and test reports are to be submitted along with the bids. If type tests carried out are not within the five years prior to the date of bidding, the bidder will arrange to carry out type tests specified, at his cost. The decision to accept/ reject such bids rests with TPCODL

**4 Bid Opening & Evaluation process****4.1. Process to be confidential**

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

**4.2. Technical Bid Opening**

Bids will be opened at CCG/TPCODL Office, Bhubaneswar. All tender bids shall be opened internally by TPCODL. Presence of any bidder will not be allowed during bid opening process. Technical bid must not contain any cost information whatsoever.

First the envelope marked "EMD" will be opened. Bids without EMD/cost of tender (if applicable) of required amount/ validity in prescribed format, shall be rejected.

Next, the technical bid of the bidders who have furnished the requisite EMD will be opened, one by one.

**4.3. Preliminary Examination of Bids/Responsiveness**

TPCODL will examine the Bids to determine whether they are complete, whether any computational errors have been made, whether required sureties have been furnished, whether the documents have been properly signed,



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TP Northern Odisha Distribution Limited



TP Southern Odisha Distribution Limited



TP Western Odisha Distribution Limited

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and whether the Bids are generally in order. TPCODL/TPWODL/TPNODL/TPSODL may ask for submission of original documents in order to verify the documents submitted in support of qualification criteria.

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

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

Bid determined as not substantially responsive will be rejected by the TPCODL/TPWODL/TPNODL/TPSODL and may not subsequently be made responsive by the Bidder by correction of the non-conformity.

#### 4.4. Techno Commercial Clarifications

Bidders need to ensure that the bids submitted by them are complete in all respects. To assist in the examination, evaluation and comparison of Bids, TPCODL/TPWODL/TPNODL/TPSODL may, at its discretion, ask the Bidder for a clarification on its Bid for any deviations with respect to the TPCODL/TPWODL/TPNODL/TPSODL specifications and attempt will be made to bring all bids on a common footing. All responses to requests for clarification shall be in writing and no change in the price or substance of the Bid shall be sought, offered or permitted owing to any clarifications sought by TPCODL/TPWODL/TPNODL/TPSODL.

#### 4.5. Price Bid Opening

Price bids will be opened internally without the presence of any bidder representative. The EMD of the bidder withdrawing or substantially altering his offer at any stage after the technical bid opening will be forfeited at the sole discretion of TPCODL/TPWODL/TPNODL/TPSODL without any further correspondence in this regard.

#### 4.6. Reverse Auctions

TPCODL/TPWODL/TPNODL/TPSODL reserves the right to conduct the reverse auction (instead of public opening of price bids) for the products/ services being asked for in the tender. The terms and conditions for such reverse auction events shall be as per the Acceptance Form attached as Annexure VI of this document. The bidders along with the tender document shall mandatorily submit a duly signed copy of the Acceptance Form attached as Annexure VI as a token of acceptance for the same.

### 5 Award Decision

TPCODL/TPWODL/TPNODL/TPSODL will award the contract to the successful bidder whose bid has been determined to be the lowest-evaluated responsive bid as per the Evaluation Criterion mentioned at Clause 2.0. The Cost for the said calculation shall be taken as the all-inclusive cost quoted by bidder in Annexure I (Schedule of Items) subject to any corrections required in line with Clause 3.1 above. The decision to place purchase order/LOI solely depends on CCG on the cost competitiveness across multiple lots, quality, delivery and bidder's capacity, in addition to other factors that CCG may deem relevant.

TPCODL/TPWODL/TPNODL/TPSODL reserves the rights to award contract to one or more bidders so as to meet the delivery requirement or nullify award decision without assigning any reason thereof.

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In case any supplier is found unsatisfactory during delivery process, the award will be cancelled and TPCODL/TPWODL/TPNODL/TPSODL reserves right to award contract to other suppliers who are found fit.

**6 Order of Preference/Contradiction**

In case of contradiction in any part of various documents in tender, following shall prevail in order of preference:

1. Schedule of Items (Annexure I)
2. Technical Specifications (Annexure II)
3. Special Conditions of Contract (Clause 7.0)
4. Submission of Bid Documents (Clause 3.0)
5. Acceptance Form for Participation in Reverse Auction (Annexure VI)
6. General Conditions of Contract (Annexure VIII)

**7 Post Award Contract Administration****4.0 Post Award Contract Administration****7.1. Special Conditions of Contract**

- After finalization of tender, Rate Contract shall be issued on successful bidder with a validity period of One Year. Prices shall be as per IEEMA PV circular till validity of issued rate contract. Within the validity of rate contract and as per requirement of material, release order shall be issued time to time.
- PV Clause shall be applicable with ceiling upto 10% on positive side & there is no ceiling on negative side. August 23 is Base Month for PVC (IEEMA Circular- July 23). Capacity for order handling within stipulated delivery period, shall be submitted by the bidder and the same shall be utilized and decided by TPCODL for placement of Release Order (RO).
- **Bidder needs to quote mandatorily for each line item of the BoQ**
- Business Associate (BA) shall submit applicable Performance Bank Guarantee as per GCC within 30 days of issuance of purchase order. PBG applicable shall be @ 5% of Rate Contract Value or 10% of PO Value. Validity of BG shall be till expiry date of PO plus delivery period plus warranty period in case of 5% value BG. Validity will be till delivery period plus warranty period for 10% value BG. Claim period will be additional one month for both cases.

Performance Bank Guarantee for MSME registered in the State of Odisha shall be 25% of the value normally prescribed

- Any change in statutory taxes, duties and levies during the contract period shall be borne by TPCODL. However, in case of delay in work execution owing to reasons not attributable to TPCODL, any increase in total liability shall be passed on the Bidder, whereas any benefits arising owing to such statutory variation in taxes and duties shall be passed on TPCODL/TPWODL/TPNODL/TPSODL.
- **Statutory Variations:** Any changes in existing taxes/ Duties and levies, Introduction of new taxes and duties etc. during the period of the contract shall be paid at actuals to BA subject to BA shall submit the tax break up in details, however, where BA has quoted the all-inclusive prices and not shown the tax break-up, this clause will not be applicable. The date of issue of MDCC shall be used for this purpose.
- BA shall submit GTP / Drawing complying our ordered Specification, within 2 weeks from issuance of rate contract for CAT-A approval by TPCODL/TPWODL/TPNODL/TPSODL before issuing clearance for Production to the manufacturer. In case the Manufacturer fails to furnish said required document within



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stipulated time line, TPCODL reserves the right to cancel the Rate Contract / Release Order with forfeiture of EMD / PBG of concerned BA.

- Quotation in all BOQ items is mandatory, and bid shall be rejected if any line of found blank in price bid.
- Delivery period shall be 90 days from date of receipt of release order / CAT-A issuance, whichever is later
- Warranty period: As mentioned in technical specification, Annexure-II enclosed.
- Delivery location: TPCODL/TPWODL/TPNODL/TPSODL as mentioned in Price Schedule
- Late delivery (LD) clause will be applicable as per GCC.
- All other terms and conditions of TPCODL/TPWODL/TPNODL/TPSODL General Conditions of Contract shall be applicable.
- TPCODL/TPWODL/TPNODL/TPSODL shall short close the issued Purchase Order/ Release Order / Rate contract, in case of any quality issues

▪ **Terms of Payment:**

On delivery of the materials in good condition and certification of acceptance by certified official, Associate shall submit the Bills/ Invoices in original in the name of TP Central Odisha Distribution Limited/ TP Northern Odisha Distribution Limited/ TP Western Odisha Distribution Limited/ TP Southern Odisha Distribution Limited to Invoice Desk. The payment shall be released within 60 days from the date of submission of certified bills/ invoices.

## 7.2 Drawing Submission and Approval

The relevant drawings need to be submitted within two weeks of receipt of firm purchase order by the successful bidder to TPCODL/TPWODL/TPNODL/TPSODL for approval. In case, re-submission of drawings is required on request of TPCODL/TPWODL/TPNODL/TPSODL, same needs to be submitted back to TPCODL within 5 days of such request.

## 7.3 Climate Change

Significant quantities of waste are generated during the execution of project and an integrated approach for effective handling, storage, transportation and disposal of the same shall be adopted. This would ensure the minimization of environmental and social impact in order to combat the climate change. Please refer attached Environment Policy and Sustainability Policy, enclosed for more details.

## 7.4 Ethics

TPCODL/TPSODL/TPNODL/TPWODL is an ethical organization and as a policy TPCODL/TPSODL/TPNODL/TPWODL lays emphasis on ethical practices across its entire domain. Bidder should ensure that they should abide by all the ethical norms and in no form either directly or indirectly be involved in unethical practice.

TPCODL work practices are governed by the Tata Code of Conduct which emphasizes on the following:

- We shall select our suppliers and service providers fairly and transparently.
- We seek to work with suppliers and service providers who can demonstrate that they share similar values. We expect them to adopt ethical standards comparable to our own.

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- Our suppliers and service providers shall represent our company only with duly authorized written permission from our company. They are expected to abide by the Code in their interactions with, and on behalf of us, including respecting the confidentiality of information shared with them.
- We shall ensure that any gifts or hospitality received from, or given to, our suppliers or service providers comply with our company's gifts and hospitality policy.
- We respect our obligations on the use of third party intellectual property and data.

Bidder is advised to refer Tata Code of Conduct (TCOC) attached for more information.

Any ethical concerns with respect to this tender can be reported to the following e-mail ID:

pradip.sil@tpcentralodisha.com

**8 Specification and standards**

As per Annexure II

**9 General Condition of Contract**

Any condition not mentioned above shall be applicable as per GCC attached along with this tender.

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**Annexure-I, Price Schedule***Unit of Measurement is EA*

S N	Item Description	TPCODL	TPNODL	TPWODL	TPSODL	Rate (Rs)	Amount (Rs)	GST Amount (Rs)	Total with GST (Rs)
1.	POWER TRANSFORMER 1 MVA 3PH 11/4 KV –CU	5	10	10					
2	TRANSFORMER 3.15 MVA 33/11KV CU	7	3	3					
3.	TRANSFORMER 5 MVA 33/11KV CU	4	10	10	29				
4.	POWER TRANSFORMER 3PH 8MVA 33/11KV	13	10	10	53				
5.	POWER TRANSFORMER 3 PH 12.5/16MVA 33/11KV	10	2	2	4				
6.	33/11kV 20/25 MVA Power Transformer	4							
7.	Supervision (avg-5 Days/PT)	5X39=195	5x32=160	5x32=160	5x86=430				

**NOTE:**

- a) All rates are to be quoted on delivered basis at TPCODL Store -Cuttack or Bhubaneswar, TPWODL Store- Burla, Sambalpur, TPNODL Store- Sovarampur, Balia, Balasore, Odisha, and TPSODL Store- Berhampur, Odisha (PAN TPSODL), should be inclusive of freight, insurance, loading & unloading, handling charges and any other charges which may be applicable.

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- b) The overall period of the rate contract/PO shall be for a period of 1 year. PO/ Release order shall be issued as per requirement of TPCODL/TPSODL/TPWODL/TPNODL. Rates will remain firm and fixed during the rate contract/PO validity of 1 year.
- c) The bids will be evaluated commercially on itemwise lowest cost.
- d) No of days for supervision of PT is indicative, may change as per requirement of TPCODL/TPSODL/TPWODL/TPNODL
- e) The bidders are advised to quote prices strictly in the above format. Failing to do so, bids are liable
- f) for rejection.
- g) The bidder must fill each and every column of the above format. Mentioning "extra/inclusive" in any of the column may lead for rejection of the price bid.
- h) No cutting/ overwriting in the prices is permissible.
- i) Quantities mentioned above is for evaluation purpose only and not guaranteed. Quantities may change as per actual requirements.

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**ANNEXURE III****Schedule of Deviations**

*Bidders are advised to refrain from taking any deviations on this TENDER. Still in case of any deviations, all such deviations from this tender document shall be set out by the Bidders, Clause by Clause in this schedule and submit the same as a part of the **Technical Bid**.*

*Unless **specifically** mentioned in this schedule, the tender shall be deemed to confirm the TPCODL/TPWODL/TPNODL/TPSODL's specifications:*

S. No.	Clause No.	Tender Clause Details	Details of deviation with justifications

*By signing this document we hereby withdraw all the deviations whatsoever taken anywhere in this bid document and comply to all the terms and conditions, technical specifications, scope of work etc. as mentioned in the standard document except those as mentioned above.*

**Seal of the Bidder:**

**Signature:**

**Name:**

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**ANNEXURE IV****Schedule of Commercial Specifications**

***(The bidders shall mandatorily fill in this schedule and enclose it with the offer Part I: Technical Bid. In the absence of all these details, the offer may not be acceptable.)***

<b>S. No.</b>	<b>Particulars</b>	<b>Remarks</b>
1.	Prices firm or subject to variation (If variable indicate the price variation clause with the ceiling if applicable)	Firm / Variable
1a.	If variable price variation on clause given	Yes / No
1b.	Ceiling	----- %
1c.	Inclusive of GST	Yes / No (If Yes, indicate % rate)
1d.	Inclusive of transit insurance	Yes / No
2.	Delivery	Weeks / months
3.	Guarantee clause acceptable	Yes / No
4.	Terms of payment acceptable	Yes / No
5.	Performance Bank Guarantee acceptable	Yes / No
6.	Liquidated damages clause acceptable	Yes / No
7.	Validity (180 days) (From the date of opening of bid)	Yes / No
8.	Inspection during stage of manufacture	Yes / No
9.	Rebate for increased quantity	Yes / No (If Yes, indicate value)
10.	Change in price for reduced quantity	Yes / No (If Yes, indicate value)
11.	Covered under Small Scale and Ancillary Industrial Undertaking Act 1992	Yes / No (If Yes, indicate, SSI Reg'n No.)

**Seal of the Bidder:****Signature:**

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**NIT No.: TPCODL/CCG/23-24/014**

**Name:**

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**ANNEXURE V****Checklist of all the documents to be submitted with the Bid**

Bidder has to mandatorily fill in the checklist mentioned below:

S. No.	Documents attached	Yes / No / Not Applicable
1	EMD of required value	
2	Tender Fee as mentioned in this tender	
3	Signed copy of this tender as an unconditional acceptance	
5	Duly filled schedule of commercial specifications (Annexure IV)	
6	Sheet of commercial/technical deviation if any (Annexure III)	
7	Balance sheet for the last completed three financial years; mandatorily enclosing Profit & loss account statement	
8	Acknowledgement for Testing facilities if available (duly mentioned on bidder letter head)	
9	List of Machine/tools with updated calibration certificates if applicable	
10	Details of order copy (duly mentioned on bidder letter head)	
11	Order copies as a proof of quantity executed	
12	Details of Type Tests if applicable (duly mentioned on bidder letter head)	
13	All the relevant Type test certificates as per relevant IS/IEC (CPRI/ERDA/other certified agency) if applicable	
14	Project/supply Completion certificates	
15	Performance certificates	
16	Client Testimonial/Performance Certificates	
17	Credit rating/solvency certificate	
18	Undertaking regarding non blacklisting (On company letter head)	
19	List of trained/untrained Manpower	

**Seal of the Bidder:****Signature:****Name**



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**ANNEXURE VI****ACCEPTANCE FORM FOR PARTICIPATION IN REVERSE AUCTION EVENT***(To be signed and stamped by the bidder)*

In a bid to make our entire procurement process more fair and transparent, TPCODL intends to use the reverse auctions as an integral part of the entire tendering process. All the bidders who are found as technically qualified based on the tender requirements shall be eligible to participate in the reverse auction event.

**The following terms and conditions are deemed as accepted by the bidder on participation in the bid event:**

1. TPCODL/TPWODL/TPNODL/TPSODL shall provide the user id and password to the authorized representative of the bidder. *(Authorization Letter in lieu of the same shall be submitted along with the signed and stamped Acceptance Form).*
2. TPCODL/TPWODL/TPNODL/TPSODL will make every effort to make the bid process transparent. However, the award decision by TPCODL/TPWODL/TPNODL/TPSODL would be final and binding on the supplier.
3. The bidder agrees to non-disclosure of trade information regarding the purchase, identity of TPCODL/TPWODL/TPNODL/TPSODL, bid process, bid technology, bid documentation and bid details.
4. The bidder is advised to understand the auto bid process to safeguard themselves against any possibility of non-participation in the auction event.
5. In case of bidding through Internet medium, bidders are further advised to ensure availability of the entire infrastructure as required at their end to participate in the auction event. Inability to bid due to telephone line glitch, internet response issues, software or hardware hangs, power failure or any other reason shall not be the responsibility of TPCODL/TPWODL/TPNODL/TPSODL.
6. In case of intranet medium, TPCODL/TPWODL/TPNODL/TPSODL shall provide the infrastructure to bidders. Further, TPCODL/TPWODL/TPNODL/TPSODL has sole discretion to extend or restart the auction event in case of any glitches in infrastructure observed which has restricted the bidders to submit the bids to ensure fair & transparent competitive bidding. In case of an auction event is restarted, the best bid as already available in the system shall become the start price for the new auction.
7. In case the bidder fails to participate in the auction event due any reason whatsoever, it shall be presumed that the bidder has no further discounts to offer and the initial bid as submitted by the bidder as a part of the tender shall be considered as the bidder's final no regret offer. Any offline price bids received from a bidder in lieu of non-participation in the auction event shall be out-rightly rejected by TPCODL/TPWODL/TPNODL/TPSODL.
8. The bidder shall be prepared with competitive price quotes on the day of the bidding event.
9. The prices as quoted by the bidder during the auction event shall be inclusive of all the applicable taxes, duties and levies and shall be FOR at TPCODL/TPSODL/TPNODL/TPWODL site.
10. The prices submitted by a bidder during the auction event shall be binding on the bidder.
11. No requests for time extension of auction event shall be considered by TPCODL/TPWODL/TPNODL/TPSODL.
12. The original price bids of the bidders shall be reduced on pro-rata basis against each line item based on the final all-inclusive prices offered during conclusion of the auction event for arriving at Contract amount.

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## 1.0 ORGANIZATIONAL VALUES

The Tata Group has always been a value driven organization. These values continue to direct the Group's growth and businesses. The six core Tata Values underpinning the way we do business are:

**Integrity** - We must conduct our business fairly, with honesty and transparency. Everything we do must stand the test of public scrutiny.

**Understanding** - We must be caring, respectful, compassionate and humanitarian towards our colleagues and customers around the world and always work for the benefit of India.

**Excellence** - We must constantly strive to achieve the highest possible standards in our day to day work and in the quality of goods and services we provide.

**Unity** - We must work cohesively with our colleagues across the group and with our customers and partners around the world to build strong relationships based on tolerance, understanding and mutual co-operation.

**Responsibility** - We must continue to be responsible and sensitive to the countries, communities and environments in which we work, always ensuring that what comes from the people goes back to the people many times over.

**Agility** - We must work in a speedy and responsive manner and be proactive and innovative in our approach.

## 2.0 ETHICS

In our effort towards Excellence and in Management of Business Ethics at TPCODL, an Ethics Management Team is constituted.

The main objective of the Ethics Management Team is to:

1. Record, address and allay the issues and concerns on ethics raised by different stakeholders like employees, consumers, vendors, Associates etc. by initiating immediate corrective actions.
2. Ensure proper communication of the ethics policies and guidelines through prominent displays at all offices of TPCODL and through printed declarations in all concerned documents where external stakeholders are involved.
3. Ensure proper framework of policies as preventive measures against any ethics violation recorded by them.
4. Prepare and submit MIS of all issues and concerns, corrective and preventive actions on monthly basis to the top management for their information.

All Associates and Stakeholders are requested to register any grievance on ethics violation on our website [www.tpccentralodisha.com](http://www.tpccentralodisha.com).

## 3.0 CONTRACT PARAMETERS

### 3.1 Issue/Award of Contract

TPCODL awards the contract to the Associate in writing in the form of Purchase Order (PO) or Rate Contract (RC), hereafter referred as Contract, through in any or all of following modes physical handover / post / e-mail / web document / fax with all the attachments/enclosures which shall be part of the contract document.

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On receipt of the contract, the associate shall return to TPCODL copy of the contract document duly signed by legally authorized representative of associate, within two days of Effective Date of Contract for contracts having contract execution time less than 30 days and within five days for all other contracts.

### **3.2 Contract Commencement Date**

The date of issue/award of contract shall be the Effective Date of Contract or Contract Commencement date.

### **3.3 Contract Completion Date**

The date of expiry of Guarantee Period shall be deemed as the Contract Completion Date.

### **3.4 Contract Period/Time**

The period from Contract Commencement Date to Contract Completion Date shall be deemed as the Contract Period/Time.

### **3.5 Contract Execution Completion Date**

The stipulated date for completing the supply as per schedule of quantities shall be deemed as the Contract Execution Completion Date.

### **3.6 Contract Price /Value**

The total all inclusive price/value mentioned in the PO/RC is the Contract Price/Value and is based on the quantity, unit rates and prices quoted and awarded and shall be subject to adjustment based on actual quantities supplied and accepted and certified by the authorized representative of the company unless otherwise specified in schedule of quantities or in contract documents.

### **3.7 Contract Document**

The Contract Document shall mean and include but not limited to the following:

- NIT/Tender Enquiry, QR, Instruction to Bidders, Special Condition of Contract (SCC) of tender, GCC, Technical & Commercial Specifications including relevant annexure and attachments).
- Bids & Proposals Received from Associate including relevant annexure/attachments.
- RC/PO with agreed deviations from the tender/bid documents.
- All the Inspection and Test reports, Detailed Engineering Drawings.
- Material Dispatch Clearance Certificate (MDCC).
- Minutes of Meeting (MoM)

### **3.8 Contract Language**

All documents, instructions, catalogues, brochures, pamphlets, design data, norms and calculations, drawings, operation, maintenance and safety manuals, reports, labels, on deliveries and any other data shall be in English Language.

The Contract documents and all correspondence between the TPCODL, Third Parties associated with the contract, and the Associate shall be in English language.

However, all signboards required indicating "Danger" and/or security at site and otherwise statutory required shall be in English, Hindi, and local languages.

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### 3.9 Reverse Auction

TPCODL reserves the right to conduct the reverse auction (instead of public opening of price bids) for the products / services being asked for in the tender. The terms and conditions for such reverse auction events shall be as per the Acceptance Form attached in Annexure F.

### 4.0 SCOPE OF WORK

All the activities that are to be undertaken by the Associate to realize the contractual deliverables in completeness form Scope of Work. Following clauses list, but not limited to, major requirements of the scope of work.

The associate shall satisfy himself and undertake fully the technical/commercial requirements of items to be supplied as listed in the Schedule of Quantities together with the tests to be performed /test reports to be furnished before dispatch, arrangement of stage and final inspections during manufacturing as per terms and conditions of contract, technical parameters & delivery terms and conditions including transit insurance to be met in order to fully meet TPCODL's requirements.

Completeness: Any supplies and services which might have not been specifically mentioned in the Contract but are necessary for the scope mentioned in Special Terms & Conditions and/or completeness of the works at the highest possible level, including any royalties, license fees & compensation to be paid, whether incurred by the associates or by a third party for the work covered in the scope, regardless of when incurred, shall be supplied/provided by the associate without any extra cost and within the time schedule for efficient, smooth and satisfactory operation and maintenance of the works at the highest possible level under Indian conditions (but according to international standards for facility of this type), unless expressly excluded from the scope of supplies and services in this Contract.

TPCODL have the right, during the performance of the Contract, to change the scope and/or technical character of the Project and/or of the supplies and services stipulated in the Contract by submitting a request in writing to the Associate. The Associate shall, within fifteen days of receipt of such request from the TPCODL, provide Purchaser with a reasonably detailed estimate of the cost of the change outlined in the request.

In the event, TPCODL requests a change, the Contract price and time shall be adjusted upwards or downwards, as the case may be and shall be mutually agreed to. The associate shall not be entitled to any extension of time unless such changes adversely affect the time schedule.

The Associate shall not proceed with the changes as requested till adjustment of contract price and time schedule where so applicable in terms of or otherwise directed by the TPCODL.

### 5.0 PRICES/RATES/TAXES

Unless specified elsewhere in the contract document, the prices/rates are inclusive of cost of finished product for which MDCC will be issued by TPCODL, packaging and forwarding charges, freight and transit insurance charges covering loading at Associate's works, transportation to TPCODL store/site & unloading & delivery at TPCODL stores/TPCODL site, cost of documentation including all the relevant test certificates and other supportive documents to be furnished.

The Prices/Rates are inclusive of all taxes, levies, cess and duties, particularly Goods and Services Tax as applicable. All government levy / taxes shall be paid only when the invoice is submitted according to the relevant act.

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The prices/rates shall remain firm till actual completion of entire supply of goods/material/equipment as per contract is achieved and shall remain valid till the completion of the contract.

The prices shall remain unchanged irrespective of TPCODL making changes in quantum in all or any of the schedules of items of contract.

### **5.1 Changes in Statutory Tax Structure**

If rate of any or all of the statutory taxes and duties applicable to the contract changes, such changes shall be incorporated by default if the changes occur within the contract execution time and shall be applicable if the contract is executed by the Associate within the Contract Execution Time.

For execution of contracts beyond contract execution time, where the delay is not attributable to TPCODL no upward revision in tax /duties shall be considered irrespective of changes in the statutory tax structure either within the contract execution time or beyond. However, in such cases, benefits due to any downward revisions in statutory tax rates shall be passed on to TPCODL.

### **6.0 TERMS OF PAYMENT**

On delivery of the materials in good condition and certification of acceptance by TPCODL official, Associate shall submit the Bills/Invoices in original in the name of "TP Central Odisha Distribution Limited" to invoice desk, complete with all required documents as under:

- Test Reports (4 sets).
- MDCC issued by TPCODL.
- Packing List.
- Drawing and Catalogue.
- Guarantee/Warrantee Card.
- Delivery Challan.
- O&M Manual.
- Copy of Order.
- Minutes of Meeting.

Bills/ invoices shall mention Supplier's GST Number. TPCODL will make 100% payment within 30 days of submission of the Bill/Invoice complete in all respects and along with all the requisite documents mentioned above, subject to condition that Associate has furnished the requisite Security-cum-Performance Guarantee as stipulated in the contract.

### **6.1 Quantity Variation**

Payment will be made on the basis of actual quantity of supplies/actual measurement of works accepted by TPCODL and not on the basis of contract quantity.

### **6.2 Full and Final Payment**



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Full & Final Payment in all contracts shall be made subject to the associate submitting “No Demand Certificate” in the format as per Annexure-C.

## 7.0 MODE OF PAYMENT

Payment shall be made through crossed Cheque or RTGS whichever of the two modes chosen by the Associate, in favour of Associate’s Bank Account on TPCODL records, on whose name Contract has been issued. Those Associates opting for the RTGS mode shall submit the details of Bank Account and other details as per annexure G. Further, for any payments made, TPCODL is not responsible for any consequences/disputes Associate have among the owners channel partners, sub-Associates and all such dispute/concerns shall be settled solely by the Associate.

## 8.0 SECURITY CUM PERFORMANCE DEPOSIT

Associates shall submit within 15 days from the effective date of issue of PO/RC, Security Performance Bank Guarantee (SPBG) in the format as per Annexure B of this document from banks acceptable to TPCODL for:

- (a) 5% of the PO value if purchase order value is more than Rs 5 Crores.
- (b) 10% of the PO value if purchase order value is less than Rs 5 Crores.

This shall remain valid till the end of the Guarantee Period of contract, plus one month.

- (c) 5% of the RC value in case of Rate Contract. This shall remain valid till the Guarantee period plus one month.

- For PO/RC values less than Rs. 5 lacs, Associate may request for deduction of amount equivalent to SPBG value from their first invoice. Such amount shall be withheld by TPCODL while processing the invoice and shall be released after completion of Guarantee Period plus one month.
- For PO/RC values less than Rs. 3 lacs, the clause (8.0) for Security cum Performance Bank Guarantee (SPBG) shall not be applicable.
- In case of RC (Rate Contract) after the expiry of RC validity, Associate shall have to submit SPBG. However, the Associate has the option to re-submit the SPBG as per actual RO (Release Order) value issued against the RC, valid for Guarantee Period plus one month. The Guarantee Period shall be considered as per the last RO issued against the said RC. The original SPBG as submitted against the RC shall be released on submission of the new SPBG to TPCODL. Alternatively, Associate may extend the validity of original SPBG only till the requisite period, i.e. Guarantee Period plus one month.

## 9.0 STATUTORY COMPLIANCE

### 9.1 Compliance to Various Acts

Associate should ensure adherence to all applicable laws, rules and regulation applicable under this contract from time to time. In case of violation any risk, costs etc shall be in associates account and keep TDPPL indemnified always till completion of contracts.

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## 9.2 SA 8000

TPCODL expects its Associates to follow guidelines of SA 8000:2014 on the following aspects

1. Child Labour
2. Forced or Compulsory Labour
3. Health & Safety
4. Freedom of Association & Right to Collective Bargaining
5. Discrimination
6. Disciplinary Practices
7. Working Hours
8. Remuneration
9. Management System

## 9.3 Affirmative Action

TPCODL appreciate and welcome the engagement/employment of persons from SC/ST community or any other deprived section of society by their business associates.

### Relaxation in Contract Clauses under Affirmative Action for SC/ ST Business Associates\*\*

TPCODL believes that inclusive growth is the key to sustainable development, and to promote the same Policy on Affirmative Action for Scheduled Caste & Scheduled Tribe Communities has been adopted across the company.

Under the same pre-text, and to promote entrepreneurship among SC/ST community TPCODL has taken initiative by proposing relaxations in contract clauses as per below:

S. No	Initiative	for SC/ ST BA's	Guideline Document
1	Tender Fees	100% waiver for SC/ST community	All Open Tenders
2	Earnest Money Deposit	50 % relaxation of estimated EMD value	All limited and Open Tenders
3	Performance Bank Guarantee	50% relaxation in PBG for order value above 50 lacs else 25% relaxation	All limited and Open tenders
4	Turnover	25% relaxation in company turnover under qualifying requirement criteria	All Open Tenders

### \*\*Classification of BAs under SC/ST shall be governed under following guidelines:

- Proprietorship/ Single Ownership Firm: Proprietor of the firm should be from SC/ST community. Governing document shall be duly audited balance Sheet for the last FY bearing the name of proprietor.
- Partnership Firm: Only such firms shall qualify which have SC/ST partners holding equal to or more than 50% of the total ownership pattern of the firm. Governing document shall be Partnership Deed and audited balance sheet/ ITR for last FY.
- Private limited company: Only such firms shall qualify which have SC/ST directors holding equal to or more than 50% of the total ownership pattern of the firm. Governing document shall be Memorandum of Understanding (MoU) and/or Article of Association (AoA).

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Governing document shall be Memorandum of Understanding (MoU) and/or Article of Association (AoA).

*Note: Certification from SC/ST commission shall be required for deciding upon SC/ST status of a person.*

## **10.0 QUALITY**

### **10.1 Knowledge of Requirements**

The Associate shall be deemed to have carefully examined and to have knowledge of the equipment, the general and other conditions, specifications, schedules, drawings, etc. forming part of the Contract and also to have satisfied himself as to the nature and character of the work to be executed and the type of the equipment and duties required including wherever necessary of the site conditions and relevant matters and details. Any information thus procured or otherwise obtained from TPCODL/Consultants shall not in any way relieve the Associate from his responsibility and executing the works in accordance with the terms of contract.

### **10.2 Material/Equipment/Works Quality**

The items / works under the scope of the Associate shall be of the best quality and workmanship according to the latest engineering practice and shall be manufactured from materials of best quality considering strength and durability for their best performance and, in any case, in accordance with the specifications set forth in this Contract. All material shall be new. Substitution of specified material or variation from the process of fabrication/ construction/ manufacture may be permitted but only with the prior written approval of the TPCODL.

### **10.3 Adherence to Rules & Regulations**

The Associate shall procure and/or fabricate/erect all materials and equipment in accordance with all requirements of Central and State enactment, rules and regulations governing such work in India and at site. This shall not be construed as relieving the Associate from complying with any requirement of TPCODL as enumerated in the Contract which may be more rigid than and not contrary to the above mentioned rules, nor providing such construction as may be required by the above mentioned rules and regulations. In case of variance of the Technical Specification from the laws, ordinance, rules and regulations governing the work, the Associate shall immediately notify the same to the TPCODL. It is the sole responsibility of the Associate, however, to determine that such variance exists. Wherever required by rules and regulations, the Associate shall also obtain the statutory authorities' approval for the plant, machinery and equipment to be supplied by the Associate.

### **10.4 Specifications and Standards**

The Associate shall follow all codes and standards referred in the Contract Document. Codes and standards of other may be followed by the Associate with the prior written approval of TPCODL, provided materials, supplies and equipment according to the standard are equal to or better than the corresponding standards specified in the Contract.

Brand names mentioned in the Contract documents are for the purpose of establishing the type and quality of products to be used. The Associate shall not change the brand name and qualities of the bought out items without the prior written approval of the TPCODL. All such products and equipment shall be used or installed in strict accordance with original manufacturer's recommendations, unless otherwise directed by the TPCODL. In any circumstances the codes, specimen and standards prescribed by any government agency should not be violated.

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## 11.0 INSPECTION/PARTICIPATION

### 11.1 Right to Carry Out Inspection

TPCODL reserves the right to send its representatives for inspection or participation at various stages of contract execution listed below, applicable as per contract construction.

- During basic design and detail engineering of material/ Equipment carried out by Associate /Outsourced Agencies.
- During manufacturing stages of the product at Associate's/Associate's Outsourced Agency's Plant/Facility.
- During Pre-dispatch Inspection and Testing of finished/manufactured product at Associate's/Associate's outsourced Agency's Plant/Facility.
- During Installation & Commissioning Activities/Stages.
- Prior to Clearing of the completed installation for commissioning.
- Any other stage as find appropriate by TPCODL during contract execution time.

All inspections and participations shall be carried out by TPCODL giving written intimation to the Associate or receiving appropriate advance written inspection call from the Associate, unless otherwise specified elsewhere in the contract document.

### 11.2 Facilitating Inspection

The Associate shall provide all opportunities and information to TPCODL's engineers to get acquainted with the technical know-how and the methods and practices adopted by the Associate in basic and detail engineering. The Associate shall provide documents, drawings, calculations etc. as may be required by TPCODL's Engineers.

The Associate shall provide free of charge office accommodation, office facilities, secretarial services, communication facilities, general and drawing office stationary, etc. as may be reasonably required by the TPCODL's engineers. Similarly, facilities shall also be provided by Associate's outsource agencies/partners/authorized dealers (collectively termed as sub associates) if such basic and detail engineering activities are carried out in the design offices of sub-Associates.

The Associate shall be responsible for the safety of employees of TPCODL/Third Party Agency when they are at the Associate's /Associate's outsource agency's plant or facility for carrying out/witnessing inspection/testing. All statutory safety precautions as applicable shall be followed by the Associate during Inspection Testing. If TPCODL inspectors are not satisfied with the safety arrangements at the plant, TPCODL have the right to call off inspection till such time corrective action is taken by the Associate.

Before raising the call for pre-dispatch final inspection and testing, the Associate shall conduct all the tests—type tests, routine tests etc-as specified in the contract document and submit copies of the test certificates to TPCODL along with the inspection call, for scrutiny of TPCODL.

The Associate and TPCODL shall jointly document all the observations, comments and action points after completion of inspection and it shall be binding on the Associate to provide compliance on all the points requiring compliance and furnish the compliance report to the designated authority of TPCODL for receiving clearance for dispatch of materials

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### **11.3 Third Party Nomination**

TPCODL also may nominate a third party for the purpose of carrying out the inspection and such an agency shall be entitled to all the rights and privileges of TPCODL as far as conducting the inspection.

### **11.4 Waiver of Inspections**

TPCODL on its own discretion shall chose to waive off any inspection and ask the Associate to submit all the test reports as applicable as per contract specifications, related to inspection and testing of the goods ordered for scrutiny and clearance for dispatch.

### **11.5 Incorrect Inspection Call**

In case it is observed that the material offered for inspection is not ready at the time of TPCODL inspection visit rendering it as futile, all costs towards such inspection shall be recovered from the BA. Taxes as applicable on such recoveries shall be borne by the BA.

## **12.0 MDCC & DELIVERY OF MATERIALS**

### **12.1 Material Dispatch Clearance Certificate**

Associate shall deliver material/goods/equipment against Supply Contracts or Supply Part of Composite/Service Contracts only after receiving Material Dispatch Clearance Certificate (hereafter termed as MDCC) issued by designated authority of TPCODL. Material delivered at TPCODL stores or at project site without a valid MDCC issued by the designated official of TPCODL shall be rejected. MDCC shall be issued to associate furnishing compliance report on the action points documented during pre-dispatch inspection and testing at Associate's/ Sub Associate's plant/ facility. In case Pre-dispatch inspection is waived at the discretion of TPCODL, then, MDCC shall be issued on receiving all the test reports-routine& type-from the Associate and finding them in order.

The associate shall include and provide for securely protecting and packing the materials so as to avoid loss or damage during handling and transport by air, sea, rail and road or any other means.

All such packing shall allow to the extent possible for easy removal and checking at Site. The associate shall take special precautions to prevent rusting of steel and iron parts during transit by sea. Gas seals or other materials shall be utilized by the associate for protection against moisture during transit of all Plant and Equipment.

Each Equipment or parts of Equipment shall be tagged with reference to the assembly drawings and corresponding part numbers. Each bale or package shall contain a packing note quoting specifically the name of the associate, item description, quantity, item / package identification.

All packing cases, containers, packing and other similar materials shall be new and supplied free by the associate and it shall not be required to be returned to the associate.

Notwithstanding anything stated in this clause, the associate shall be entirely responsible for loss, damage or depreciation or deterioration to the materials and supplies due to faulty and/or insecure packing or otherwise during transportation to the Site until otherwise provided herein.

In case of the consignments dispatched by road, the associate shall ensure that it or its subcontractors:

- i) Identify and obtain the correct type of trucks/trailers, keeping in view the nature of consignments to be dispatched.

ii) Take such actions as may be necessary to avoid all possible chances of damages during transit and to ensure that all packages are firmly secured.

Timelines for inspection and MDCC is as below:

S. No.	Inspection	MDCC issuance time including Inspection time (max.)
1	Outside Bhubaneswar	12 days
2	Within Bhubaneswar	5 days
3	Waiver*	3 working days

\* Associate is expected to raise the inspection call assuming that Inspection shall be carried out by TPCODL. The decision for waiver of inspection shall be on sole discretion of TPCODL.

### 12.2 Right to Rejection on Receipt

Goods/Material/Equipment delivered in condition physically damaged & incomplete as a product ordered, or not packed and transported as per the terms and conditions of the contract is liable to be rejected. Such item shall be lifted back by Associates within 15 days from receipt of rejection note from TPCODL and have to supply back the material within next 30 days or within the timeframe mutually decided by Associate and TPCODL.

If delivery of the material is beyond the agreed time, Liquidated damage clause, mentioned in this GCC separately shall be applicable; but the period for levy of LD shall be considered as per the original delivery schedule and not from the agreed timelines for material rectification.

### 12.3 Consignee

Unless otherwise specified in the Contract Document, Materials/Goods/Equipment shall be consigned to "Stores-In-Charge", TPCODL, Bhubaneswar.

### 12.4 Submission of mandatory documents on Delivery

Following documents shall be mandatorily submitted by BA along with supply of material to TPCODL stores/site:

S. No.	Documents	Requisite
1	Invoice copy in original	With all consignments
2	LR copy	Wherever required
3	Packing list	With all consignments
4	MDCC	With all consignments
5	Purchase order / Release order	Signed copy
6	Test certificates	With all consignments
7	Inspection/JVR report	In case pre-dispatch inspection is conducted
8	Device data in CD as per template for metering items	Wherever applicable

### 12.5 Dispatch and Delivery Instructions

S. No.	Instructions
1	Purchase order/ Release order no. shall be mentioned on invoice and on material

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2	TPCODL material code and material description shall be mentioned in invoice and on material.
3	“Property of TPCODL” shall be embossed on material.
4	The material shall be properly sealed and packed in standard packing as per purchase order terms & conditions.
5	The weight and quantity of material shall be mentioned wherever applicable
6	The material supplied shall be co-related with the packing list.
7	The name plate detail on equipment shall include Material code, Material description, specification detail of material [as applicable], Serial No. Year of manufacturing, PO/RO no. and date, “PROPERTY OF TPCODL, Bhubaneswar”, Guarantee period and Associate’s name.
8	In case of manual unloading, supplier / transporter shall deploy sufficient Labour for unloading the material at TPCODL central store. For heavy item(s), crane will be provided by TPCODL [unloading cost will be recovered from the associate].
9	The driver should have valid License and one helper in truck. All the documents of truck like registration papers, PUC etc. should be available in Truck.
10	BA representative should accompany the material and get it unloaded / stacked in his presence wherever possible.

### 13.0 GUARANTEE

#### 13.1 Guarantee of Performance

Associates shall stand guarantee that the equipment and material supplied under the contract is free from design, manufacturing, material, construction, erection & installation and workmanship & quality defects and is capable of its due, rated and intended quality performance, as an integrated product delivered under the contract, for a specific period termed as Guarantee Period(as elaborated elsewhere in this clause). The Associate should also guarantee that the equipment/material is new and unused except for the usage required for the tests and checks required as part of quality assurance.

#### 13.2 Guarantee Period

The Guarantee Period will be equipment/service/work specific and shall be as specified in the Standard Specifications of TPCODL for the equipment/material/service/work and where standard specifications are not part of contract documents or guarantee period is not specified in the standard specifications,, the guarantee period shall be as per the Special Terms and Conditions of the Contract. In case of no mention of the guarantee period in standard specifications or SCC Guarantee Period will be 12 Months from the Date of Commissioning or 24 months from the date of delivery of final lot of supplies made, whichever is earlier.

#### 13.3 Failure in Guarantee Period (GP)

If the equipment and material supplied under the contract fails to perform its due, rated & intended quality performance, during the Guarantee period, the associate is liable to undertake repair/rectify/replace the equipment and material supplied within time frame specified in the SCC or elsewhere in the contract documents at associate’s cost to make the equipment and material supplied/service or work rendered under the contract of performing its due, rated and intended quality performance. If Associate fails to repair/rectify/replace the equipment or material supplied rendered under the contract, failed in Guarantee Period, TPCODL will be at liberty to get the same done at Associate’s risks and costs and recover all such expenses plus the TPCODL’s own

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charges (@ 20% of expenses incurred), from the Associate or from the "Security cum Performance Deposit" as the case may be.

If during the Warranty/ Guarantee period some parts of the supplies are replaced owing to the defects/ damages under the Warranty, the Warranty period for such replaced parts shall be until the expiry of twelve months from the date of such replacement or renewal or until the end of original Guarantee period, whichever is later.

Any repairs during the Guarantee Period shall be carried out by the Associate within 30 days of reporting the issue to Associate by TPCODL. However, if replacement of the Equipment is required, Associate shall notify the same to TPCODL within 7 days of reporting the issue by TPCODL. Thereafter, the total time for supply of new equipment/ material shall be equal to the original delivery period of that equipment/ material as specified in the Contract. In case the Associate is not able to rectify/ replace the faulty equipment/ material within the stipulated timelines as mentioned above, penalty shall be levied as per the Liquidated Damages clause mentioned in this document. The penalty amount shall be recovered from the payment due to the vendor or by encashment of the SPBG as the case may be.

#### **13.4 Cost of repairs on failure in GP**

The cost of repairs/rectification/replacement, required transportation, site inspection /mobilization/dismantling and re-installation costs as applicable, to be borne by Associate. The Associate has to ensure that the interruption in the usage of intended purpose of the equipment is minimized to the maximum extent In lieu of the time taken for repairs/rectification/replacement.

#### **13.5 Guarantee period for Goods Outsourced**

If the Associate outsources partly equipment/materials/services from third party as mutually agreed upon at the pre award stage of contract, TPCODL shall have the benefit of any additional guarantee period if provided by the third party for the part supplied/executed by them.

#### **13.6 Latent Defect**

Hidden defects in manufacturing or design of the product supplied and which could not be identified by the tests conducted but later manifested during operation of the equipment are termed as latent defects. Associates shall further be responsible for 'free replacement' for another period of THREE years from the end of the guarantee period for any 'Latent Defects' if noticed and reported by the Company.

#### **13.7 Support beyond the Guarantee Period**

The Associate shall ensure availability of spares and necessary support for a period of atleast 10 years post completion of guarantee period of equipment supplied against the contract.

#### **14.0 LIQUIDATED DAMAGES**

- a) For supplies which are of standalone use, multiple in quantities and having a single final delivery schedule, Liquidated damages shall be levied without prejudice to any of the other contractual rights of TPCODL, as described below:

For delay of each week and part thereof from the delivery schedule specified in the contract, 1% of contract value corresponding to undelivered quantity, provided full quantity is supplied within 130% of the original contract time. If full contractual quantity is not delivered within 130% of contract time for delivery, TPCODL has the right to levy LD on the entire contract value, subject to a maximum of 10% of the total contract value.



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- b) For Supplies having phased delivery schedule as per contract terms, standalone use and multiple in quantities, Liquidated damages shall be levied without prejudice to any of the other contractual rights of TPCODL, as described below:

For the purpose of calculating and applying LD, each delivery lot shall be considered separately. For delay of each week and part thereof, from the delivery schedule specified for the lot, 1% of the contract value corresponding to the undelivered quantity of the lot subject to a maximum of 10% of the total contract value of the subject lot. However, if full contractual quantity is not delivered within 130% of contract time for delivery, TPCODL has the right to levy LD on the entire contract value, subject to a maximum of 10% of the total contract value. Deduction of LD shall be on landed cost i.e contract value inclusive of taxes and in pursuant statutory compliance GST would be applicable at the stipulated rate and the same shall be borne by Business Associate. In case of LD deduction, a GST invoice shall be issued by TPCODL as a proof of deduction/recovery.

#### **14.1 LD Waiver Request**

Any request of LD waiver shall be submitted within thirty (30) days of deducting LD. Request submitted beyond the timeline shall not be entertained.

#### **15.0 UNLAWFUL ACTIVITIES**

The Associate shall have to ensure that none of its employees are engaged in any unlawful activities (whether covered under the scope of the present GCC or not) subversive of the TPCODL's interest failing which appropriate action (legal or otherwise) may be taken against the Associate by the TPCODL, in accordance with the terms of the present GCC.

#### **16.0 CONFIDENTIALITY**

Associate and its employees or representatives thereof shall strictly maintain the confidentiality of various information they come across while executing the contract as detailed below.

##### **16.1 Documents**

All maps, plans, drawings, specifications, schemes and other documents or information related to the Contract/Project and the subject matter contained therein and all other information given to the Associate by the TPCODL in connection with the performance of the contract shall be held confidential by the Associate and shall remain the property of the TPCODL and shall not be used or disclosed to third parties by the Associate for any purpose other than for which they have been supplied or prepared. The Associate may disclose to third parties, upon execution of confidentiality agreements, such part of the drawings, specifications or information if such disclosure is necessary for the performance of the Work provided such third parties agree in writing to keep such information confidential to the same extent and degree as provided herein, for the benefit of the TPCODL.

##### **16.2 Geographical Data**

Maps, layouts and photographs of the unit/plant including its surrounding regions showing vital installation for national security of country or those of TPCODL shall not be published or disclosed to the third parties or taken out of the country without prior written approval of the TPCODL and upon execution of confidentiality agreements satisfactory to the TPCODL with such third parties prior to disclosure.

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### 16.3 Associate's Processes

Title to secret processes if any developed by the Associate on an exclusive basis and employed in the design of the equipment shall remain with the Associate. TPCODL shall hold in confidence such processes and shall not disclose such processes to the third parties without prior approval of the Associate and execution by such third parties of secrecy agreements satisfactory to the Associate prior to disclosure. Upon completion of contract, such processes shall become the property of the TPCODL. Title to technical specifications, drawings, flow sheets, norms, calculations, diagrams, interpretations of test results, schematics, layouts and such other information, which the Associate has supplied to the TPCODL under the Contract shall be passed on to the TPCODL. The TPCODL shall have the right to use these for construction, erection, start-up, Trial Run, operation, maintenance, modifications and/or expansion of the works including for the manufacture of spare parts.

### 16.4 Exclusions

The provision of Clauses 16.1 to 16.3 shall not apply to information:

- Which at the time of disclosure are in the public domain which later on become part of public domain through no fault of the party concerned, or
- Which were in the possession of the party concerned prior to disclosure to him by the other party, or
- Which were received by the party concerned after the time of disclosure without restriction on disclosure or use, from a third party who did not acquire such information directly or indirectly from the other party or has no obligation of confidentiality for such information.

### 16.5 Violation

In case of violation of this clause, the Associate is liable to pay compensation and damages as may be determined by the competent authority of TPCODL.

## 17.0 INTELLECTUAL PROPERTY RIGHTS

If, in the course of performance of its functions and duties as envisaged by the scope of the present GCC, the Associate acquires or develops, any unique knowledge or information which would be covered, or, is likely to be covered within the definition of a trademark, copyright, patent, business secret, geographical indication or any other form of intellectual property right, it shall be obliged, under the terms of this present GCC, to share such knowledge or information with the TPCODL. All rights, with respect to, or arising from such intellectual property, as afore mentioned, shall solely vest in TPCODL.

Moreover, the Associate undertakes not to breach any intellectual property right vesting in a third party/parties, whether by breach of statutory provision, passing off, or otherwise. In the event of any such breach, the Associate shall be wholly liable to compensate, indemnify or make good any loss suffered by such third party/parties, or any compensation/damages arising from any legal proceeding/s, or otherwise. No liability of TPCODL shall arise in this respect, and any costs, damages, expenses, compensation payable by TPCODL in this regard to a third party/parties, arising from a legal proceeding/s or otherwise, shall be recoverable from the Associate.

## 18.0 INDEMNITY

The Associate shall at all times indemnify, keep indemnified and hold harmless the TPCODL and its officers, directors, employees, affiliates, agents, successors and assigns against all actions, claims, demands, costs, charges and expenses arising from or incurred by reason of any

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infringement of patent, trade mark, registered design, copy rights and/or industrial property rights by manufacture, sale or use of the equipment supplied by the Associate whether or not the TPCODL is held liable for by any court judgement. In this connection, the TPCODL shall pass on all claims made against him to the Associate for settlement.

The Associate assumes responsibility for and shall indemnify and save harmless the TPCODL from all liability, claims, costs, expenses, taxes and assessments including penalties, punitive damages, attorney's fees and court costs which are or may be required to be paid by the TPCODL and its officers, directors, employees, affiliates, agents, successors and assigns arising from any breach of the Associate's obligations under the Contract or for which the Associate has assumed responsibilities under the Contract including those imposed under any local or national law or laws, or in respect to all salaries, wages or other compensation for all persons employed by the Associate or his Sub-Associates or suppliers in connection with the performance of any work covered by the Contract. The Associate shall execute, deliver and shall cause his Sub-Associate and suppliers to execute and deliver, such other further instruments and to comply with all the requirements of such laws and regulation as may be necessary there under to conform and effectuate the Contract and to protect the TPCODL.

The TPCODL shall not be held responsible for any accident or damages incurred or claims arising, due to the Associate's error there from prior to completion of work. The Associate shall be liable for such accidents and after completion of work for such accidents as the case may be due to negligence on his part to carry out Work in accordance with Indian laws and regulations and the specifications set forth herein.

## 19.0 LIABILITY & LIMITATIONS

### 19.1 Liability

Except for any specific liability which may be identified in the Contract and which may be payable hereunder, Associate shall not be liable for any special, incidental, indirect, or consequential Damages or any loss of business Contracts, revenues or other financial loss (or equivalents thereof no matter how claimed, computed or characterized) arising out of or in connection with the Performance of the Work or supply of Goods ***unless caused by Associate's negligence, willful misconduct or breach of contract.***

If the Associate is a joint venture or consortium, all concerned parties shall be jointly and severally bound to the TPCODL for the fulfillment of the provisions of the Contract. The consortium or the joint venture shall designate one party as their leader, who will be the coordinator between the parties and TPCODL. The constituents & leader of the consortium or joint venture shall not be changed without the prior consent of TPCODL.

TPCODL shall have no liability or any special, incidental, indirect or consequential Damages for any loss of Business Contracts, revenues or other financial loss arising out of this Contract.

### 19.2 Limitation of Liability

The total liability of Associate against any contract shall be limited to the Total All Inclusive Contract Value.

## 20.0 FORCE MAJEURE

Force Majeure applies if the performance by either Party ("the Affected Party") of its obligations under Contract is materially and adversely affected.

"Force Majeure" shall mean any event or circumstance or combination of events or circumstances referred below and their consequences that wholly or partly prevents or unavoidably delays any

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Party in the performance of its obligations under this Agreement, but only and to the extent that such events and circumstances are not within the reasonable control, directly or indirectly, of the Affected Party and could not have been avoided even if the Affected Party had taken reasonable care:

- Act of war (whether declared or undeclared), invasion, armed conflict or act of foreign enemy, embargo, blockade, revolution, riot, bombs, religious strife or civil commotion, etc. ▪ Politically motivated sabotage, or terrorism, etc.
- Action or Act of Government or Governmental agency for which remedy is beyond the control of the affected parties. ▪ Any act of God.

Note: Causes like power breakdown/ shortages/fire/strikes, accidents etc do not fall under Force Majeure.

Time being the essence of the Contract, if either party is prevented from the performance of its obligations in whole or in part due to an event of Force Majeure, then provided Notice of happening of any event by the Affected Party is given to the other party within seven (7) days from the date of occurrence of such event, which DIRECTLY has impact on works and submitted details and quantum of resulting effect, but at the same time had made all possible efforts to mitigate and overcome effects thereof, the Affected Party's performance under this Contract shall be suspended until such event ceases and the Scheduled Completion shall be delayed accordingly.

If Force Majeure event(s) continue for a period of more than three months, the parties shall hold consultation to discuss the further course of action.

Neither party shall be considered to be in default or in breach of its obligation under the Contract to the extent that performance of such obligation by either party is prevented by any circumstances of Force Majeure which arise after effective date of Contract.

Neither party can claim any compensation from the other party on account of Force Majeure.

## **21.0 SUSPENSION OF CONTRACT**

### **21.1 Suspension for Convenience**

TPCODL may, at any time and at its sole option, suspend execution of all or any portions of the schedule of items of contract to be supplied/work to be executed by Associate under the contract by providing to the Associate at least two business days written notice for contracts having contract completion period less than sixty days and at least seven business days' notice for all other contracts.

Upon receipt of any such notice, the Associate shall respond as follows as applicable as per contract construction.

- Immediately discontinue further supply of material/goods specified in the suspension notice for supply contracts
- Immediately discontinue further service/work and supply of materials of those services/materials/work specified in the suspension notice for service /composite contract
- Promptly make every reasonable effort to obtain suspension, upon terms satisfactory to TPCODL, of all orders, outsourcing arrangements, and rental Contracts to the extent that they relate to performance of the portion of Work suspended by the notice.

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- Protect and maintain the portion of the service/Work already completed, including the portion of the Work suspended hereunder, unless otherwise specifically stated in the notice.
- Continue delivering/carrying out the supply/service/work items as per contract conditions, which do not fall under purview of the suspension notice.

On receipt of resumption notice from TPCODL, the Associate shall resume execution of contract as specified in the resumption notice, within the time frame specified in the resumption notice.

### **21.2 Suspension for Breach of Contract conditions.**

TPCODL shall suspend execution of whole/or part thereof the contract till such time Associate complies with the conditions stipulated under section clause 22.1 for breach/default of contract conditions.

### **21.3 Compensation in lieu of Suspension**

If the suspension of the contract in whole or in part is for convenience of TPCODL and not due to any breach of contract conditions by the associate, TPCODL at its discretion shall consider compensating all reasonable additional costs incurred by Associate in lieu of suspension of whole or part of contract, on representation of the Associate providing justified estimates of such additional costs and such estimates are found acceptable and approved by competent authority of TPCODL.

If the suspension of contract in whole or part thereof is due to breach of contract conditions (refer clause 22.1) by the Associate, Associate shall not be entitled for any compensation for any cost incurred in lieu of suspension of whole or part of contract and also shall be liable for compensating all the losses arising to TPCODL in lieu of suspension of contract. Resumption notice shall be subject to the Associate taking corrective action for the breach of contract conditions within the time frame and as per the terms specified in the suspension notice.

## **22 TERMINATION OF CONTRACT**

### **22.1 Termination for Default/Breach of Contract**

The contract / PO /RC shall be subject to termination by TPCODL in case of breach of the contract by the Associate which shall include but not be limited to the following:

- a. Withdrawal or intimation by the Associate of its intent to withdraw or surrender the execution / completion of the contracted work /PO or failure in ensuring adherence to any delivery schedules, in deviation of the contract/PO.
- b. Refusal or neglect on the part of the Associate to supply material/equipment of quantity or quality as specified by TPCODL and within the timeframe as specified in the contract document or refusal or neglect to execute the services/work in terms of the agreed standards of quantity or quality and/or within the timeframe specified in the contract/PO.
- c. Failure in any respect to perform any portion of the Work contracted with promptness, diligence, or in accordance with the terms of the contract.
- d. Failure to furnish guarantees as specified and /or failure to comply with the terms thereof.
- e. Failure to furnish such relevant documents or information within the time specified which may be necessary for due execution / completion of the works and documentation.

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- f. Liquidation, bankruptcy either voluntary or involuntary OR entering into any composition or compromise with its creditors, or Insolvency.
- g. In case any reasonable information has been received by TPCODL that Associate has adopted/ or attempted to adopt any unethical conduct, action in award of the contract /PO or at any time thereafter.
- h. Failure to comply with applicable statutory provisions as contained in the contract or failure to comply with the applicable laws.
- i. Failure to comply with safety regulations/clauses stipulated in the contract or as may be generally instructed by TPCODL.

If the default or breach as specified under clause 22 (except sub clause g thereof) be committed by the associate for the first time, TPCODL shall issue, along the with notice of default or breach, a warning notice instructing the associate to take remedial/corrective action within the time frame stipulated in the warning notice and not to repeat the same in future. The timeframe for corrective action by the associate shall be specific to the nature of breach of contract and the same shall not be objected to by the Associate. If the Associate fails to comply with the instructions in the warning notice or in taking corrective action to the satisfaction of TPCODL then TPCODL may terminate the entire or part of contract at its discretion by issuing termination notice without incurring any liability on this ground.

In case the contract is terminated for any breach of the nature specified in clause 22 g stated above, TPCODL shall have the right to terminate all the contracts TPCODL is having with the Associate by issuing termination notice which shall be without prejudice to the other rights of TPCODL available to it under law.

Without prejudice to its right to terminate for breach of contract, TPCODL may, without assigning any reason, terminate the Contract in whole or in part at any time at its discretion while the contract is in force by serving a written notice of two weeks to the Associate.

In the event of TPCODL having proceeded with termination of the contract the associate shall comply and proceed further in the following manner:

- a) Associate shall discontinue the supply, on the expiry of the said period of two weeks.
- b) Associate shall ensure that no further steps are being taken towards discharge of the obligations, terms and conditions as contained in the contract/PO. This shall include initiation of actions not limited to discontinuation of other allied and associated arrangements which the associate might have entered into with third parties for due discharge of its obligations under the contract with TPCODL.
- c) The Associate shall perform thereafter such tasks as may be necessary to preserve and protect the terminated portion of the material/service/work in progress and the materials and equipment at TPCODL sites or in transit thereto. However the associate shall continue to fulfill its contractual obligations with regard to the part of contract not terminated.
- d) It shall be open for TPCODL to conduct a joint assessment with the associate of the material, supplies, equipment ,works or in general as to the subject matter of the contract in regard to which the associate claims having completed its obligations before or during such termination.

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- e) It shall be open to TPCODL to seek invocation of the performance bank guarantee or any other guarantee or other security deposit by whatever name called submitted by the associate, which shall not be objected to or protested against by the associate.

In case of termination of the contract the parties agree to be governed inter alia by the following:

- a) In case TPCODL exercises its right of termination as stated above the associate shall not dispute or object to the same.
- b) The Associate shall be entitled to receive and claim only such payments OR sums of money from TPCODL as may be found payable to it in regard to works executed by it under the terms of the contract and no other claim of any nature whatsoever shall be made by the Associate.
- c) All such provisions which the parties have agreed to survive and prevail even after termination of the contract shall remain effective despite the termination.

In the event of such termination, TPCODL may finish the Work by whatever method it may deem expedient, including the hiring of services and /or purchase of material equipment from such third parties as TPCODL may deem fit or may itself provide any labor or materials and perform any part of the Work. The associate undertakes to bear the incremental costs if any paid by TPCODL in such a case attributable to failure on the part of the associate. The Associate in such a case shall not be entitled to receive any further payments and any sums found payable to it may be adjusted by TPCODL against the amount recoverable from him on this ground. The same shall be without prejudice to other rights available to TPCODL under law against the associate. Upon the termination of any of the contract due to occurrence of any circumstances provided in clauses stated above and constituting repeated breach or misconduct, TPCODL shall be entitled to bar the associates its agents, affiliates from undertaking any negotiation / tendering, bidding, participation activities concerning TPCODL for a period of two years from date of such termination. The same shall be without prejudice to other rights available to TPCODL.

### **22.2 Termination for Convenience of Associate**

Associate at its convenience may request for termination of contract, clearly assigning the reason for such request. TPCODL has full right to accept, reject or partially accept such request. However, associate shall continue its supply as per contract till final approval is given to associates for such termination.

### **22.3 Termination for Convenience of TPCODL**

TPCODL at its sole discretion may terminate the contract by giving 30 days prior notice in writing or through email to the Associate. TPCODL shall pay the Associate for all the supplies/ services rendered till the actual date of contract termination against submission of invoice by the Associate to that effect.

## **23.0 DISPUTE RESOLUTION & ARBITRATION**

In case of any dispute or difference the parties shall endeavour to resolve the same through conciliatory and amicable measures within 15 Days failing which the matter may be referred by either party for resolution by the sole arbitrator to be appointed mutually by both the parties. The arbitral proceedings shall be conducted in accordance with Arbitration and Conciliation Act 1996 and the place of arbitration shall be Bhubaneswar. The language to be used at proceedings shall be English and the award of the arbitrator shall be final and binding on the parties. The parties shall bear their respective costs of arbitration. The associate shall continue to discharge its obligations towards due performance of the works as per the terms of the contract during the

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arbitration proceedings unless otherwise directed in writing by TPCODL or suspended by the arbitrator. Further, TPCODL shall continue making such payments as may be found due and payable to the associate for such works.

### **23.1 Governing Laws and Jurisdiction**

The parties shall be subject to the jurisdiction of the courts of law in Bhubaneswar and any matter arising here from shall be subject to applicable law in force in India.

## **24.0 ATTRIBUTES OF GCC**

### **24.1 Cancellation**

The Company reserves the right to cancel, add, delete at its sole discretion, all or any terms of this GCC or any contract, order or terms agreed between the parties in pursuance without assigning any reasons and without any compensation to the Associates.

### **24.2 Severability**

If any portion of this GCC is held to be void, invalid, or otherwise unenforceable, in whole or part, the remaining portions of this GCC shall remain in effect.

### **24.3 Order of Priority**

In case of any discrepancies between the stipulations in General Conditions of the Contract (GCC) and Special Conditions of Contract (SCC), the GCC shall stand superseded by the SCC to the extent stipulated hereinabove while balance portion of respective clauses of GCC shall continue to be applicable.

## **25.0 ERRORS AND OMISSIONS**

The Associate shall be responsible for all discrepancies, errors and omissions in the drawings, documents or other information submitted by him, irrespective of whether these have been approved, reviewed or otherwise accepted by the TPCODL or not. However any error in design/drawing arising out of any incorrect data/written information from TPCODL will not be considered as error and omissions on part of the Associate.

## **26.0 TRANSFER OF TITLES**

The title of ownership and property to all equipment, materials, drawings & documents shall pass to the TPCODL on acceptance of material by store/site after Inspection.

However, such passing of title of ownership and property to the TPCODL shall not in any way absolve, dilute or diminish the responsibility and obligations of the Associate under this Contract including loss or damages and all risks, which shall vest with the Associate.

## **27.0 INSURANCE**

The Contractor shall take out the Insurance Policies which shall cover all risks including the following, as applicable:-

- a) The value of the policy shall cover the total value of all the items till they are handed over to TPCODL.
- b) TPCODL shall be the principal holder of the policy. The Associate shall be the loss payee under the policy. Associate / Sub-contractor of the Associate shall not be holders or beneficiaries in the policy nor shall they be named in the policy. TPCODL reserves the exclusive right to assign the policy.



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- c) While the payment of premium may be phased in agreement with the insurance company, at no time shall goods and services required to be provided by the associate shall remain uninsured in accordance with (a) above.
- d) A copy of the Insurance policy shall be made available to TPCODL prior to first dispatch lot of any Equipment and policy shall be kept alive and valid at all times up to the stage of final acceptance.
- e) TPCODL reserves the right to take out whatever policy that is deemed necessary by him if the associate fails to keep the said policy alive and valid at all times and/or causes lapses in payment of premium thereby jeopardizing the said policy. The cost of such policy(s) shall be recovered / deducted from the amount payable to the associate.
- f) The policy shall ensure that the TPCODL's decision regarding replacement of goods damaged, lost or rendered unusable shall be final.

In all cases, the associate shall lodge the claims with the underwriters and also settle the claims and shall also notify TPCODL of any filed claims. However, the associate shall proceed with the repairs and/or replacement of the equipment/components without waiting for the settlement of the claims. In case of seizure of materials by concerned authorities, the associate shall arrange prompt release against bond, security or cash as required. TPCODL, upon request by the associate, will extend all reasonable assistance to the associate in such a case.

All the insurance claims shall be processed and settled by the associate and the missing/damaged items shall be replaced/repared by them without any extra cost to TPCODL and without affecting the completion time.

### 28.0 SUGGESTIONS & FEEDBACK

We welcome all our Business Associates to write to us about their experience with TPCODL; be it our Company, our services or our people. Each and every concern, issue, query and suggestion from you will help us to become a better company to work with and shall help us develop a strong bonding of trust and a long term relationship with you.

You may send your feedback by filling up our Business Associate Feedback Form enclosed herewith as *Annexure-E*. You can also log on to our website [www.tpcentralodisha.com](http://www.tpcentralodisha.com) to provide your feedback.

- Suggestions for us
- Feedback form
- Knowledge Sharing/ Experience with TPCODL
- Any issues with TPCODL.

Submission of feedback form is mandatory before the release of final payment to the BA.

### 29.0 CONTACT POINTS

In case Business Associate needs information with respect to payments or has any grievances, same may be lodged by log on to our website [www.tpcentralodisha.com](http://www.tpcentralodisha.com)

### 30.0 LIST OF ANNEXURES

S. No.	Subject	Annexure
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1.	Performa for Bid Security Bank Guarantee	A
2.	Performa for Performance Bank Guarantee (CP cum EP)	B
3.	Performa for No Demand Certificate by Associate	C
4.	Performa For Application For Issuance of Consolidated TDS Certificate	D
5.	Business Associate Feedback Form	E
6.	Acceptance Form For Participation In Reverse Auction Event	F
7.	Form for RTGS Payment	G
8.	Vendor Appraisal Form	H
9.	Manufacturer Authorization Form	I

**ANNEXURE-A**

**PROFORMA FOR BID SECURITY BANK GUARANTEE**

**The TP Central Odisha Distribution Limited  
Bhubaneswar**

WHEREAS, (Name of the Bidder) \_\_\_\_\_  
(hereinafter called "the BIDDER") has submitted his bid dated \_\_\_\_\_ for the (Name  
of Contract) \_\_\_\_\_ (hereinafter called "the BID").

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KNOW ALL men by these presents we (Name of the Bank) \_\_\_\_\_ of (Name of the Country) \_\_\_\_\_ having our registered office at \_\_\_\_\_ (hereinafter called "the BANK) are bound unto The TP Central Odisha Distribution Limited (TPCODL) in the sum of \_\_\_\_\_ for which payment well and truly to be made to the TPCODL the Bank binds himself, his successors and assigns by these presents.

SEALED with the Common Seal of the said Bank this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_\_.

The CONDITIONS of this obligation are:

- i) If the Bidder withdraws his Bid during the period of bid validity specified in the Proforma of Bid or
- ii) If the Bidder having been notified of the acceptance of his Bid by the TPCODL during the period of bid validity fails or refuses to furnish the Contract Performance Bank Guarantee, in accordance with the Instructions to Bidders.

We undertake to pay the TPCODL upto the above amount upon receipt of its first written demand, provided that in its demand the TPCODL will note that amount claimed by it is due to it owing to the occurrence of one or both conditions, specifying the occurred condition or conditions.


This Guarantee will remain in force upto and including the date (No of days as mentioned in tender enquiry) days after the closing date of submission of bids as stated in the Invitation to Bid or as extended by you at any time prior to this date, notice of which extension to the Bank being hereby waived, and any demand in respect thereof should reach the Bank not later than the above date.

**DATE** ..... **SIGNATURE OF THE BANK** .....

**WITNESS** ..... **SEAL** .....

(Signature, Name & Address) ( At least 2 witnesses)

GENERAL CONDITIONS OF CONTRACT

	TP CENTRAL ODISHA DISTRIBUTION LIMITED	
	WORK INSTRUCTION /OPERATING GUIDELINES	
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**ANNEXURE- B**

**PROFORMA FOR PERFORMANCE BANK GUARANTEE (CP cum EP)**

**(On Rs.100/- Stamp Paper) Note:**

- a) Format shall be followed in toto
- b) Claim period of one month must be kept up
- c) The guarantee to be accompanied by the covering letter from the bank confirming the signature to the guarantee

**The TP Central Odisha Distribution Limited**

**Bhubaneswar**

**CP cum EP BG No.....**

**Order/Contract No.....dated.....**

1. You have entered into a Contract No \_\_\_\_\_ with M/s. \_\_\_\_\_ (hereinafter referred to as "the Vendor") for the supply cum erection / civil work of \_\_\_\_\_ (hereinafter referred to as "the said Equipment") for the price and on the terms and conditions contained in the said contract.
2. In accordance with the terms of the said contract, "the Vendor" agreed to furnish you with an irrevocable, unconditional and acceptable bank guarantee for 10% of the value of contract and to be valid till the end of Guarantee period plus one month towards "Contract cum Equipment performance". For this purpose you have agreed to accept the guarantee.
3. In consideration thereof, we, \_\_\_\_\_ hereby irrevocably and unconditionally guarantee to pay to you on demand but in any case before the end of five working days from the date of the claim and without demur and without reference to "the Vendor" such amount or amounts not exceeding the sum of Rs. \_\_\_\_\_ (Rupees \_\_\_\_\_ only) being \_\_\_\_\_% (\_\_\_\_\_ percent) of the total value of the contract on receipt of your intimating that "the Vendor" has not fulfilled his contractual obligations. You shall be the sole judge for such non-fulfillment and "the Vendor" shall have no right to question such judgment.
4. You shall have the right to file / make your claim on us under the guarantee for a **further period of one month** from the date of expiry.
5. This guarantee shall not be revoked without express consent and shall not be affected by your granting time or any other indulgence to "the Vendor", which shall include but not be limited to, postponement from time to time of the exercise the same in you or any right which you may have against "the Vendor" and to exercise the same in any covenant contained or implied in the said contract or any other course or remedy or security available to you, and our Bank shall not be released from its obligations under this guarantee by

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your exercising any of your rights with reference to matters aforesaid or any of them or by reasons of any other act or forbearance or other acts of omission or commission on your part or any other indulgence shown by you or by any other matter or thing whatsoever which under the law would, but for this provision have the effect of relieving our bank from its obligation under this guarantee.

6. We also agree that you shall be entitled at your option to enforce this guarantee against our bank as a principal debtor, in the first instance, notwithstanding any other security or guarantee that you may have in relation to "the Vendor's" liabilities in respect of the premises
7. This guarantee shall not be affected by any change in the constitution of our Bank or "the Vendor" or for any other reason whatsoever.
8. Any claim / extension under the guarantee can be lodge-able at outstation banks or at Bhubaneswar branch and claim will also be payable at Bhubaneswar Branch (to be confirmed by Bhubaneswar Branch by a letter to that effect in case BG is from the branch outside Bhubaneswar).
9. Notwithstanding anything herein contained, our liability under this guarantee is limited to Rs. \_\_\_\_\_ (Rupees \_\_\_\_\_) only and the guarantee will remain in force upto and including \_\_\_\_\_ (Date) and shall be extended from time to time for such period or period as may be desired by "the Vendor".
10. Unless a demand or claim under this guarantee is received by us in writing within one months from \_\_\_\_\_ (expiry date) i.e. on or before \_\_\_\_\_ (claim period end date), we shall be discharged from all liabilities under this guarantee thereafter.

Dated at \_\_\_\_\_ this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_

Bank's rubber stamp

1. Banks full address  
  
Designation of Signatory
2. Bank official number

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**ANNEXURE-C**

**PROFORMA FOR “NO DEMAND CERTIFICATE” BY ASSOCIATE**

(On Company's Letter head or with Company Seal)

(To be submitted by the Associate to TPCODL Accounts Department at the time of receipt of full and final payment)

**(Certificate No. CCP/002)**

Name of the Project Order/

Contract No.

Dated

Name of the Associate Scheme

No. / Job No.

We, M/s. \_\_\_\_\_ (Associate) do hereby acknowledge and confirm that we have received the full and final payment due and payable to us from TPCODL, in respect of our aforesaid Order No \_\_\_\_\_ dated \_\_\_\_\_ including amendments, if any, issued by TPCODL to our entire satisfaction and we further confirm that we have no claim whatsoever pending with TPCODL under the said contract / W.O.

Notwithstanding any protest recorded by us in any correspondence, documents, measurement books and / or final bills etc., we waive all our rights to lodge any claim or protest in future under this contract.

We are issuing this “NO DEMAND CERTIFICATE” in favour of TPCODL, with full knowledge and with our free consent without any undue influence, misrepresentation, coercion etc.

**Place**

**Name**

(Company Seal)

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**ANNEXURE-D**

**PROFORMA FOR APPLICATION FOR ISSUANCE OF CONSOLIDATED TDS  
CERTIFICATE**

To be printed on the letterhead

To,

The TP Central Odisha Distribution Limited,

Bhubaneswar

**Sub: Application for issuance of Consolidated TDS Certificate for the FY \_\_\_\_\_**

Dear Sir,

I / we hereby request / authorize you to issue me / us a consolidate TDS Certificate for the financial year \_\_\_\_\_ against tax deducted at source by you from my / our payments / bills during the said year from time to time under Chapter XVII – B of the Income Tax Act, 1961. For and on behalf of

Signature

Name

Address

Contact No. (Land Line)

(Mobile)

PAN #

Assessing authority

**ATTACH THE COPY OF PAN CARD**

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**ANNEXURE-E**

**BUSINESS ASSOCIATE FEEDBACK FORM**

With an objective to improve our internal processes and systems, and serve you better, we solicit your valuable feedback & suggestions. It is estimated that it will take about 10 minutes to complete this survey. We assure you that your feedback shall be kept confidential. Please send the duly filled feedback form in the "TPCODL addressed - attached envelop"

**You are associated with us as**

- OEMs    Service Contractor    Material Suppliers    Material & Manpower Supplier

**You are associated with us for**

- Less than 1 year    More than 1 year but less than 3 years    More than 3 years

**Your office is located at**

- Bhubaneswar    Within 200 kms from Bhubaneswar    More than 200 kms from Bhubaneswar

**Your nearly turnover with TPCODL**

- Less than 25 Lacs    25 Lacs to 1 Crore    More than 1 Cr.

**Additional Information**

<b>Your Name</b>	
<b>Your Designation</b>	
<b>Your Organization</b>	
<b>Contact Nos.</b>	
<b>Email</b>	

*We once again thank you for your participation in this survey. Please spare 10 minutes to give your feedback on following pages (Section A to E)*



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**SECTION – A**

(Please ✓ mark in the relevant box and give your remarks / suggestions / information for our improvement).

S. No.	Parameters	1	2	3	4	5	Remarks/ Suggestion
		Do Not Agree	Slightly in Agreement	In Fair Agreement	Mostly in Agreement	Fully Agree	
1	You receive all relevant queries / tenders from us in timely manner.						
2	We provide you enough lead time to respond to our queries / tenders.						
3	We provide you adequate support (drawings, documents, clarifications, briefing etc.) to enable you meet our requirements.						
4	All following elements of our contract / purchase order are rational :						
4.1	Scope of Work						
4.2	Delivery / Execution Schedule						
4.3	Payment Terms						
4.4	Liquidated Damages						
4.5	Performance Guarantee						
5	Our purchase orders / contracts are simple, specific & easy to understand						
6	TPCODL demonstrate willingness to be flexible in administration of Contract / Purchase Order						
7	We provide timely responses / clarifications to your queries						
8	TPCODL representative you interact / coordinate with is adequately empowered to support you in meeting contractual obligations						
9	TPCODL provide you all necessary infrastructure support for timely and quality completion of work (including AMC)						
10	TPCODL Engineer-in-Charge timely certifies the jobs executed/ material supplied						
11	TPCODL Engineer-in-Charge efficiently supervises the job execution for timely completion of job						
12	BIRD (Bill Inward Receipt Desk) initiative has improved payment disbursement process						

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S. No.	Parameters	1	2	3	4	5	Remarks/ Suggestion
		Do Not Agree	Slightly in Agreement	In Fair Agreement	Mostly in Agreement	Fully Agree	
13	Our approach for Inspection and Quality Assurance effective to expedite project completion?						
14	TPCODL never defaults on contractual terms						
15	In TPCODL Contracts closure is done within set time limit						
16	Our material receiving procedures are well defined and efficiently deployed to reduce mutual inconvenience						
17	Bank Guarantees are released in time bound manner						
18	Our processes related to payment / account settlement are effective.						
19	You get payments on time						
20	TPCODL Employees follow Ethical behaviour						

### SECTION – B

SECTION – B (Please rate the following parameters on a scale of 1 to 5, where 1 - Minimum; 5 - Maximum)

S. No.	Parameters	1	2	3	4	5	Remarks/ Suggestion
1	How do you rate courtesy/ empathy/ attitude level and warmth of TPCODL employees you interact with from following team?						
1.1	Project Engineering						
1.2	District / Zones						
1.3	Projects/HOG (TS &P)						
1.4	Inspection & Quality Assurance						
1.5	Stores						
1.6	Metering & Billing						
1.7	Accounts / Finance						
1.8	Administration						
1.9	IT & Automation						
2	How would you rate TPCODL in comparison to your other clients in terms of <b>fairness of treatment and transparency</b> with its Business Associates?						
3	How would you rate TPCODL in comparison to your other clients in terms of <b>processes and systems to manage partnership</b> with its Business Associates						
4	How would you rate TPCODL in comparison to your other clients in terms of <b>building long term &amp; mutually relationship</b> with its Business Associates						

### SECTION – C

Please √ mark in the relevant box and give your remarks / suggestions / information for our improvement.

S. No.	Parameters	Certainly No	Probably No	Certainly Yes	Probably Yes	Remarks/ Suggestion
1	Based on your experience with TPCODL, would you like to continue your relationship with TPCODL?					
2	If someone asks you about TPCODL, would you talk "positively" about					

	TPCODL?					
3	Would you refer TPCODL name to others in your community, fraternity and society as a professional & dynamic organization?					

**SECTION - D**

**If we ask you to rate us on a scale of 1 to 10, how will you rate TPCODL, that truly represents your overall satisfaction with us (please tick appropriate box) -**

1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	----

**SECTION - E**

Please ✓ mark in the relevant box and give your remarks / suggestions / information for our improvement.

Please spare your thoughts for TPCODL's improvement in particular areas of weaknesses, particularly relating to some great practices, attitudes that you have seen elsewhere in Indian and International Organizations, which you recommend TPCODL to adopt. Please give your valuable salient recommendations.

Please spare your thoughts for TPCODL's improvement in particular areas of major concerns for you. We also welcome your suggestions to adopt any best practices, altitudes that you

Recommendation	<i>Please tick (✓) your top 5 expectations out of the following 10 points listed below -</i>	
(Please list down improvement you expect from TPCODL)	<i>Timely payment</i>	
1	<i>Flexibility in Contracts/PO</i>	
	<i>Clarity in PO,s &amp; Contracts</i>	
2	<i>Timely response to quarries</i>	
	<i>Timely certification of works executed</i>	
3	<i>Clarity in Specs, drawings, other docs etc.</i>	
	<i>Adequate information provided on website for tender notification, parties qualified etc.</i>	
4	<i>Timely receipt of material at site for execution</i>	
	<i>Performance Guarantee/EMD released in time</i>	

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5	<i>Inspection &amp; quality assurance support for timely job completion</i>
---	---

We thank you for your time and courtesy!!

**ANNEXURE-F**

**ACCEPTANCE FORM FOR PARTICIPATION IN REVERSE AUCTION EVENT**

***(To be signed and stamped by the bidder prior to participation in the auction event)***

In a bid to make our entire procurement process more fair and transparent, TPCODL intends to use the reverse auctions through SAP-SRM tool as an integral part of the entire tendering process. All the bidders who are found as technically qualified based on the tender requirements shall be eligible to participate in the reverse auction event.

**The following terms and conditions are deemed as accepted by the bidder on participation in the bid event:**

1. TPCODL shall provide the user id and password to the authorized representative of the bidder. (Authorization Letter in lieu of the same shall be submitted along with the signed and stamped Acceptance Form).
2. TPCODL will make every effort to make the bid process transparent. However, the award decision by TPCODL would be final and binding on the supplier.
3. The bidder agrees to non-disclosure of trade information regarding the purchase, identity of TPCODL, bid process, bid technology, bid documentation and bid details.
4. The bidder is advised to understand the auto bid process to safeguard themselves against any possibility of non-participation in the auction event.
5. In case of bidding through Internet medium, bidders are further advised to ensure availability of the entire infrastructure as required at their end to participate in the auction event. Inability to bid due to telephone line glitch, internet response issues, software or hardware hangs, power failure or any other reason shall not be the responsibility of TPCODL.
6. In case of intranet medium, TPCODL shall provide the infrastructure to bidders. Further, TPCODL has sole discretion to extend or restart the auction event in case of any glitches in infrastructure observed which has restricted the bidders to submit the bids to ensure fair & transparent competitive bidding. In case an auction event is restarted, the best bid as already available in the system shall become the start price for the new auction.
7. In case the bidder fails to participate in the auction event due any reason whatsoever, it shall be presumed that the bidder has no further discounts to offer and the initial bid as submitted by the bidder as a part of the tender shall be considered as the bidder's final no regret offer. Any offline price bids received from a bidder in lieu of non-participation in the auction event shall be out rightly rejected by TPCODL.
8. The bidder shall be prepared with competitive price quotes on the day of the bidding event.
9. The prices as quoted by the bidder during the auction event shall be inclusive of all the applicable taxes, duties and levies and shall be FOR at TPCODL site.
10. The prices submitted by a bidder during the auction event shall be binding on the bidder.
11. No requests for time extension of the auction event shall be considered by TPCODL.
12. The original price bids of the bidders shall be reduced on pro-rata basis against each line item based on the final all inclusive prices offered during conclusion of the auction event for arriving at Contract amount.

**Signature & Seal of the Bidder**

**ANNEXURE-G**

To,

DGM (Finance)  
The TP Central Odisha Distribution Limited  
Bhubaneswar

Sub: **e-Payments through National Electronic Fund Transfer (NEFT) OR Real Time Gross Settlement System (RTGS)**

Dear Sir,

We request and authorize you to affect e-payment through NEFT/RTGS to our Bank Account as per the details given below:-

Vendor Code :

Title of Account in the Bank :

Account Type :

(Please mention here whether account is Savings/Current/Cash Credit)

Bank Account Number :

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Name & Address of Bank :

Bank Contact Person's Names :

Bank Tele Numbers with STD Code :

Bank Branch MICR Code :

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

(Please enclose a Xerox a copy of a cheque. This cheque should not be a payable at par cheque)

Bank Branch IFSC Code :

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

(You can obtain this from branch where you have your account)

Email Address of accounts person: (to : send payment information)

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Name of the Authorized Signatory: \_\_\_\_\_ :

Contact Person's Name:

Official Correspondence Address:

We confirm that we will bear the charges, if any, levied by our bank for the credit of NEFT/RTGS amounts in our account. Any change in above furnished information shall be informed to TPCODL well in time at our own. Further, we kept TPCODL indemnified for any loss incurred due to wrong furnishing of above information.

Thanking you,

For \_\_\_\_\_

**(Authorised Signatory)**

**(Signature with Rubber Stamp)**

**Certification from Bank:**

We confirm that we are enabled for receiving NEFT/RTGS credits and we further confirm that the account number (specify Bank a/c no.) of (Please mention here name of the account holder), the signature of the authorised signatory and the MICR and IFSC Code of our branch mentioned above are correct.

This also is certified that the above information is correct as per Bank record

**(Manager's/ Officers Signature under Bank Stamp)**

**ANNEXURE-H**  
**VENDOR APPRAISAL FORM**

<b>TO BE SUBMITTED BY VENDOR (To be filled as applicable)</b>			
<b>VENDOR:</b>			
<b>1.0</b>	<b>DETAILS OF THE FIRM</b>		
	1.1	NAME (IN CAPITAL LETTERS)	:
	1.2	TYPE OF CONCERN (PROPRIETARY) Partnership, Pvt. Ltd., Public Ltd. etc.	:
	1.3	YEAR OF ESTABLISHMENT	:
	1.4	LOCATION OF OFFICE POSTAL ADDRESS TELEGRAPHIC ADDRESSES, TELEX NO. FAX NO.	:
	1.5	LOCATION OF MANUFACTURING UNITS	:
		i) UNITS 1	:
		ii) OTHER UNITS	:
<b>2.0</b>	<b>PRODUCTS MANUFACTURED</b>		
<b>3.0</b>	<b>TURNOVER DURING THE LAST 3 YEARS (TO BE VERIFIED WITH THE LATEST PROFIT &amp; LOSS STATEMENT).</b>		
<b>4.0</b>	<b>VALUE OF FIXED ASSETS</b>		
<b>5.0</b>	<b>NAME &amp; ADDRESS OF THE BANKERS</b>		
<b>6.0</b>	<b>BANK GUARANTEE LIMIT</b>		
<b>7.0</b>	<b>CREDIT LIMIT</b>		
<b>8.0</b>	<b>TECHNICAL</b>		
	8.1	NO. OF DESIGN ENGINEERS (INDICATE NO. OF YEARS EXPERIENCE IN RELATED FIELDS)	:
	8.2	NO. OF DRAUGHTS MEN	:
	8.3	COLLABORATION DETAILS (IF ANY)	:
		8.3.1 DATE OF COLLABORATION	:
		8.3.2 NAME OF COLLABORATOR	:
		8.3.3 RBI APPROVAL DETAILS	:
		8.3.4 EXPERIENCE LIST OF COLLABORATOR	:
		8.3.5 DURATION OF AGREEMENT	:
	8.4	AVAILABILITY OF STANDARDS / DESIGN PROCEDURES / COLLABORATOR'S /	:



		DOCUMENTS (CHECK WHETHER THESE ARE LATEST/CURRENT)	
	8.5	TECHNICAL SUPPORT, BACK-UP GUARANTEE, SUPERVISION, QUALITY CONTROL BY COLLABORATOR (WHEREVER ESSENTIAL). (THIS CLAUSE IS RELEVANT WHEN VENDOR'S EXPERIENCE IS INADEQUATE)	:
	8.6	QUALITY OF DRAWINGS	:
<b>9.0</b>	<b>MANUFACTURE</b>		
	9.1	SHOP SPACE, LAYOUT LIGHTING, VENTILATION, ETC.	:
	9.2	POWER (KVA)	:
		MAINS INSTALLED	:
		UTILIZED	:
		STANDBY POWER SOURCE	:
	9.3	MANUFACTURING FACILITIES (ATTACH LIST OF EQUIPMENT AS APPLICABLE)	:
		9.3.1 MATERIAL HANDLING	:
		9.3.2 MACHINING	:
		9.3.3 FABRICATION	:
		9.3.4 HEAT TREATMENT	:
		9.3.5 BALANCING FACILITY	:
		9.3.6 SURFACE TREATMENT PRIOR TO PAINTING/ COATING, POLISHING, PICKLING, PASSIVATION, PAINTING, ETC.	:
	9.4	SUPERVISORY STAFF	:
	9.5	ADEQUACY OF SKILLED LABOURS (MACHINISTS, WELDERS, ETC.)	:
	9.6	NO. OF SHIFTS	:
	9.7	TYPE OF MATERIAL HANDLED (SUCH AS CS, SS, ETC.)	:
	9.8	WORKMANSHIP	:
	9.9	MATERIAL IN STOCK AND VALUE	:
	9.10	TRANSPORT FACILITIES	:
	9.11	CARE IN HANDLING	:
<b>10.0</b>	<b>INSPECTION / QC / QA / TESTING</b>		
	10.1	NUMBER OF PERSONNEL (INDICATE NO. OF YEARS OF EXPERIENCE)	:
	10.2	INDEPENDENCE FROM PRODUCTION	:

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	10.3	AVAILABILITY OF PROCEDURAL WRITE UP/QUALITY PLAN	:
	10.4	INCOMING MATERIAL CONTROL AND DOCUMENTATION	:
	10.5	RELIABILITY/REPUTATION OF SUPPLY SOURCES	:
	10.6	STAGE INSPECTION AND DOCUMENTATION	:
	10.7	SUB-ASSEMBLY & DOCUMENTATION	:
	10.8	FINAL INSPECTION AND DOCUMENTATION	:
	10.9	PREPARATION OF FINAL DOCUMENTATION PACKAGE	:
	10.10	TYPE TEST FACILITIES	:
	10.11	ACCEPTANCE TEST FACILITIES	:
	10.12	CALIBRATION OF INSTRUMENTS AND GAUGES (WITH TRACEABILITY TO NATIONAL STANDARDS) (ATTACH LIST)	:
	10.13	STATUTORY APPROVALS LIKE BIS, IBR, ETC.(AS APPLICABLE)	:
	10.14	SUB-VENDOR APPROVAL SYSTEM AND QUALITY CONTROL	:
	10.15	DETAILS OF TESTS CARRIED OUT AT INDEPENDENT RECOGNIZED LABORATORIES	:
		i) FURNISH LIST OF TESTS CARRIED OUT AND THE NAME OF THE LABORATORY WHERE THE TESTS WERE CONDUCTED	:
		ii) CHECK AVAILABILITY OF CERTIFICATES AND REVIEW THESE WHEREVER POSSIBLE	:
	<b>11.0</b>	<b>EXPERIENCE (INCLUDING CONSTRUCTION / ERECTION / COMMISSIONING) TO BE FURNISHED IN THE FORMAT INDICATED IN APPENDIX)</b>	:
	<b>12.0</b>	<b>SALES, SERVICE AND SITE ORGANIZATIONAL DETAILS</b>	:
	<b>13.0</b>	<b>CERTIFICATE FROM CUSTOMERS (ATTACH COPIES OF DOCUMENTS)</b>	:
	<b>14.0</b>	<b>POWER SITUATION</b>	:
	<b>15.0</b>	<b>LABOUR SITUATION</b>	:
	<b>16.0 *</b>	<b>APPLICABILITY OF SC/ST RELAXATION (Y/N) IF YES, SUPPORTING DOCUMENTS TO BE ATTACHED</b>	
	<b>17.0</b>	<b>ORGANIZATIONAL DETAILS</b> 1. PF NO 2. ESI NO 3. INSURANCE FOR WORK MAN COMPENSATION ACT NO 4. ELECTRICAL CONTRACT LIC NO 5. ITCC / PAN NO 6. SALES TAX NO 7. WC TAX REG. NO	:
	<b>18.0</b>	<b>DOCUMENTS TO BE ENCLOSED:</b>	

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	<ol style="list-style-type: none"> <li>1. FACTORY LICENSE</li> <li>2. ANNUAL REPORT FOR LAST THREE YEARS</li> <li>3. TYPE TEST REPORT FOR THE ITEM</li> <li>4. PAST EXPERIENCE REPORTS</li> <li>5. ISO CERTIFICATE –QMS, EMS, OHAS, SA</li> <li>6. REGISTRATION OF SALES TAX</li> <li>7. COPY OF TIN NO.</li> <li>8. COPY OF SERVICE TAX NO.</li> <li>9. REGISTRATION OF CENTRAL EXCISE</li> <li>10. COPY OF INCOME TAX CLEARANCE.</li> <li>11. COPY OF PF REGISTRATION</li> <li>12. COPY OF ESI REGISTRATION</li> <li>13. COPY OF INSURANCE FOR WORK MAN COMPENSATION ACT NO</li> <li>14. COPY OF ELECTRICAL CONTRACT LIC NO</li> <li>15. COPY OF PAN NO</li> <li>16. COPY OF WC TAX REGISTRATION</li> <li>17. DOCUMENTS IN SUPPORT OF SC/ST RELAXATION AT S.NO.16.0</li> <li>18. GSTN CERTIFICATE</li> </ol>	
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\* **Classification of BA s under SC/ST shall be governed under following guidelines:**

- **Proprietorship/ Single Ownership Firm:** Proprietor of the firm should be from SC/ST community. Governing document shall be Proprietorship Deed.
- **Partnership Firm:** Only such firms shall qualify which have SC/ST partners holding equal to or more than 50% of the total ownership pattern of the firm. Governing document shall be Partnership Deed.
- **Private Limited Company:** Only such firms shall qualify which have SC/ST directors holding equal to or more than 50% of the total ownership pattern of the firm. Governing document shall be Memorandum of Understanding (MoU) and/or Article of Association (AoA).

*NOTE: Certification from SC/ST Commission shall be required for deciding upon SC/ST status of a person.*

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**ANNEXURE-I**  
**MANUFACTURER AUTHORIZATION FORM**

*(To be submitted on OEM's Letter Head)*

Date: .....

Tender Enquiry No.: .....

To,  
Chief (Procurement & Stores)  
The TP Central Odisha Distribution Limited,  
Bhubaneswar

Sir,

WHEREAS M/s. *[name of OEM]*, who are official manufacturers of ..... having factories at *[address of OEM]* do hereby authorize M/s *[name of bidder]* to submit a Bid in relation to the Invitation for Bids indicated above, the purpose of which is to provide the following Goods, manufactured by us

.....and to subsequently negotiate and sign the Contract.


We hereby extend our full guarantee and warranty in accordance with the Special Conditions of Contract or as mentioned elsewhere in the Tender Document, with respect to the Goods offered by the above firm in reply to this Invitation for Bids.

We hereby confirm that in case, the channel partner fails to provide the necessary services as per the Tender Document referred above, M/s *[name of OEM]* shall provide standard warranty on the materials supplied against the contract. The warranty period and inclusion / exclusion of parts in the warranty shall remain same as defined in the contract issued to their channel partner against this tender enquiry.

Yours Sincerely,


For .....

Authorized Signatory

Contract Ref No.....	THE TATA POWER COMPANY LIMITED TERMS AND CONDITIONS OF CONTRACT	
	PACKAGE.....	

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Contract Ref No.....	THE TATA POWER COMPANY LIMITED TERMS AND CONDITIONS OF CONTRACT	
	PACKAGE.....	

**TERMS & CONDITIONS OF CONTRACT**

**1. SCOPE OF WORK:**


- 1.1 The scope of work under this Contract includes all activities required to complete the Works in accordance with the Specifications, drawings & BOQ which are part of Contract.
- 1.2 Supply of all resources inclusive of, but not limited to, men, materials and machinery, equipment, tools & tackles, scaffolding, formwork, consumables, all enabling activities etc., complete required for above works at each and every stage in time, to adhere to the completion date are included in scope of work unless otherwise specifically stated elsewhere in this agreement.
- 1.3 All temporary facilities required for the Works like site office, stores, employee welfare facilities, labour accommodation & transportation etc are in Contractor’s scope of work.
- 1.4 The entire scope of Contract Works shall be carried out strictly in accordance with the true intent and meaning of the scope of Contract Works, specifications, drawings and BOQ taken together, so that the Contract Works when completed are fit for the intended purposes. All documents comprising the scope of Contract Works and all parts of each of these documents or document mentioned therein are supplementary and complimentary to each other and shall be construed accordingly.

**2. COORDINATION WITH OTHER CONTRACTORS:**

Contractor shall be required to co-operate and co-ordinate with the other Contractors and/or Subcontractor’s working simultaneously at Site at the same premises, and shall maintain harmonious and cordial relations at all times. There shall be no exclusive access for the Contract works, a proper coordination is required from other trade works. Contractor shall take necessary steps to ensure that the equipment and works of Owner, third parties, other contractors including other utility services like water supply pipeline, telephone cables etc are not damaged during execution of Contract Works or otherwise by Contractor or Contractor’s employees, subcontractors, suppliers etc. Contractor shall be responsible for all such damages and shall have to repair/replace and/or compensate for such damages at its own cost and indemnify the Owner for any losses suffered by the Contractor as a result of such damages caused by the Contractor.

**3. TIME OF COMPLETION:**

Time is of the essence in this Contract.  
The starting and completion date of the Work in all respects shall be as per the construction schedule provided elsewhere in the Contract. The Contractor shall strictly adhere to the program and the Owner’s representative(s) shall review the same periodically.

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Contractor shall start his mobilization activities within 7 working days from the date of this agreement/Notice to proceed and intimate the progress to Owner's representative time to time.

**4. COMPLETION OF THE WORKS:**

Completion of the works shall be on the issuance of a Completion Certificate by the Owner to the Contractor. Following minimum criteria shall be fulfilled before issuance of completion certificate.

**4.1 Completion Criteria**

4.1.1 The Contract Works shall be Complete when the following criteria have been satisfied:

- i) Completion of the Works and successful completion of all tests to the satisfaction of Owner in accordance the scope, technical specifications and Contract documents
- ii) Rectification of all punch list items and certification of the same by Owner
- iii) Submission of all As-Built Drawings

**5. CONFIDENTIALITY:**

Contractor shall not, without the previous written consent of Owner's representative, use, copy, publish, disclose or otherwise deal with, nor cause nor permit its sub-contractors, agents, employees, directors, advisors or any persons for whom it is contractually or otherwise responsible for, to use, copy, publish, disclose or otherwise deal with any confidential information, otherwise than for the performance of its obligations under the under the Contract, disclosure to advisors or otherwise as required under the applicable laws or local laws.

**6. CODES AND STANDARDS:**


The work shall be carried out as per the specifications laid down by the consultant. In the absence of the relevant code of practices also, the instructions of the authorized Owner's Representatives and or standard engineering practice shall be adopted. In case of contradictions/conflicts between the specifications, the interpretation of the Owner's representative shall be final and binding on both parties.

**7. PRICE & PAYMENT TERMS:**

7.1 **Price:** The agreed Contract Price and rates as per the price schedule given elsewhere in Contract shall remain fixed till the completion of works.

**7.2 Payment Terms**

- i) Monthly running bill shall be paid based on actual completion of work at site duly certified by Engineer in charge.
- ii) Retention: 10% of the gross value of each Running account (RA) shall be retained as retention money. This retention money shall be released after satisfactory completion of defect liability period.

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- iii) Income tax and any other statutory recoveries as applicable shall be recovered from Contractor monthly running bills and TDS certificate for the deductions shall be furnished.
- iv) All payments shall be made by the Owner to the Contractor within 45 days from the date of receipt of Contractor's error free invoice along with all the back-up documents complete in all respects.
- v) All payments are subject to signing of Contract Agreement and submission of an unconditional EMD cum Contract Performance bank guarantee.

**7.3** Where mode of measurement is not specified in Contract documents/specification, the measurements will be taken at site as per relevant I.S. Code of Practice for Measurements.

**7.4** The Owner/Owner's representative may from time to time intimate to the Contractor that they require the works to be measured and the Contractor shall attend or send a qualified agent to assist the Owner's representative in taking such measurements and calculations and to furnish all particulars or to give all assistance required by either of them. The Contractor shall give all assistance for taking measurements like steel measuring tapes, scaffolds, ladder and including surveyors with surveying instruments for checking and confirming levels.


**7.5** The final bill shall be submitted by the Contractor within 45 days of the date of the certificate of completion furnished by the Owner, otherwise Owner's representative's certificate of the measurement and the total amount payable for the work accordingly shall be final and binding on all parties.

**8. EXTRA/DEVIATED ITEMS:**

**8.1** No extra item shall be carried out without the prior approval from the Owner in writing. Any change in the specification/design resulting in additional expenditure shall be carried out only with the prior approval of the Owner in writing.

**8.2** Extra items approved by Owner shall be paid on the basis of vouchers of cost of materials and labour produced by the Contractor. Vouchers produced for materials, labour, machinery etc. shall be accepted only if such vouchers are as per the prevailing market rates. The Contractor shall be paid 20 percent of the cost of materials, labour and operation of plant and machinery etc. required to execute the item, towards his profit and overhead charges. For such extra work, the Contractor shall maintain time sheets of personnel engaged and machinery used for execution of same and get them certified by the Owner. Only such labour and plant cost based on above records, which in the opinion of the Owner is justified, shall be taken into account to determine the extra item rate.




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**9. TAXES & DUTIES:**

- 9.1 The price & rates quoted by Contractor and as mentioned in the schedule of price shall be inclusive of all taxes, Octroi, statutory clearances, duties, levies etc. Complete for each item.
- 9.2 Contractor shall submit an Income Tax Clearance certificate from the Income Tax department for the period including the past three (3) years.
- 9.3 Contractor shall provide a valid Provident Fund registration number; VAT and service tax registration number and evidence of the same shall be enclosed.
- 9.4 Failure to submit the evidence for the above will entitle the Owner to deduct appropriate tax liability values, Provident Fund values at the applicable rates from approved billing values. Such deductions shall not be refundable to the Contractor.
- 9.5 Any statutory variation in rate of applicable Indian taxes, duties, levies etc., any variation in applicable taxes or interpretation/enforcement of the same or introduction of new taxes or the introduction/amendment of any exemptions (other than Direct taxes i.e. Income Tax, corporate tax etc), levied in India, starting from 2 (two) Days prior to the Closing Date for submission of Bid but within the Guaranteed Completion Date of Works, shall be to the account of the OWNER/PROJECT MANAGER. Such adjustment shall be limited to direct transactions between the OWNER/PROJECT MANAGER and the Contractor and no amounts shall be payable on account of variation on taxes, duties and levies between the Contractor and its sub vendors/Sub-contractors/suppliers.

**10. LABOUR LAWS & INDEMNIFICATION:**

- 10.1 All employees and personnel engaged by the Contractor and approved sub-contractors shall be the employees of the Contractor or such approved sub-contractors, as the case may be and shall not, under any circumstances, be deemed to be the employees or agents or contractors of the Owner. Contractor shall comply with all the applicable laws, including labour related laws of the State Government, Central Government and local authorities as applicable to the place of work. All records to be maintained under these laws shall be maintained by Contractor and produced to the concerned authorities and the Owner as and when directed to do so. No extra payment will be made by the Owner to comply with such laws.  
Contractor shall bear the entire responsibility, liability and risk relating to coverage of his workforce under different statutory regulations including Workmen’s Compensation Act, The Employees Provident Fund Act, The Employees State Insurance Act, Factories Act 1948, the Contract labour Regulation Act 1970 and any other relevant regulations as applicable.  
Contractor shall be solely responsible for the payment of all employee and worker related benefits such as provident fund, bonus etc as applicable as per the various statutory regulations and shall keep Owner indemnified in this regard against any claim by its employees or workmen or sub-contractors.

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[10.2 The Contractor shall be fully responsible for the due compliance by him and his sub-contractors with all statutory requirements and with all applicable labour laws including Contract Labour Abolition and Regulation Act, Workmen’s Compensation Act, P.F./E.S.I., Labour welfare fund, Act as may be applicable to the Contractor, the sub-contractors and their employees. The Contractor shall fully indemnify and save harmless the Owner from and against all claims, demands, expenses, losses, liabilities, charges, actions, suits and proceedings whatsoever including claims under aforesaid Acts and laws which may be brought or made against the Owner, its Officers or servants by reason or in consequence of any matter or thing done or omitted to be done by the Contractor and/ or its sub-contractors and all costs, charges and expenses which may become payable by the Owner in respect thereof.


10.3 Contractor shall fully indemnify, save harmless and defend the Owner & its Representative/s from and against any and all claims, including reasonable legal costs, (collectively the “Damages”), including by third parties in respect of death or bodily injury or in respect to loss or damage to any property (other than the Works, Plant or part thereof not yet taken over) which arises out of or in consequence of the Services whilst the Contractor has responsibility for the care of the Works to the extent resulting from Contractor’s or any Sub-Contractor’s or their agents or employees act, negligence, or strict liability or omission in the performance of the Services hereunder; provided that the foregoing obligation shall not apply to the extent such damages are caused by the intentional acts or omissions of the Owner or Owner’s representative/s.

**11. QUANTITIES:**

11.1 The quantities against various items of work furnished in the Schedule of Quantities are only approximate and are based on preliminary designs. They are meant only for the purpose of having a common base of comparison of various tenders. Prices and rates quoted shall be firm for a variation in the total Contract price by ± 25% (plus or minus twenty five percent) with the provision that quantity of individual items of work may vary to any extent. No additional financial compensation will be payable in this regard.

BIDDER shall furnish percentage extra/rebate over the Contract Price in case variation in the contract price exceeds ± 25%. In case BIDDER does not specify this, the quoted price shall be deemed to remain unaltered for any variation beyond ±25%. No extension of time will be granted in case of increase /decrease of quantities/Contract Price beyond ± 25% due to additional quantities of work to any extent for any or all items of work.

11.2 The quantities of the various kinds of work to be done and materials to be furnished under this Contract which have been estimated and are set forth in the proposal or the Agreement or the Schedule of Quantities and Rates are the best available, but may not be accurate in any or all particulars and are only for the purpose of comparing on a uniform basis the bids offered for the work under this Contract

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- 11.3 The CONTRACTOR agrees that neither the OWNER/PROJECT MANAGER nor the ENGINEER nor any of the employees or agents thereof shall be held responsible if any of the said estimated quantities should be found to be not even approximately correct in the construction of the work and that he will not at any time dispute or complain of such statement nor assert that there was any misunderstanding in regard to the character, size and type of work to be done or the kind or amount of the materials to be furnished or work to be done. Further, the CONTRACTOR shall make no claim for anticipated profits, for loss of profit or for damage because of a difference between the quantities of the various kinds of work to be done or materials actually delivered and the estimated quantities set forth by the OWNER/PROJECT MANAGER or the ENGINEER
- 11.4 The rates/prices quoted by the CONTRACTOR in the schedule of rates/prices shall be fixed irrespective of any variation in the quantities of individual items of work and/or in the total Contract Price unless otherwise specified in the Contract.

**12. RISK AND INSURANCE:**

- 12.1 Contractor shall maintain with respect to the Work to be done under the Contract, in each applicable jurisdiction, all statutory insurance benefits and other insurances required by law.  
Contractor shall be responsible for suitably insuring his entire work force , tools, plant, third party liability at the project site, all risk comprehensive insurance including CAR policy for entire Works under the Contract and any such risk, till the works are complete and handed over. Copies of all such insurances shall be submitted by Contractor to Owner's representative for review. Owner shall be fully indemnified in this respect.
- 12.2 **Liability Limitation:** The Contractor's total liability to the Owner for all matters under or arising out of this Contract, other than the Excluded Matters, is limited to 100% of the Total Contract Value in aggregate. For the purpose of this clause 12.2, "Excluded Matters" shall mean liabilities arising on the Contractor on account of fraud, willful default, reckless misconduct by the Contractor or any regulatory penalties / third party claims that are made on the Owner on account of a breach of this Contract by the Contractor.

**13. MATERIAL STORAGE, LABOUR ACCOMMODATION AND PROTECTION OF THE WORKS:**

- 13.1 Contractor shall take all necessary steps to protect the Contract Works until fully taken over by the Owner. Completion shall be acknowledged by the issuance of a Completion Certificate issued by the Owner.
- 13.2 If available at site, space for material storage may be provided to Contractor, otherwise Contractor to arrange separately for the storage of materials at his own cost.
- 13.3 Contractor shall make all necessary arrangements for the accommodation of Contractor's labourers and personnel outside the site at no cost to the Owner.

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13.4 Contractor shall make all necessary arrangements for transporting labours and workers from the accommodation to the work place at no charge to the Owner.

**14. CONSTRUCTION WATER , POWER AND STAGING:**

14.1 Water and Electricity required for the execution of the works shall be aranged by the Contractor at his own cost.

14.2 It shall be ensured by the CONTRACTOR that work shall proceed uninterrupted even in the event of power failures with the help of DG Sets and Diesel compressors. As such, adequate number of diesel operated machinery (such as boring rigs, concrete mixers, vibrators, welding sets, etc.) shall be provided by the CONTRACTOR it its cost as an alternative arrangement in case electrically operated machinery are proposed to be brought to site.

14.3 Necessary scaffolding for the work is in the scope of the Contractor.

**15. SAFETY & QUALITY:**

**15.1 SAFETY RULES & REGULATIONS**


15.1.1 Contractor shall abide by Health, Safety & Environment policy of Tata Power as mentioned in clause 15.3 below. Also Contractor and his personnel shall follow all safety standards, specifications and practices in construction as per applicable laws and also as instructed by Owner’s Safety In charge. Any violation shall attract penalty as determined by the Owner. All safety appliances and personal protective equipment required such as, but not limited to, safety helmets, safety footwear, safety belts, goggles, hand gloves etc. shall be arranged by Contractor at Contractor's cost. All Contractor works shall be monitored by the Safety engineer of the Owner. If the Owner is aware of any non compliance thereto, then the Owner will not only be entitled to make alternate arrangements for the same but also recover costs and damages for the same plus the Owner’s own charges as deemed fit by the Owner.

Contractor and all Contractors’ personnel shall abide by all safety standards, specifications and practices in construction and also as instructed by Owner’s representative. Contractor is responsible for the safety of Contractor's staff and workmen. Contractor shall be subject to Safety audit at regular intervals.

15.1.2 Contractor shall indemnify the Owner against all claims, proceedings, legal actions etc whatsoever which arise due to Contractor’s failure of following safety rules & regulations as mentioned above.

**15.2 QUALITY OF THE WORKS**

15.2.1 The works carried out by the Contractor shall be of best quality as per industry standard and specifications issued by the Owner. Wherever required, Contractor shall submit

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relevant test certificates for the materials/equipment/machinery/tools supplied/usage. If in any case the material used by the Contractor for the intended work is found defective, then the Contractor must replace the materials within 7 days of such defect notice. If the Works carried out by Contractor are not as per specification or relevant standards, the same shall be entrusted to some other agency at Contractor's risk and cost. The Contractor shall deploy sufficient numbers of dedicated full time quality assurance/quality control engineers at work place.


**15.3 TOTAL COMPLIANCE TO TCOC, SHE AND CSM:**

The Contractor shall abide and comply with Owner Safety, Health & Environment policies, Contract Safety Management (CSM), Sustainability and TCOC manuals / documents as enclosed, in totality.

**15.4 CONSEQUENCE MANAGEMENT FOR SAFETY**

In addition to CSM manual, following to be complied by the Contractor

- i) All Contractors working with Tata Power are to be ISO 14001 / OSHAS certified. In case it is not, Contractor shall obtain ISO 14001 / OSHAS within 6 months of the Effective Date of the Contract.
- ii). Contractors who have obtained OHSAS certification and have achieved 100% safety audit score for compliance will be eligible for 0.25% of the contract value as incentive which shall be payable at the time of closure of the Contract based on overall safety audit score.
- iii). 2% of monthly invoice value shall be retained towards safety assessment. The said payment will be released after the safety audit / performance score is calculated by the Company for the respective month provided there are no safety incidents / violations reported for the Contractor for the respective month after deduction of LDs as enumerated below:
  - a) 1st time violation of safety with severity 4 and 5 (highest severity) - Rs.10,000/- per incident
  - b) 2nd time violation of safety with severity 4 and 5 (highest severity) - Rs.25,000/- per incident
  - c) 3rd time onwards violation of safety with severity 4 and 5 (highest severity) - Rs.100,000/- per incident
- iv). For multiple incidents (more than 5 incident during contract), Project Manager / Site Manager to be changed by the Contractor.
- v). In case of fatality, LD of Rs.5,00,000/- shall be payable by the Contractor.
- vi). The above LDs shall be over and above liabilities including 3rd party claims & liabilities / statutory liabilities arising out of bodily injury or including death whether by accident or otherwise.

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- vii). Contractor shall submit list of tools & tackles with details of make, year of manufacturing, valid certification to the Project Manager/ User for their approval
- viii). Project Manager may during the execution of project inspect & verify that the tools & tackles are as per the qualification requirements approved by him and will have right to seek replacements in case of any discrepancies. The Contractor shall always comply with such directives.
- ix). Safety Committee at Site shall be the sole authority and shall have the sole right to assess the safety performance / audit of the Contractor and their decision on rewards / LDs shall be final and binding on the Contractor. Contractor to note that in case of repeated safety violations / gross violations of Company's Safety Policy, the Contract may be terminated without notice and the Contractor delisted from Tata Power / associates / group companies.

**16. SERVICES AND FACILITIES BY THE OWNER/PROJECT MANAGER:**

The following facilities and services will be provided by the OWNER/PROJECT MANAGER to the Contractor:


- i) Only a base line and one permanent benchmark would be furnished to the Contractor near the site. Surveying and laying out of all works shall be in Contractor's scope. Contractor shall maintain without disturbance during the course of execution of the work the reference line and the workbench mark.
- ii) The Owner will hand over to the Contractor within one week from the date of issue of Letter of Intent some areas, as available at site to enable Contractor to make arrangements for stores, site office, etc. at his own cost. If space provided for storage facilities is not sufficient, the Contractor has to make his own arrangement for space at his own cost outside the plant.

**17. CONTRACTOR'S PERSONNEL:**

Contractor shall engage a Project Manager at site at all times who will be single point of contact for the Works. Contractor shall also engage qualified & experienced Engineers & supervisors at site at all times. Contractor shall also engage a separate Safety officer and Quality incharge and adequate safety stewards for the entire duration of Contract.

**18. PROGRESS OF WORK:**

- 18.1 Within 7 days upon award, the Contractor shall submit an detailed Contract Works program containing all the important milestones in the project to the Owner for approval. The work program shall fulfill the time requirements as stipulated elsewhere in Contract. Such program shall be supported with details of resource deployment.
- 18.2 Contractor has to provide weekly and monthly progress report and progress photographs to the Owner. Contractor shall also submit a resources schedule to the Owner and augment the workforce of equipment as and when required to attain requisite progress of works without any extra cost to Owner.

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**19. WORK IN MONSOON & DEWATERING:**

- 19.1 The construction and erection work may entail working in monsoon also. The CONTRACTOR must maintain a minimum labour force as may be required for the job and plan and execute the construction and erection during monsoon according to the prescribed schedule. No extra rate will be considered for such work in monsoon. During monsoon and other period it shall be the responsibility of the Contractor to keep the construction site free from accumulating of water, at his own cost.
- 19.2 During inclement weather, rains, CONTRACTOR shall suspend concreting for such time as the Owner may direct and shall protect from damage all works already in progress or completed just then. All such temporary protective measures shall be at Contractor's cost and any damage to works shall be made good by the Contractor at his own expense.

**20. DELAYS AND EXTENSION OF TIME:**

- 20.1 The time allowed for carrying out the work as mentioned in the Contract shall be strictly observed by the Contractor.
- 20.2 If the Contractor shall desire an extension of time for completion of work on the grounds of his having been unavoidably hindered in its execution or any other ground, he shall apply in writing to the Owner within 5 days of the date of hindrance on account of which he desires such extension as aforesaid. This application must be accompanied by sufficient documentation giving reasons for seeking such extension. No application for such extension shall be entertained if it is not received in sufficient time to allow the Owner to consider it and the Contractor shall be responsible for the consequences arising out of such negligence. Upon receipt, Owner may accept or reject such application.

In the event of a disruption (other than suspension by Owner) to the Schedule and if in the opinion of Contractor it is not the responsibility of Contractor or its any Sub-contractor and which might have been caused due to action of any third parties which CONTRACTOR might not have reasonably prevented, and that Contract entitles Contractor to time extension and/ or other relief from Owner, the Contractor shall notify the Owner within twenty four (24) hours and provide a written report (to the best of Contractor's knowledge at the time) of the disruption within 72 (Seventy Two) Hours of Contractor's learning of the disruption and such report shall be supplemented on a prudent, informative and timely basis thereafter not later than 14 (Fourteen) Days from the date of Contractor's first learning of such disruption. In such an event the Contractor may modify and resubmit for approval to Owner, computer based network schedule and modifications if any required to the Schedule. Upon receipt, Owner shall take reasonable action in accordance with the Contract.

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Contractor in any case has to inform to Owner immediately upon learning of any possible hindrances to the Works which have caused or may cause delay or other impact to the Works to enable Owner take suitable action.

20.3 The OWNER/PROJECT MANAGER shall have the right to order discontinuance/suspension of the work, in whole or in part, for such time as may be necessary in the opinion of OWNER. In such an event, the OWNER/PROJECT MANAGER will grant such extension of time for completion of the Contract which in its opinion is proper and/or other relief in accordance with Contract in consequence of such delay.

**21. LIQUIDATED DAMAGE:**

In the event that the works are delayed beyond the interim milestone completion date / contractual completion date, Liquidated damage to the extent of 1% of the contract value per week of delay shall be levied, subject to a maximum of 10 % of the total contract value.

**22. STEP IN PROVISION:**

22.1 Should the progress or quality of the works be found to be persistently lesser than that required to complete the works by the Completion Date, following due notification to the Contractor of such progress deficiencies, Owner reserves the right to:

- a) Supplement the resources of the Contractor at Contractor's cost
- b) Remove a part of, or all remaining works from, the Contractor's scope and have the works completed by others at Contractor's risk and cost.

22.2 The Owner shall incur no cost greater than the Contract value in supplementing the Contractor, or completing the works by other means. All cost beyond that of the Contract value shall be borne by the Contractor.

**23. ASSIGNMENT & SUBCONTRACTING:**


Contractor shall not assign or subcontract in part or otherwise any portion of this Contract without prior written approval of Owner.

**24. DEFECTS & WARRANTY:**

Contractor is responsible for defects in the Works for a period of 12 (Twelve) months from the date of Issuance of the Completion certificate issued by the Owner/Project Manager to the Contractor for the Works.

**25. TERMINATION OF CONTRACT:**




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If the Contractor (being an individual or a firm) commit any 'Act of Insolvency', or shall be adjudged as insolvent, or shall make an assignment or composition for the greater part in number or amount of his creditors, or shall enter into a Deed of Assignment with his creditors, or (being an Incorporated Company) shall have an order made against him or pass an effective Resolution for winding up either compulsorily or subject to the supervision of the Court or voluntarily, or if the Official Assignee of the Contractor shall repudiate the Contract, or if the Contractor shall assign or sublet the Contract without the consent in writing of the Owner first obtained, or if the Owner's representative shall certify in writing to the Owner that in his opinion the Contractor,

- i. Has abandoned the Contract, or
- ii. Has failed to commence the works, or has, without any lawful excuse under these conditions suspended the progress of the works for fourteen days after receiving from the Owner written notice to proceed, or
- iii. Has failed to proceed with the works with such due diligence and failed to make such due progress as would enable the works to be completed within the time agreed upon, or
- iv. Has neglected or failed persistently to observe and perform all or any of the acts, matters or things required by this Contract to be observed and performed by the Contractor for seven days after written notice shall have been given to the Contractor requiring the Contractor to observe or perform the same, or

Then and in any of the said causes the OWNER/PROJECT MANAGER with the written consent of the ENGINEER may, notwithstanding any previous waiver, after giving seven days notice in writing to the Contractor, terminate the Contract. Notwithstanding any such termination, the Contractor shall continue to be responsible for all liabilities that have accrued under this Contract prior to the date of such termination. And further, the OWNER/PROJECT MANAGER with the consent of the ENGINEER by his agents or servants may enter upon and take possession of the works and all plant, tools, scaffolding, sheds, machinery, steam and other power, utensil and materials, lying upon premises or the adjoining lands or roads, and use the same as his own property or may employ the same by means of his own servants and workmen in carrying on and completing the works or by employing any other Contractor's or other persons or person to complete the works and the Contractor shall not in any way interrupt or do any act, matter or thing to prevent or hinder such other Contractor or other person or persons employed for completing and finishing or using the materials and plant for the works.

The Owner shall thereafter ascertain and certify in writing under his hand what (if anything) shall be due or payable to the Contractor by the Owner, for the value of the said plant and materials so taken possession of by the Owner, and the expense or loss which the Owner shall have been put to in getting the works to be so completed, and the amount, if any owing to the Contractor and the amount which shall be so certified shall, thereupon, be paid by the Owner to the Contractor or by the Contractor to the Owner as the case may be, and the certificate of the Owner shall be final and conclusive between the parties.

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**26. DISPUTES & ARBITRATION:**

- 26.1 In case any dispute or difference shall arise between the OWNER/PROJECT MANAGER or the ENGINEER on his behalf and the CONTRACTOR arising out of or in relation to or concerning this Contract or the construction, meaning, operation or effect hereof or of any clause herein contained or as to the rights, duties or liabilities of the parties hereto respectively or of the ENGINEER under or by virtue of these presents or otherwise or in connection with the subject matter of these presents or arising out of or in relation thereto (except as to matters left to the sole discretion of the ENGINEER) the same shall be referred to the arbitration of a single arbitrator in case the parties can agree upon one, otherwise, to two arbitrators, one to be appointed by each party and an umpire to be appointed by the two arbitrators before entering upon the references and in either case in accordance with and subject to the provisions of the Indian Arbitration and Reconciliation Act 1996 or any statutory modification or re-enactment thereof for the time being in force. All arbitration proceedings shall be conducted in English language only and the decision of the arbitration tribunal constituted in accordance with the above shall be final and binding upon the parties. Each party to the dispute shall bear its own costs, unless otherwise specified by the arbitration tribunal in its order. The seat and venue of all arbitration proceedings under this Contract shall be Mumbai.
- 26.2 Work under the Contract shall continue during the arbitration proceedings and no payments due or payable by the Owner shall be withheld on account of such proceedings.


**27. LAW, LANGUAGE & MEASUREMENTS**

- 27.1 Applicable law to this Contract shall be the Indian Law. The respective rights, privileges, duties and obligations of the Owner and the Contractor under this Contract shall be governed and determined by the Laws of State , where the project is located and of the Republic of India.
- 27.2 All correspondence and documentation pertaining to this Contract shall be in the English language only. The official text of this Contract shall be English, regardless of any translation that may be made for the convenience of the Parties. All correspondence, information, literature, data, manuals, definitive documents, notices, waivers and all other communication, written or otherwise, between the Parties in connection with this Contract shall be in English.
- 27.3 All measurements shall be in metric system

**28. FORCE MAJEURE:**

**28.1 Definition of Force Majeure**

“Force Majeure” shall mean an event or circumstance beyond the reasonable control of the Owner/Project Manager or the Contactor which could not have been foreseen, prevented or mitigated by such Party using its reasonable diligence and which makes it impossible for such Party to perform the whole or in part its obligations under the Contract, including but not limited to:


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- a) Act of God.
- b) An act of war, (whether declared or undeclared) hostilities invasion, armed conflict or an act of foreign enemies, blockade, embargo, revolution, military action, or sabotage.
- c) Contamination by radio-activity from any nuclear fuel, or form any nuclear waste from the combustion of nuclear fuel, radioactive toxic explosive, or other hazardous properties.
- d) Riot, civil commotion, terrorism or disorder, unless solely restricted to employees of the Contractor or of his Sub-contractors.
- e) Natural or regional industrial disputes or targeted disputes which are part of national or regional campaign and which is not reasonably within the powers of a Party to prevent, or which is not specific to the Party or any of his Contractors or Subcontractors.
- f) Operation of the forces of nature such as earthquake, hurricane, lightning, tidal wave, tsunami, typhoon or volcanic activity.

**28.2 Excused Performance**

If either Party is rendered wholly or partially unable to perform its obligations under this Contract because of a Force Majeure Event, that party will be excused from whatever performance is affected by the Force Majeure event to the extent so affected provided that:

- a) The affected Party gives the other Party Written Notice of the occurrence of the Force Majeure Event as soon as practicable after the occurrence of the Force Majeure Event and also gives the other Party Written Notice describing in reasonable detail the particulars of such occurrence, including an estimation of its expected duration and probable impact on the performance of such Party's obligations hereunder, and thereafter continues to furnish thereto timely regular reports with respect to continuation of the Force Majeure Event;
- b) The suspension of performance shall be of no greater scope and of no longer duration than is reasonably required by the Force Majeure;
- c) No liability of either Party which arose before the occurrence of the Force Majeure Event causing the suspension of performance shall be excused as a result of the occurrence;
- d) The affected Party shall exercise all reasonable efforts to mitigate or limit Damages to the other Party;
- e) The affected Party shall use its best efforts to continue to perform its obligations hereunder and to correct or cure the event or condition excusing performance;

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- f) When the affected Party is able to resume performance of its obligations under this Contract, that Party shall give the other Party Written Notice to that effect and shall promptly resume performance hereunder.

**28.3 Limitations**

Notwithstanding anything to the contrary contained herein:

- a) any act, event, or occurrence listed above or asserted as a Force Majeure Event that results materially from the negligence or intentional acts of the affected party (including in the case of Contractor or any Sub-contractor thereof) shall not constitute a Force Majeure Event; and
- b) The affected Party shall not be relieved from obligations under this Contract to the extent that the negligence or wilful misconduct of the affected Party (or in the case of Contractor or any Sub-Contractor thereof) contributes to or aggravates the Force Majeure Event.

**28.4 Effect of Force Majeure Event**

Neither the Owner/Project Manager nor the Contractor shall be considered in default or in Contractual breach to the extent that performance of obligations is prevented by a Force Majeure Event, which arises after the Effective Date. Except as otherwise provided in a Change Order, an extension of time shall be granted to Contractor only to the extent Contractor proves to Owner/Project Manager:


- a) The performance of the Work or supply of Goods is actually and necessarily delayed by an event of Force Majeure; and
- b) The effect of such event of Force Majeure could not have been prevented or avoided or removed despite exercise of reasonable due diligence whether before, after or during the event of Force Majeure.

**28.5 Payment to Contractor**

If, in consequence of Force Majeure, the Plant or any part thereof shall suffer loss or damage, the Contractor shall be entitled to claim and receive payment for the cost of Work or supply of Goods executed in accordance with the Contract, prior to the event of Force Majeure.

**28.6 Optional Termination, Payment and Release**

Irrespective of any extension of time, if a Force Majeure Event occurs and its effect continues for a continuous period of [180 days], the Owner/Project Manager may give to the other a Notice of termination, which shall take effect 30 (thirty) Days after the giving of the Notice. If, at the end of the 30 (thirty) Day period, the effect of the Force Majeure Event continues, the Contract shall terminate. If the Contract is so terminated, the Owner/Project Manager shall determine the work done and pay to the Contractor all amounts due and payable for such work.

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**29. CHANGE:**

A Change Order shall be issued by the Owner in accordance with this clause, when Owner proposes to make any change in the Scope, Services, the Contract Price, the Performance Guarantees and/or the Schedule.

**29.1 Further detailing not a Change Order**

Contractor’s performance of Services shall be subject to further detailing from time to time and Contractor shall receive no additional compensation for such detailing to the extent that such detailing does not constitute a Change Order.

No change made necessary because of any default of the Contractor in the performance of its obligations under the Contract shall be deemed to be a Change, and such change shall not result in any adjustment of the Contract Price or the Time for Completion.

**29.2 Right to Change Order**


Change Orders may be initiated by the Owner/Project Manager/Owner’s Representative at any time during the Contract Period, either by instruction or by a request (the “Change Order Notice”) to the Contractor to submit a proposal. If the Owner/Project Manager/Owner’s Representative requests the Contractor to submit a proposal and subsequently elects not to proceed with the change, the Contractor shall not be reimbursed for the Cost incurred for proposal.

The Contractor shall not make any alteration and/or modification of the Services unless and until the Owner/Project Manager/Owner’s Representative instructs or approves a Change Order in Writing.

**29.3 Change Order Procedure**


If the Owner/Project Manager/Owner’s Representative issues a Change Order Notice, the Contractor shall submit a proposal addressing proposed design and/or work to be performed with supporting details, any modification to the schedule as a result of the change and adjustment in Contract price, within fifteen (15) Days or any other period as mutually agreed:

- 29.3.1 The Owner/Project Manager/Owner’s Representative shall respond with approval, rejection or comments within a period to be mutually agreed after receipt of such proposals.
- 29.3.2 If the Owner/Project Manager/Owner’s Representative instructs or approves in Writing a Change Order, he shall proceed with adjustments to the Contract Price, Schedule of Payments, Performance Guarantees as required.
- 29.3.3 Contractor shall not suspend performance of this Contract during review and negotiation of any Change Order, except as may be directed by Owner/Project Manager or required by Applicable Law.
- 29.4 Payment in respect of the approved Change Orders shall be released by Owner/Project Manager to the Contractor on satisfactory completion of such Change Order and its certification by the Owner’s Representative in the same manner as applicable to corresponding milestone payments under the Contract.

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**30. MISCELLENIOUS:**

- 30.1 Site conditions has been made clear to the Contractor during tendering stage and the Contractor has understood the scope of work, hence, no claims of whatsoever nature shall be entertained by the Owner on account of any such reason cited by the Contractor at later date. It also understood that the Contractor has inspected the site of work, has fully acquainted himself with site conditions and has obtained for himself on his own responsibility and at his own expenses all information which may be necessary for execution of work.
- 30.2 In case work is nearly or is anticipated to be suspended by Contractor, or in case only unimportant progress is being made, or in case it is apparent that the CONTRACTOR is about to forfeit his Contract or that the money yet due to him will not complete his Contract, the Owner may, at his discretion, withhold any payment which may be due to the CONTRACTOR.
- 30.3 No claims shall be entertained on account of idle time charges.
- 30.4 The work shall be carried out with due diligence and all work shall be executed in a workman like manner subject to the approval of the Owner (or any other duly authorized representative of the Owner) whose decision as to rate of progress and quality of work or material shall be final and binding.
- 30.5 The Owner shall have right to omit or cancel, add or alter any items of work without assigning any reason whatsoever and no claim for compensation for damage will be entertained for such omissions, alterations, additions and cancellations.
- 30.6 The Contractor has to maintain the pollution limits to the minimum. The Contractor shall in advance intimate to Owner and other related Contractors about the areas of work which may be subjected to pollution, dust or noise and shall take proper pollution and dust control measures to prevent dust from rising as a result of pile boring or other such activities
- 30.7 Upon completion of work, the Contractor shall promptly demobilise from the site and leave the place in a manner as directed by the Owner, including cleaning of the area. CONTRACTOR shall start demobilisation only after the successful completion of the contract. No equipment, plant material or personnel shall be de-mobilised from the site unless with the express consent of the OWNER's Project Manager. The OWNER reserves the right to disallow in de-mobilisation if works under this scope of this contract are not completed to his satisfaction.
- 30.8 The Contractor is normally expected to work during daytime only and is required to complete the work in all respects as stipulated elsewhere. However, night work or working on Holidays may be stipulated by the Owner or permitted in exigencies with

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prior approval of the Owner. Sufficient lights shall be provided by the CONTRACTOR to safeguard the workmen and the public when the night work is in progress.

- 30.9 No claims for extra works shall be entertained unless such extra works are agreed to in writing by the Contractor's Representative.
- 30.10 The Contractor is responsible for safety and security of the works executed by him under the Contract.
- 30.11 The Contractor to obtain at his own cost all Material entry permits to the state (Road Permits), statutory work permits and responsible for safe working procedures at sites, safety of men and machineries.
- 30.12 Day to Day debris cleaning and housekeeping is in the scope of the Contractor and no extra charges shall be paid for the same.

Date.....

## CORPORATE ENVIRONMENT POLICY

**Tata Power is committed to a clean, safe and healthy environment, and we shall operate our facilities in an environmentally sensitive and responsible manner. Our commitment to environmental protection and stewardship will be achieved by:**

- Complying with the requirements and spirit of applicable environmental laws and striving to exceed required levels of compliance wherever feasible
- Ensuring that our employees are trained to acquire the necessary skills to meet environmental standards
- Conserving natural resources by improving efficiency and reducing wastage
- Making business decisions that aim towards sustainable development
- Engaging with stakeholders to create awareness on sustainability



(Praveer Sinha)  
CEO & Managing Director

Date: 15<sup>th</sup> June, 2018





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# Safety Terms and Conditions

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## 1. Definitions

- 1.1 **Order Manager:** Order Manager is the Tata Power representative, who has the ownership of the given job under the signed contract.
- 1.2 **Service Provider/Contractor/vendor:** An individual or an organization that provides services to Tata Power under a signed contract.
- 1.3 **Site Safety Management Plan:** It is the safety plan agreed between Contractor /service provider & Tata Power. It will contain the entire job specific safety requirement and will be signed by the service provider.
- 1.4 **High Risk Job:** Any job which has significant health and safety risk associated to it. The list of high risk jobs has been identified at Tata Power level.
- 1.5 **Emergency:** a serious, unexpected, business discontinuity and often dangerous situation resulting loss of revenue/property and requiring immediate action.

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## 2. Safety Policy



### HEALTH AND SAFETY POLICY

Tata Power is committed to provide safe and healthy working environment for the prevention of work related injuries and ill-health. Safety is one of our core values. We strive to be a leader in safety excellence in the global power and energy business. In pursuit of this, we are committed to the following:


- Maintain and continually improve our management systems to eliminate hazards and reduce health & safety risks to all our stakeholders.
- Incorporate appropriate health & safety criteria into business decisions for selection of plant and technology, performance appraisal of individuals and appointments in key positions.
- Comply and endeavour to exceed all applicable health & safety legal and other requirements
- Integrate health & safety procedures and best practices into every operational activity with assigned line-functional responsibilities at all levels.
- Involve our employees and business associates in maintaining a safe and healthy work environment through consultation and participation
- Inculcate safety culture by visible leadership and empowerment.
- Ensure required competency to enable our employees and business associates for working safely.
- Promptly report incidents, investigate, share crucial learnings and prevent recurrences.
- Influence our business associates in enhancing their health and safety standards and align with Tata Power's health & safety codes and practices.
- Set safety & health metrics as indicators of excellence, monitor progress and continually improve health and safety performance.

We shall ensure the availability of appropriate resources at all times to fully implement and communicate this policy to all stakeholders by suitable means and periodically review its relevance in continuously changing business environment.

Date: 11<sup>th</sup> March, 2019  
  
 Lighting up Lives!

  
 (Praveer Sinha)  
 CEO & Managing Director



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### 3. Safety Organization & Responsibilities

#### 4.1 Contractor Site Management and Supervision

**Each Contractor will be responsible for fulfilling all statutory and safety requirements as per the laws of the land and not limited to Factory Act, Electricity Act, Electricity Rules and Regulations, Shop and Establishment Act etc.**

Each Contractor shall provide at least one competent full time safety supervisor for workforce of less than 100 numbers. When workforce ranges from 100 to 1000, the contractor has to provide at least one qualified safety officer and safety supervisors (reporting to the safety officer) in the ratio 1:100. For every 1000 addition in workforce, the contractor has to add 1 safety officer. The Tata Power Project Safety Manager will review and approve the appointment of all safety supervisors. Contractor/Subcontractor safety supervisors/officers will work with Tata Power Safety Managers and align themselves with Tata Power safety requirements.

Each Contractors'/Subcontractors' Site Manager is responsible, and will be held accountable, for the safety of their sub contractors and workforce and for ensuring that all equipment, materials, tools and procedures remain in safety compliance at job site, including:

- 4.1.1 Holding officer/supervisors accountable for safety and actively promote safe work performance.
- 4.1.2 Participate in and cooperate with all safety program requirements to be implemented in order to meet Tata Power safety objectives.
- 4.1.3 Ensure timely reporting of safety incidents, near misses, unsafe acts and conditions.
- 4.1.4 Identify the training needs of its employees and maintain all safety training documents.
- 4.1.5 Provide safety performance report at an agreed frequency.
- 4.1.6 Stopping of unsafe work (acts and/or conditions) immediately, until corrective action be taken.

#### 4.2 Contractor Supervisors and General Staff

Contractors' site supervisors and general staff members in charge of job site functions such as field engineering, warehousing, purchasing, cost and scheduling, etc. are responsible for the safe performance of the work of those they supervise. They must set an example for their fellow employees by being familiar with applicable sections of the Site Safety program and ensuring that all site activities are performed with SAFETY as the primary objective.

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Each site supervisor is responsible and will be held accountable for identifying, analyzing and eliminating or controlling all hazards through implementation of an aggressive, pro-active Health, Safety and Environmental Program from project inception through project completion. Each supervisor will proactively participate in the SHE program by observing, correcting unsafe acts, and recording these observations.

#### **4.3 Contractor Workforce**

Contractor workforce must make safety a part of their job by following safety rules and regulations and by using all safeguards and safety equipments. They must take an active part in the Site Safety program to ensure their own safety and injury-free employment as well as being alert to unsafe practices of their fellow employees.

Every member of the workforce is expected to report for work without influence of any Drug/Alcohol. All employees are expected to report any hazardous conditions practices and behaviors in their work areas and correct where ever possible.

Workforce is responsible for active participation in safety and health programs, suggestion systems, trainings and in immediate reporting of all injuries, any unsafe practices, conditions or incidents to their supervisors.

#### **4.4 Vendor/Contractor**

Vendors/Contractor shall at all times comply with, and ensure that their workforce comply with all site safety rules and regulations. Specifically, with applicable provisions of the Tata Power Site Safety Management Plan, and all statutory safety rules and regulations.

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#### **4. Site Safety Rules and Procedures:**

The work in the safest possible manner can only happen when it has been carefully planned and all applicable procedures are followed. The Tata Power Safety Procedures are derived from Tata Power best practices and the applicable Government acts regulations. In each case, the most stringent regulation is used.

Following is the list of Tata Power’s critical Safety Rules and Procedures. Contractor shall refer to approved Rules and Procedures for detailed requirements and ensure conformance.

##### **5.1 Lock Out and Tag Out Procedure**

This procedure is intended to be used for the protection of Personnel while servicing or performing maintenance on equipment / pipeline / vessel / process systems. This is a general procedure that shall be used as the minimum requirements for isolation of equipment, pipelines, machines, system from all possible sources of hazardous energy and / or material such as Steam, Hot Water, Compressed Air, any other process fluid / chemical energy /Mechanical energy or Electrical energy. For complete procedure kindly refer Procedure Document No. TPSMS/CSP/LOTO/001 REV 01 available on official website of Tata Power ([www.tatapower.com](http://www.tatapower.com))

##### **5.2 Excavation Safety (Shoring and Sloping) Procedure**

This procedure is developed to cover the safe practices required for shoring and sloping in excavation and trenching jobs. This procedure is developed to establish mandatory requirements for practices to protect personnel, property and equipment from hazards associated with above activities. For complete procedure kindly refer Procedure Document No TPSMS/CSP/EXS/002 REV 01 available on official website of Tata Power ([www.tatapower.com](http://www.tatapower.com))

##### **5.3 Confined Space Entry Procedure**

This procedure outlines the steps required to perform the confined space entry and to protect personnel from the hazards of entering and conducting operations in confined spaces. For complete procedure kindly refer Procedure Document No –TPSMS/CSP/CSE/003 REV 01 available on official website of Tata Power ([www.tatapower.com](http://www.tatapower.com))



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#### **5.4 Working at Height Procedure**

This procedure describes the rules and procedures to protect employees from the hazards of working at heights.

This procedure is developed to cover the safe practices required for Working at Heights. This procedure is developed to establish mandatory requirements for practices to protect personnel from hazards associated in this area. For complete procedure kindly refer Procedure Document No –TPSMS/CSP/WAH/004 REV 01 available on official website of Tata Power ([www.tatapower.com](http://www.tatapower.com))

#### **5.5 Heavy Equipment Movement Safety Procedure**

Heavy equipment lifting and movement is an activity involving loading, unloading, storage and movement from one place to another including lifting and erection or repairing of equipment with cranes or hoists. Material, machinery and equipment handling operations are being carried out by large capacity cranes and hoists, which make the job safer and faster. This procedure addresses the hazards and precautions associated with such equipment and their use. For complete procedure kindly refer Procedure Document No –TPSMS/CSP/HEMS/005 REV 01 available on official website of Tata Power ([www.tatapower.com](http://www.tatapower.com))

#### **5.6 Mobile Crane Safety Procedure**

Mobile cranes are responsible for many incidents, injuries. Falling loads from mobile cranes pose a severe hazard to operators and nearby workers and property. Many types of cranes, hoists, and rigging devices are used for lifting and moving materials. To maintain safe, appropriate standards has to be adhered to and only qualified and licensed individuals shall operate these devices. For complete procedure kindly refer Procedure Document No –TPSMS/CSP/MCS/006 REV 01.

#### **5.7 Scaffold Safety Procedure**

This procedure is developed to provide information on the safe erection, use, dismantling and maintenance of access scaffolding in the workplace. It is developed to establish mandatory requirements for practices to protect personnel from hazards associated with erection, use and dismantling of scaffolds. For complete procedure kindly refer Procedure Document No –TPSMS/CSP/SCAF/007 REV 01 available on official website of Tata Power ([www.tatapower.com](http://www.tatapower.com))

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### **5.8 Electrical Safety Procedure**

The objective of these standards is to specify minimum mandatory requirements and advisory guidance for identifying and controlling hazards to ensure 'Zero Harm' with regard to operation maintenance and testing of electrical equipment. For complete procedure kindly refer Procedure Document No- TPSMS/CSP/ELEC/010 REV 01 available on official website of Tata Power ([www.tatapower.com](http://www.tatapower.com))

### **5.9 Job Safety Analysis (JSA) Procedure**

This objective of this procedure is to have a task based risk assessment process in place that identifies, evaluates and controls the risks associated with work activities, and as a result, prevents those involved in the task or those potentially affected by the task, from being harmed. For complete procedure kindly refer Procedure Document No- TPSMS/CSP/JSA/009 REV 01 available on official website of Tata Power ([www.tatapower.com](http://www.tatapower.com))

### **5.10 Fire Safety Management Procedure**

Objective of This standard is to specify the minimum mandatory requirements and advisory guidelines to ensure prevention of fire related incidents and managing / controlling their impacts if they do occur. For complete procedure kindly refer Procedure Document No- TPSMS/CSP/FSM/011 REV 01

### **5.11 Permit To Work Procedure**

Given the inherent hazards of the power generation and distribution industry, a significant number of TATA POWER operations and installations are critical. Work Permit (WP) System is an essential element in controlling the workplace risks in an effective manner. For complete procedure kindly refer Procedure Document No –TPSMS/CSP/PTW/008 REV 01 available on official website of Tata Power ([www.tatapower.com](http://www.tatapower.com))

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### **5.12 Lift (Elevator) Safety Procedure**

To provide safe operating procedure for taking control of lift car before entering and existing the pit of OTIS make elevators. For complete procedure kindly refer Procedure Document No – TPSMS/GSP/LIFT/001 REV 01 available on official website of Tata Power ([www.tatapower.com](http://www.tatapower.com))

### **5.13 Working on conveyor belt Procedure**

This procedure is developed to cover the safe practices required for Working on live equipment and to protect personnel from hazards associated with it. For complete procedure kindly refer Procedure Document No – TPSMS/GSP/CONV/002 REV 01 available on official website of Tata Power ([www.tatapower.com](http://www.tatapower.com))

### **5.14 Handling Hazardous Materials Procedure**

This Procedure is developed to provide procedure for recycling and / or safe disposal of used / waste batteries in compliance with all legislation. For complete procedure kindly refer Procedure Document No-TPSMS/GSP/HAZM/003 REV 01 available on official website of Tata Power ([www.tatapower.com](http://www.tatapower.com))

### **5.15 Material Handling and Storage Procedure**

The purpose of this document is to provide procedures to assist the safe handling of materials (manual handling and mechanical handling). For complete procedure kindly refer Procedure Document No – TPSMS/GSP/MATL/004 REV 01 available on official website of Tata Power ([www.tatapower.com](http://www.tatapower.com))

### **5.16 Contractor Safety Management Procedure**

The purpose of this document is to engage with contractors in a way to create safe work environment for everyone working for Tata Power. For complete procedure kindly refer Procedure Document No – TPSMS/GSP/CSM/015 REV 01 available on official website of Tata Power ([www.tatapower.com](http://www.tatapower.com))

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The above procedures will be updated periodically and the updated version of the procedures as well as any additional critical procedure will be available on official website of Tata Power ([www.tatapower.com](http://www.tatapower.com)) for your reference.

## 5. Training and Capability Building

Safety Training and capability building of workforce is a major component of safety management program. All training required must be provided and documented as specified by Tata Power and Indian Regulations. Tata Power Safety Manager will audit contractors training and related documentation to assure its adequacy.

### 6.1 Tata Power Site Safety Orientation

All Tata Power contractor and subcontractor workforce is required to attend Tata Power Site Safety Orientation Training to receive a Safety Training Card, which is required to obtain a Gate Pass to the site, prior to entry.

This Safety Orientation Course will be for duration of minimum half day. The information provided during the orientation will include, but is not limited to following:


1. Job rules, personal safety and conduct
2. Hazards reporting
3. Reporting of injuries
4. Emergency procedures
5. Safety Activities and Program including disciplinary measure and incentives.
6. Critical safety procedure relevant to the job

### 6.2 Capability Building

Appropriate training such as L1, L2 & L3 is given to ensure that a jobholder, either supervisor or worker, is competent to do his/her job safely. The skill training is provided through TPSDI and other agencies authorized by Tata Power on the list of 15 procedures mentioned under safety procedure.

Contractor shall ensure that concerned workmen are provided with adequate training before he/she is allowed to execute the work.

An evaluation test will be conducted after the completion of the training. Those workmen employee who meet the minimum required competency will be provided with Gold Card which is valid for 3 years, post which the workmen has to reappear for the assessment. If the workman is not able to qualify the assessment, he/she will be given 3 additional attempts to clear in 3 month timeframe failing which he/she will not be allowed to work on high risk jobs.

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## 6. Pre Employment and Periodic Medical check up

Contractor shall arrange to conduct a pre employment and periodic medical check-up for its entire workforce by Tata Power medical officer or Tata Power authorized medical officer. The contractor shall be able to produce the certificate prior to the employment. The contractor shall also organize to conduct periodical medical checkup (six monthly) for the following category of employees:

- Drivers (Check for Vision & Hearing)
- Equipment Operators (Check for Vision & Hearing)
- Workforce working at Height (Check for Vision, Hearing, Vertigo & Height Phobia)
- Workforce Handling the hazardous substances (Coal, ash and chemicals)
- Workforce in high decibel area (> 90 Decibel, Check for Hearing)
- Workforce, working in specific areas requiring specific medical attention should conduct the medical test as laid down in the respective Site Safety Management Plan.

## 7. Safety Performance Evaluation and Penalties

8.1 A certain percentage of the bill value will be retained against every running bill as safety performance retention. The amount will be released with the last invoice based on “Safety Performance score” attached in CSM-F-3 of CSM procedure. The amount is based on following table

Contract Value	Retention Amount(%)
Upto 10 Lakhs	2.5
10 – 50 lakhs	2
0.5 to 10 Cr	1.5
>10 Cr	1

8.2 Safety performance Score will be monitored by the Order Manager every month.

8.3 For the contract value of more than Rs 1 Cr or contract duration more than 12 months, the retention amount shall be released half yearly based on safety performance. For all remaining contracts, the retention amount will be released with the final bill.

8.4 In case of job stoppage due to safety violations/ unsafe observations at the site, no time extension shall be given to the contractor, if such delays are attributable to contractor.

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- 8.5 In case of fatality, limb loss or loss of property, vendor has to pay for liability, legal, statutory and additional mutually agreed settlement charges imposed by the appointed committee. This charge is over and above the retention amount.
- 8.6 The committee will finalize an amount between 5 -50 lakhs based on factors such as advise by statutory authorities, contract value and impact of accident etc.
- 8.7 Safety performance bonus 1% (limiting to 50 lakhs) of the invoice value will be considered at the end of the job if the contractual safety performance score is 100%.
- 8.8 During the progress of the work, concerned Supervisor/Engineer will visit and inspect the work site regularly and evaluate the safety performance of the contractor based on matrix attached herewith.
- 8.9 Order Manager, divisional chief and SBU head have the authority to terminate the contract in case of three consecutive serious violations.

#### Safety Performance Evaluation - CSM-F-3

	<b><u>Lead Indicators</u></b>	<b>Unit Of measurement</b>	<b>Target</b>	<b>weight age</b>
1	% of Employee certified in TPSDI/Authorized agency	%	50	10
2	CFSA score (Annexure 6.1)	Average Severity of Violations	1.49	20
3	Monthly inspection completed for Critical Equipments, lifting Tools & Tackles and hand tools used at site	%	80	5
4	Condition of tools, tackles and equipments	%	100	15
	<b><u>Lag Indicators</u></b>			
1	Number of Fatalities	No.	0	30
2	Number of Lost work day case ( LWDC)	No.	0	10
3	Man-days Lost	No.	0	10

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In addition to above evaluation criteria, for specific violations penalty shall be imposed on the contractors under following circumstances:

Sr No	Description of violation	Severity	Penalty /
1.	Working without Permit	5	5000/-
2.	Untrained (TPSDI) worker on high-risk jobs.	5	5000/-
3.	Unhygienic/Bad condition of PPE	2	250/-
4.	Not following Tata Power Procedure & Standard	4	2000/-
5.	Unsafe Act/Condition of Severity 4	4	2000/-
6.	Unsafe Act/Condition of Severity 5	5	5000/-
7.	No Earthing of Electrical equipment	5	5000/-
8.	Damaged welding cable	5	5000/-
9.	Violation of Positive Isolation Procedure ( LOTO Not followed )	5	5000/-
10.	ELCB of more than 30 mA/ELCB not working	5	5000/-
11.	On/Off switch of welding m/c not working	5	5000/-
12.	Electric cable tied with metal wire	5	5000/-
13.	Leakage found DA hose / cylinder	5	5000/-
14.	Use of LPG	5	5000/-
15.	Use of Three-wheeler at the work site.	5	5000/-
16.	Starting the job without Tool Box Talk	5	5000/-
17.	Splatter falling on DA hose / Gas-line/ pathways / Equipment	5	5000/-
18.	No safety latch in crane hook	5	5000/-
19.	Load raised or swung over people or occupied areas of buildings	5	5000/-
20.	Persons standing in swing area of construction equipments.	5	5000/-
21.	Using damaged slings.	5	5000/-
22.	Unstable scaffolding/non standard Scaffolding in use	5	5000/-
23.	Handrails and mid-rails are missing	5	5000/-
24.	Safety Harness not anchored with lifeline/fixed structure	5	5000/-
25.	Fall arrestor not provided/ Not being used.	5	5000/-
26.	Double life line not used for working at height	5	5000/-
27.	No rubber mat in DB room	4	2000/-
28.	Water found accumulated in DB room/near welding machine.	4	2000/-
29.	Inserting electric cables into socket, without using plug.	4	2000/-
30.	Use of damaged electrical cable/two core cables.	4	2000/-
31.	Inflammable material found in D.B Room./ welding areas.	4	2000/-
32.	Loose material falling into excavated pit	4	2000/-
33.	Water logging into excavated pit	4	2000/-
34.	No / inadequate Barricade	4	2000/-

Sr No	Description of violation	Severity	Penalty /
35.	Undercut / cave-in found on sides of excavated pits	4	2000/-
36.	Grinding wheel/ Coupling/ Piling winch/other rotating parts without guard	4	2000/-
37.	The HMV/Mobile Crane operator does not having a valid HMV driving license.	4	2000/-
38.	The loading area is not leveled properly.	4	2000/-
39.	Ladder not anchored at top	4	2000/-
40.	Opening found in working platform of scaffolding/floor	4	2000/-
41.	Inadequate illumination at the working area	4	2000/-
42.	Loose material lying on Gantry ,platform	4	2000/-
43.	Cleaning body with Compressed Air.	3	500/-
44.	Gas Cylinders using without cap.	3	500/-
45.	Gas Cylinders stored without securing	3	500/-
46.	Bringing inside any other chemicals, apart from approved by Safety dept.	3	500/-
47.	Using drum for sitting or accessing height.	3	500/-
48.	Misusing emergency facilities like fire hydrant line/ hose box/ spray system/ eye wash etc.	3	500/-
49.	No provision of Safety net where falling materials or tools may occurs	3	500/-
50.	Taking electrical supply from non designated outlet (other than socket).	3	500/-
51.	Restricted gangways due to unwanted materials.	3	500/-
52.	Not reporting incident.	3	500/-
53.	Entering into restricted area like switch yard/ hazardous storage etc.	3	500/-
54.	Work without supervision	3	500/-
55.	Parking of vehicle without applying wheel choke at right front-front and left rear-rear wheels other than passengers cars.	3	500/-
56.	Vehicle without helper or co-driver.	3	500/-
57.	Not wearing florescent safety jacket at site.	3	500/-
58.	People travelling in load body of vehicle.	3	500/-
59.	Parking of vehicles at non designated area.	3	500/-
60.	Shifting heavy materials without guide ropes.	3	500/-
61.	Using other than 24V lamp inside the confined space/Use of other than 24V lamps.	3	500/-
62.	Angular/ starch loading/ lifting with Crane or hoist.	3	500/-
63.	By passing the limit switch/ Safety Interlock.	3	500/-
64.	Housekeeping activities on road without proper barricade.	3	500/-



Sr No	Description of violation	Severity	Penalty /
65.	Trying to board or alit from running vehicle.	3	500/-
66.	Cylinder Valves of Gas cylinders not closed when not in use.	3	500/-
67.	Flash-back arrester not used.	3	500/-
68.	Trolley wheel found damaged.	3	500/-
69.	Guy ropes of required length on both sides of object are not used during movement with load.	3	500/-
70.	Scotch block/wedge not provide when the vehicle is parked.	3	500/-
71.	Suitable Trolley not provided to hold the cylinders.	3	500/-
72.	Locked First Aid box	3	500/-
73.	Caution boards, danger signs (luminescent /red) along with emergency contact number are not found displayed.	3	500/-
74.	Person found jumping barricading tape	3	500/-
75.	Stacking of pipes, pile casing , drums without chock blocks/wedges	3	500/-
76.	The terrain on which Heavy Equipment/Machinery moves is not reasonably hard.	3	500/-
77.	Without Safety Helmet at working sites	4	250/-
78.	Without Crash Helmet (on bikes)	4	500/-
79.	Without Full body double lanyard Safety Harness (for work at height)	5	5000/-
80.	Without Hand gloves - Material Handling, Welding, Cutting,	4	100/-
81.	Without Safety goggles/ face shield - Welding/Cutting /Grinding	5	5000/-
82.	Handling Chemical without PVC Apron	5	5000/-
83.	Smoking in prohibited area (Closed Go-downs, Storage of flammable material, Storage of Gas cylinders)	5	1000/-
84.	Sleeping at Work Place	3	100/-
85.	Driving beyond speed limit	3	1000/-
86.	Seat Belt While Driving (for front seat passengers and driver)	3	500/-
87.	Driving without license	4	1000/-
88.	Heavy Commercial vehicles without reverse horn	3	500/-
89.	Non functional Head light/ tail light and side indicators	3	100/-
90.	Using Mobile Phone During Driving	5	5000/-
91.	Poor visibility of registration number/ without registration number	3	100/-
92.	Broken/ without Side view mirror	3	100/-
93.	Over speeding above specified limit	3	500/-
94.	Broken/ Without Pressure gauge on Oxygen/ LPG / Acetylene cylinder.	3	500/-

<b>The Tata Power Company Ltd</b>		<i>Safety Terms and Condition</i>
<i>Document No. TPSMS/GSR/STC/009 REV 02</i>		<i>Date of Issue: 19/09/2019</i>

<b>Sr No</b>	<b>Description of violation</b>	<b>Severity</b>	<b>Penalty /</b>
95.	Without Flash back arrestor on Industrial Acetylene & Oxygen cylinders.	5	5000/-
96.	Spillage of hazardous material/chemicals during transportation	4	2000/-
97.	Electrical equipment without Earthing/ ELCB/ Double Insulation Cable.	5	5000/-
98.	Lifting Tools & Tackles used without/ expired Test Certificates.	5	5000/-
99.	Housekeeping repeatedly not maintained		
100.	• First Time	3	Warning
101.	• Second Time	4	1000/-
102.	• Third Time	5	5000/-
103.	Serious Violation Of House Keeping (after 1 <sup>st</sup> or 2 <sup>nd</sup> warning to be decided by Project Manager depending on the severity)		Rs.10000/- and above
104.	Repeat Violation of same nature	5	5X Violation

## HEALTH AND SAFETY POLICY

**We, at Tata Power, reaffirm our belief that the health and safety of our stakeholders is of the utmost importance and takes precedence in all our business decisions. In pursuit of this belief and commitment, we strive to:**

- Maintain and proactively improve our management systems to minimize health and safety hazards to our stakeholders and all others influenced by our activities.
- Comply and endeavour to exceed all applicable occupational health & safety legal and other requirements by setting the highest standards.
- Integrate health & safety procedures and best practices into every operational activity with assigned line-functional responsibilities at all levels, for improving and sustaining health & safety performance.
- Involve our employees in maintaining a safe and healthy work environment through risk assessments, periodic reviews of operational procedures, safe work methods and adoption of new technology.
- Develop a culture of safety through active leadership and provide appropriate training at all levels to enable employees developing their skills to work safely.
- Incorporate appropriate health & safety criteria into business decisions for selection of plant and technology, performance appraisal of individuals and appointments in key positions.
- Ensure availability at all times of appropriate resources to fully implement the health & safety policy of the company.
- Promptly report incidents, investigate for root causes and ensure lessons learnt shared and deployed across the company.
- Ensure service providers and their workmen align with company's safety codes and practices for the health and safety of personnel working with us.
- Set safety & health metrics as indicators of excellence, monitor progress and continually improve performance.

We shall actively communicate this policy to all stakeholders by suitable means and periodically review its relevance in continuously changing business environment.



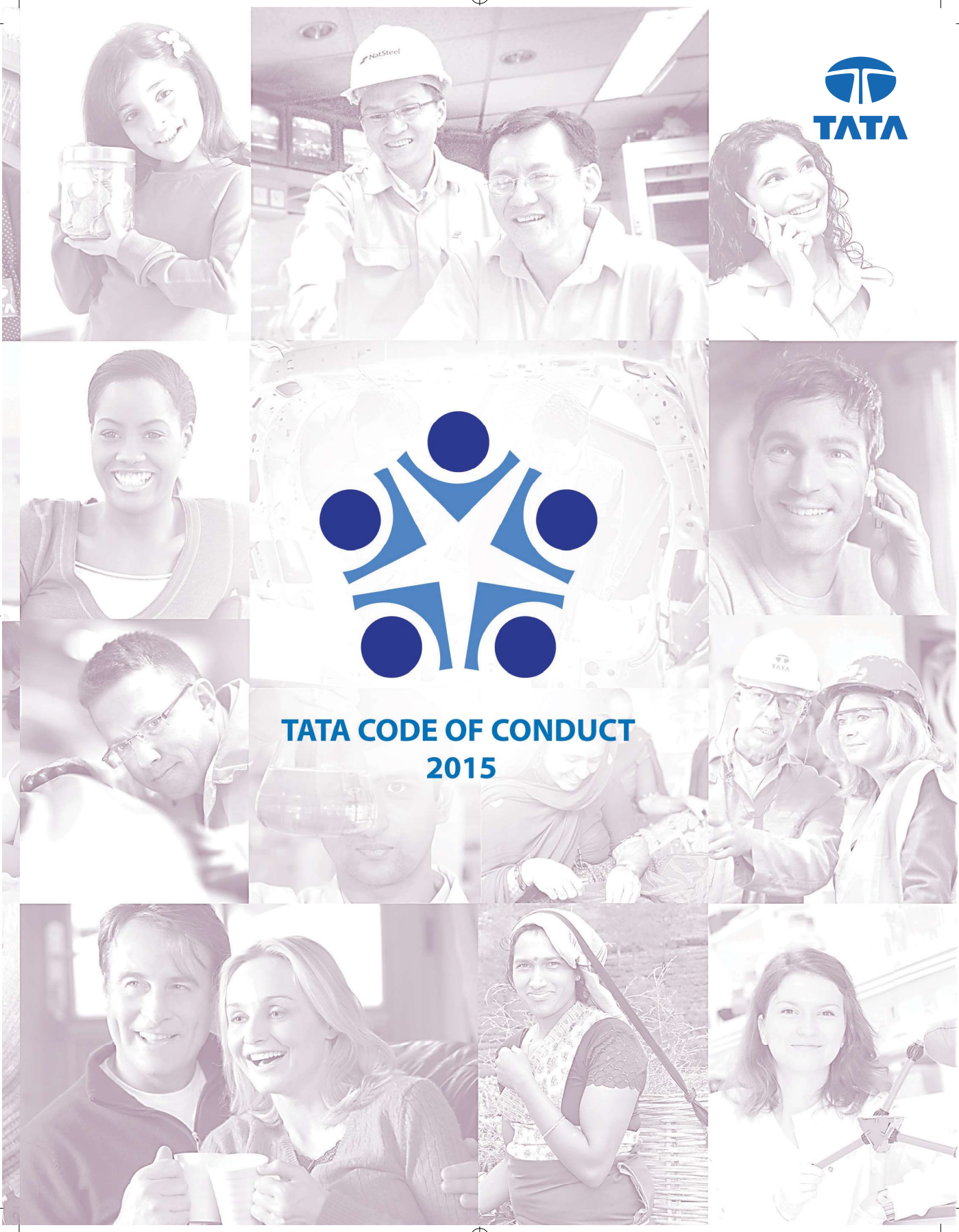
(Praveer Sinha)  
CEO & Managing Director

Date: 15<sup>th</sup> June, 2018





**TATA CODE OF CONDUCT  
2015**



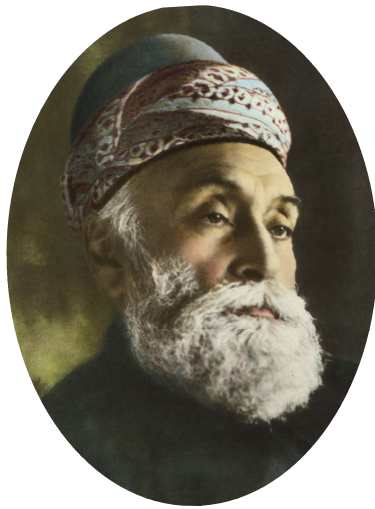
## LEADERSHIP THAT INSPIRES

For over 100 years, the Tata group has been led by visionaries who have stayed true to the vision of the founder, Jamsetji Tata.

A vision that placed the greater good of society at par with business growth.

A vision that put into practice pioneering social initiatives that changed the way responsible business was run.

And a vision that brought into the group a strong social conscience.



We do not claim to be more unselfish, more generous or more philanthropic than other people. But we think we started on sound and straightforward business principles, considering the interests of the shareholders our own, and the health and welfare of the employees, the sure foundation of our success.

**Jamsetji Tata**  
Founder of the Tata group  
Chairman (1868 – 1904)

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## FOREWORD

Tata companies have consistently adhered to the values and ideals articulated by the Founder for over 150 years. The Tata Code of Conduct was first formalized by Mr Ratan Tata. It articulates the Group's values and ideals that guide and govern the conduct of our companies as well as our colleagues in all matters relating to business. Today, the Code is a bedrock on which we base our individual, as well as leadership commitments to core Tata values.

The Tata Code of Conduct outlines our commitment to each of our stakeholders, including the communities in which we operate, and is our guiding light when we are sometimes faced with business dilemmas that leave us at ethical crossroads. The Code is also dynamic in that it has been periodically refreshed in order to remain contemporary and contextual to the changes in law and regulations. However it remains unaltered at its core.

Our stellar reputation and success as a business entity has been defined by the powerful commitment and adherence to the core values and principles expressed in this Code, by all our employees, directors and partners. I trust every Tata colleague and Tata company will continue to not only comply with the laws and regulations that govern our business interests around the world, but will continue to set new standards of ethical conduct that will generate deep respect and inspire emulation by others.

**N. Chandrasekaran**

21<sup>st</sup> February, 2017





## A. OUR VALUES

TATA has always been values-driven. The five core values that underpin the way we conduct our business activities are:



### INTEGRITY

We will be fair, honest, transparent and ethical in our conduct; everything we do must stand the test of public scrutiny.

### UNITY

We will invest in our people and partners, enable continuous learning, and build caring and collaborative relationships based on trust and mutual respect.

### RESPONSIBILITY

We will integrate environmental and social principles in our businesses, ensuring that what comes from the people goes back to the people many times over.

### PIONEERING

We will be bold and agile, courageously taking on challenges, using deep customer insight to develop innovative solutions.

### EXCELLENCE

We will be passionate about achieving the highest standards of quality, always promoting meritocracy.

These universal values serve as the foundation for the Tata Code of Conduct. They find expression within the value system of every Tata company.

## B. SCOPE AND PURPOSE OF THIS CODE

1. This Code sets out how we behave with:
  - our employees, or those who work with us;
  - our customers;
  - the communities and the environment in which we operate;
  - our value-chain partners, including suppliers and service providers, distributors, sales representatives, contractors, channel partners, consultants, intermediaries and agents;
  - our joint-venture partners or other business associates;
  - our financial stakeholders;
  - the governments of the countries in which we operate; and
  - our group companies.
2. In this Code, “we or us” means our company, our executive directors, officers, employees and those who work with us, as the context may require.
3. The term “our group companies” in this Code typically means companies Tata Sons intends for this Code to apply to, and / or to whom Tata Sons has issued this Code.
4. This Code sets out our expectations of all those who work with us. We also expect those who deal with us to be aware that this Code underpins everything we do, and in order to work with us they need to act in a manner consistent with it.

### REMEMBER...

It is our commitment to protect our reputation and our brand equity by adhering to the values and principles set out in this Code. By doing so, we strengthen our unique culture and identity.

## OUR CORE PRINCIPLES



The Tata philosophy of management has always been, and is today more than ever, that corporate enterprises must be managed not merely in the interests of their owners, but equally in those of their employees, of the consumers of their products, of the local community and finally of the country as a whole.

**J.R.D. Tata**

Chairman, Tata Sons (1938 – 1991)

## C. OUR CORE PRINCIPLES

1. We are committed to operating our businesses conforming to the highest moral and ethical standards. We do not tolerate bribery or corruption in any form. This commitment underpins everything that we do.
2. We are committed to good corporate citizenship. We treat social development activities which benefit the communities in which we operate as an integral part of our business plan.
3. We seek to contribute to the economic development of the communities of the countries and regions we operate in, while respecting their culture, norms and heritage. We seek to avoid any project or activity that is detrimental to the wider interests of the communities in which we operate.
4. We shall not compromise safety in the pursuit of commercial advantage. We shall strive to provide a safe, healthy and clean working environment for our employees and all those who work with us.
5. When representing our company, we shall act with professionalism, honesty and integrity, and conform to the highest moral and ethical standards. In the countries we operate in, we shall exhibit culturally appropriate behaviour. Our conduct shall be fair and transparent and be perceived as fair and transparent by third parties.
6. We shall respect the human rights and dignity of all our stakeholders.
7. We shall strive to balance the interests of our stakeholders, treating each of them fairly and avoiding unfair discrimination of any kind.
8. The statements that we make to our stakeholders shall be truthful and made in good faith.
9. We shall not engage in any restrictive or unfair trade practices.
10. We shall provide avenues for our stakeholders to raise concerns or queries in good faith, or report instances of actual or perceived violations of our Code.
11. We shall strive to create an environment free from fear of retribution to deal with concerns that are raised or cases reported in good faith. No one shall be punished or made to suffer for raising concerns or making disclosures in good faith or in the public interest.
12. We expect the leaders of our businesses to demonstrate their commitment to the ethical standards set out in this Code through their own behaviour and by establishing appropriate processes within their companies.
13. We shall comply with the laws of the countries in which we operate and any other laws which apply to us. With regard to those provisions of the Code that are explicitly dealt with under an applicable law or employment terms, the law and those terms shall take precedence. In the event that the standards prescribed under any applicable law are lower than that of the Code, we shall conduct ourselves as per the provisions of the Code.

### REMEMBER...

“Good faith” means having a reasonable belief that the information you have provided is truthful. It does not mean having ‘all the evidence’ about the potential violation or case reported.

## OUR EMPLOYEES



Once you got the best people, the people who shared our values and ideals, we left them free to act on their own. We do not fetter them. We encourage them and give them opportunities for leadership.

**J.R.D. Tata**

Chairman, Tata Sons (1938 – 1991)

## D. OUR EMPLOYEES

### Equal opportunity employer

1. We provide equal opportunities to all our employees and to all eligible applicants for employment in our company. We do not unfairly discriminate on any ground, including race, caste, religion, colour, ancestry, marital status, gender, sexual orientation, age, nationality, ethnic origin, disability or any other category protected by applicable law.
2. When recruiting, developing and promoting our employees, our decisions will be based solely on performance, merit, competence and potential.
3. We shall have fair, transparent and clear employee policies which promote diversity and equality, in accordance with applicable law and other provisions of this Code. These policies shall provide for clear terms of employment, training, development and performance management.

### Q&A

**A job requirement entails extensive travel. One of the candidates has excellent relevant experience and qualifications. However, this candidate is a single parent. As a result, I feel such a situation would significantly hinder this candidate's ability to cope with the job requirement. What should I do?**

In accordance with the Code, the decision to recruit an employee should be based upon merit. We cannot make a presumption that the candidate would not be able to meet the travel requirements of the job. All eligible candidates should be provided with equal opportunity to demonstrate or justify that they can cope with the travel requirements of the job. Being a single parent cannot be a ground to be discriminated against at any stage of recruitment or ongoing employment in our company.

### REMEMBER...

We do not tolerate harassment in any form and therefore we expect every employee to discourage such misdemeanours in the workplace.

### Dignity and respect

4. Our leaders shall be responsible for creating a conducive work environment built on tolerance, understanding, mutual cooperation and respect for individual privacy.
5. Everyone in our work environment must be treated with dignity and respect. We do not tolerate any form of harassment, whether sexual, physical, verbal or psychological.
6. We have clear and fair disciplinary procedures, which necessarily include an employee's right to be heard.
7. We respect our employees' right to privacy. We have no concern with their conduct outside our work environment, unless such conduct impairs their work performance, creates conflicts of interest or adversely affects our reputation or business interests.

### Human rights

8. We do not employ children at our workplaces.
9. We do not use forced labour in any form. We do not confiscate personal documents of our employees, or force them to make any payment to us or to anyone else in order to secure employment with us, or to work with us.

### Bribery and corruption

10. Our employees and those representing us, including agents and intermediaries, shall not, directly or indirectly, offer or receive any illegal or improper payments or comparable benefits that are intended or perceived to obtain undue favours for the conduct of our business.

#### REMEMBER...

Violation by even a single employee of any law relating to anti-bribery, anti-corruption, anti-competition, data privacy, etc. could result in severe financial penalties and cause irreparable reputational damage to the company.

### Gifts and hospitality

11. Business gifts and hospitality are sometimes used in the normal course of business activity. However, if offers of gifts or hospitality (including entertainment or travel) are frequent or of substantial value, they may create the perception of, or an actual conflict of interest or an 'illicit payment'. Therefore, gifts and hospitality given or received should be modest in value and appropriate, and in compliance with our company's gifts and hospitality policy.

### Freedom of association

12. We recognise that employees may be interested in joining associations or involving themselves in civic or public affairs in their personal capacities, provided such activities do not create an actual or potential conflict with the interests of our company. Our employees must notify and seek prior approval for any such activity as per the 'Conflicts of Interest' clause of this Code and in accordance with applicable company policies and law.

#### REMEMBER...

As a general rule, we may accept gifts or hospitality from a business associate, only if such a gift:

- has modest value and does not create a perception (or an implied obligation) that the giver is entitled to preferential treatment of any kind;
- would not influence, or appear to influence, our ability to act in the best interest of our company;
- would not embarrass our company or the giver if disclosed publicly.

The following gifts are never appropriate and should never be given or accepted:

- gifts of cash or gold or other precious metals, gems or stones;
- gifts that are prohibited under applicable law;
- gifts in the nature of a bribe, payoff, kickback or facilitation payment\*;
- gifts that are prohibited by the gift giver's or recipient's organisation; and
- gifts in the form of services or other non-cash benefits (e.g. a promise of employment).

(\*'Facilitation' payment is a payment made to secure or speed up routine legal government actions, such as issuing permits or releasing goods held in customs.)



### Working outside employment with us

13. Taking employment, accepting a position of responsibility or running a business outside employment with our company, in your own time, with or without remuneration, could interfere with your ability to work effectively at our company or create conflicts of interest. Any such activity must not be with any customer, supplier, distributor or competitor of our company. Our employees must notify and seek prior approval for any such activity as per the 'Conflicts of Interest' clause of this Code and in accordance with applicable company policies and law.

### Integrity of information and assets

14. Our employees shall not make any wilful omissions or material misrepresentation that would compromise the integrity of our records, internal or external communications and reports, including the financial statements.
15. Our employees and directors shall seek proper authorisation prior to disclosing company or business-related information, and such disclosures shall be made in

accordance with our company's media and communication policy. This includes disclosures through any forum or media, including through social media.

16. Our employees shall ensure the integrity of personal data or information provided by them to our company. We shall safeguard the privacy of all such data or information given to us in accordance with applicable company policies or law.
17. Our employees shall respect and protect all confidential information and intellectual property of our company.
18. Our employees shall safeguard the confidentiality of all third party intellectual property and data. Our employees shall not misuse such intellectual property and data that comes into their possession and shall not share it with anyone, except in accordance with applicable company policies or law.
19. Our employees shall promptly report the loss, theft or destruction of any confidential information or intellectual property and data of our company or that of any third party.

### Q&A

**I am an accountant in the finance department of my company. Due to my artistic skills, I received an offer to pen cartoons for a children's publication for which I would receive compensation. I plan to undertake this activity during week-ends. What should I do before accepting this offer?**

Before accepting the offer, you should ascertain whether the company policies and rules require you to make a disclosure to your supervisor so that the company may determine whether your undertaking this activity adversely affects our company's interests. On confirmation from the company that it does not do so, you would be free to take up the activity. It is also your duty to bring to the attention of the company whenever there is any change in the situation you have disclosed.

20. Our employees shall use all company assets, tangible and intangible, including computer and communication equipment, for the purpose for which they are provided and in order to conduct our business. Such assets shall not be misused. We shall establish processes to minimise the risk of fraud, and misappropriation or misuse of our assets.
21. We shall comply with all applicable anti-money laundering, anti-fraud and anti-corruption laws and we shall establish processes to check for and prevent any breaches of such laws.

### Insider trading

22. Our employees must not indulge in any form of insider trading nor assist others, including immediate family, friends or business associates, to derive any benefit from access to and possession of price sensitive information that is not in the public domain. Such information would include information about our company, our group companies, our clients and our suppliers.

### Q&A

**Our company has recently announced the launch of a new business initiative. In connection with this, your friend who is a journalist with a leading business newspaper has asked you to provide some information that he could cover in his forthcoming article. He has promised not to quote you, or reveal your identity. Should you be giving him this information?**

No. You should not be sharing information of this nature with the media, even if it is assured that the source would remain anonymous. Only authorised personnel in the company are permitted to speak to the media and provide information of this nature.

**Our company has a "Use of Social Media" policy that lays down the "dos and don'ts" for use of social media even if you may access such media on your own time. Why is there such a policy?**

External communication is a serious matter. It must be carefully managed because information put out with reference to our company or its businesses needs to be clear, truthful and not violate any undertakings we have given to other parties. In each business there are managers nominated to authorise and make different types of statements to the outside world. These managers should be consulted about any request for information you may receive or information you think we should give out.

In using social media, in particular blogs or social networking sites, you should exercise great caution while talking about our company or the business we do. It may feel like you are chatting with friends or expressing a personal opinion but even while doing so you cannot share any confidential information of our company.

### REMEMBER...

We must respect the property rights of others by never misusing their assets, intellectual property or trade secrets, including the copying or downloading of unauthorised software, trademarks, copyrighted material or logos. We should never make unauthorised copies of computer software programs or use unlicensed personal software on company computers.

### Prohibited drugs and substances

23. Use of prohibited drugs and substances creates genuine safety and other risks at our workplaces. We do not tolerate prohibited drugs and substances from being possessed, consumed or distributed at our workplaces, or in the course of company duties.

### Conflicts of interest

24. Our employees and executive directors shall always act in the interest of our company and ensure that any business or personal association *including close personal relationships* which they may have, does not create a conflict of interest with their roles and duties in our company or the operations of our company. Further, our employees and executive directors shall not engage in any business, relationship or activity, which might conflict with the interest of our company or our group companies.

25. Should any actual or potential conflicts of interest arise, the concerned person must immediately report such conflicts and seek approvals as required by applicable law and company policy. The competent authority shall revert to the employee within a reasonable time as defined in our company's policy, so as to enable the concerned employee to take necessary action as advised to resolve or avoid the conflict in an expeditious manner.

26. In the case of all employees other than executive directors, the Chief Executive Officer / Managing Director shall be the competent authority, who in turn shall report such cases to the Board of Directors on a quarterly basis. In case of the Chief Executive Officer / Managing Director and executive directors, the Board of Directors of our company shall be the competent authority.

### Q&A

**You are responsible for maintaining our company's customer database. One of your friends is starting a business venture and requests you to share a few particulars from this database for marketing purposes of his business. He assures you that he would keep the data as well as his source confidential. Should you do so?**

No. You should respect the confidentiality of customer information and not share any part of the database with any person without due authorisation.

**You have access to revenue numbers of different business units of our company. While having a conversation with you over evening drinks, your friend enquires about the financial performance of our company. You do not share detailed information with your friend, but share approximate revenue figures. Is this conduct of yours correct?**

No, it is not. You are not permitted to share financial information of our company with others who do not need to know this information. Financial information should always be safeguarded and disclosed only on a need-to-know basis after obtaining requisite approvals. Sharing of any price sensitive information that is not generally available with the public could also lead to violation of applicable insider trading laws.

27. Notwithstanding such or any other instance of conflict of interest that exists due to historical reasons, adequate and full disclosure by interested employees shall be made to our company's management. At the time of appointment in our company, our employees and executive directors shall make full disclosure to the competent authority, of any interest leading to an

actual or potential conflict that such persons or their immediate family (including parents, siblings, spouse, partner, children) or persons with whom they enjoy close personal relationships, may have in a family business or a company or firm that is a competitor, supplier, customer or distributor of, or has other business dealings with, our company.

### REMEMBER...

A conflict of interest could be any known activity, transaction, relationship or service engaged in by an employee, his/her immediate family (including parents, siblings, spouse, partner, and children), relatives or a close personal relationship, which may cause concern (based upon an objective determination) that the employee could not or might not be able to fairly perform his/her duties to our company.

### Examples of Potential Conflicts of Interest

A conflict of interest, actual or potential, arises where, directly or indirectly, an employee or executive director:

- (a) engages in a business, activity or relationship with anyone who is party to a transaction with our company;
- (b) is in a position to derive an improper benefit, personally or for any family member or for any person in a close personal relationship, by making or influencing decisions relating to any transaction;
- (c) conducts business on behalf of our company or is in a position to influence a decision with regard to our company's business with a supplier or customer where a relative of, or a person in close personal relationship with, an employee or executive director is a principal officer or representative, resulting in a personal benefit or a benefit to the relative;
- (d) is in a position to influence decisions with regard to award of benefits such as increase in salary or other remuneration, posting, promotion or recruitment of a relative or a person in close personal relationship employed in our company or any of our group companies;
- (e) undertakes an activity by which the interest of our company or our group companies can be compromised or defeated; or
- (f) does anything by which an independent judgement of our company's or our group companies' best interest cannot be exercised.

28. If there is a failure to make the required disclosure and our management becomes aware of an instance of conflict of interest that ought to have been disclosed by an employee or executive director, our management shall take a serious view of the

matter and consider suitable disciplinary action as per the terms of employment. In all such matters, we shall follow clear and fair disciplinary procedures, respecting the employee's right to be heard.

### Examples of activities normally approved (post-disclosure) as per applicable company policy

Acceptance of a position of responsibility (whether for remuneration or otherwise) in the following cases would typically be permitted, provided the time commitments these demand do not disturb or distract from the employee's primary duties and responsibilities in our company, and are promptly disclosed to the relevant competent authority:

- (a) Directorships on the Boards of any of our group companies, joint ventures or associate companies.
- (b) Memberships/positions of responsibility in educational/professional bodies, where such association will promote the interests of our company.
- (c) Memberships or participation in government committees/bodies or organisations.

### Q&A

**You are in a relationship with a colleague who has been recently moved into your team and would now be reporting to you. What should you do?**

Romantic or close personal relationships with another employee where a reporting relationship exists and one is responsible for evaluating the other's performance, is likely to create a conflict of interest. In such a situation, you would need to report the potential conflict to your supervisor.

**Your company is submitting a proposal to a company in which you were previously employed. You have confidential information pertaining to your previous employer, which you believe will help your present employer in winning the contract. Should you share this information?**

No. You should not share this information with your company since it relates to confidential information of a third party. Your company respects its employees' duty to protect confidential information that they may have relating to their previous employers.

**You are the purchasing manager in the procurement department of your company. You receive an invitation from a supplier to attend a premier sporting event as her guest. This particular supplier is one of the vendors who has submitted a proposal for an open tender issued by your company. Should you accept the invitation?**

No. You should not accept the invitation in this instance. Since you are in a key decision-making role for the tender, any unusual benefit that you receive could be perceived as an inducement that could compromise your objectivity.

## OUR CUSTOMERS



We have continued to enjoy prosperity, even with adverse times to fight against. Our relations with all concerned are the most friendly. We have maintained the same character for straight-forward dealing with our constituents and customers. Our productions have continued to be of the same high quality, and therefore command the best reputation and realise the highest prices. ... I mention these facts only to point out that with honest and straight-forward business principles, close and careful attention to details, and the ability to take advantage of favourable opportunities and circumstances, there is a scope for success.

### Jamsetji Tata

Founder of the Tata group  
Chairman, Tata Sons (1868 – 1904)

## E. OUR CUSTOMERS

### Products and services

1. We are committed to supplying products and services of world-class quality that meet all applicable standards.
2. The products and services we offer shall comply with applicable laws, including product packaging, labelling and after-sales service obligations.
3. We shall market our products and services on their own merits and not make unfair or misleading statements about the products and services of our competitors.

### Export controls and trade sanctions

4. We shall comply with all relevant export controls or trade sanctions in the course of our business.

### Fair competition

5. We support the development and operation of competitive open markets and the liberalisation of trade and investment in each country and market in which we operate.
6. We shall not enter into any activity constituting anti-competitive behaviour such as abuse of market dominance, collusion, participation in cartels or inappropriate exchange of information with competitors.
7. We collect competitive information only in the normal course of business and obtain the same through legally permitted sources and means.

### Dealings with customers

8. Our dealings with our customers shall be professional, fair and transparent.
9. We respect our customers' right to privacy in relation to their personal data. We shall safeguard our customers' personal data, in accordance with applicable law.

## Q&A

**You are the Regional Sales Manager of our company. You have become a member of an “informal group”, on an instant messaging service, whose members are the regional sales heads of our company’s competitors. The administrator of the group has requested an in-person meeting to informally discuss market conditions and brainstorm on “pricing strategy” from an industry perspective. What should you do?**

Any meeting with competitors, especially to discuss “pricing strategy”, could be an attempt to promote an anti-competitive practice or manipulate prices. You should respond by declining this invitation and exiting the “informal group”. You should also report this incident to your supervisor and your Legal department.

**You are attending a customer meeting with a colleague, and your colleague makes an untruthful statement about the company’s services. What should you do?**

You should assist your colleague in correcting the inaccuracy during the meeting if possible. If this is not possible, raise the issue with your colleague after the meeting to enable him/her or the company to correct any misrepresentation made to the customer.

**While working on a customer project, you receive a call from your colleague. He used to manage that customer account before you took over his role. He recalls that he had worked with the customer on developing a new ordering system which he thinks would be beneficial for another customer and requests you to send him the project details. What should you do?**

You must not share this information without specific approval of the customer; you are not permitted to use a customer’s assets, including software, for another customer or for any personal use.

## REMEMBER...

Striving for excellence in the standards of our work and in the quality of our goods and services is a core Tata value. It is the unwavering practice of this value that builds and sustains customer trust in our brand.



# OUR COMMUNITIES AND THE ENVIRONMENT



In a free enterprise, the community is not just another shareholder in business but is in fact the very purpose of its existence.

**Jamsetji Tata**

Founder of the Tata group  
Chairman, Tata Sons (1868 – 1904)

## F. OUR COMMUNITIES AND THE ENVIRONMENT

### Communities

1. We are committed to good corporate citizenship, and shall actively assist in the improvement of the quality of life of the people in the communities in which we operate.
2. We engage with the community and other stakeholders to minimise any adverse impact that our business operations may have on the local community and the environment.
3. We encourage our workforce to volunteer on projects that benefit the communities in which we operate, provided the principles of this Code, where applicable, and in particular the 'Conflicts of Interest' clause are followed.

### The environment

4. In the production and sale of our products and services, we strive for environmental sustainability and comply with all applicable laws and regulations.
5. We seek to prevent the wasteful use of natural resources and are committed to improving the environment, particularly with regard to the emission of greenhouse gases, consumption of water and energy, and the management of waste and hazardous materials. We shall endeavour to offset the effect of climate change in our activities.

## OUR VALUE-CHAIN PARTNERS



If we had done some of the things that some other groups have done, we would have been twice as big as we are today. But we didn't, and I would not have it any other way.

**J.R.D. Tata**

Chairman, Tata Sons (1938 – 1991)

(on the pace of expansion of the Tata group in the 1960s and 70s)

## G. OUR VALUE-CHAIN PARTNERS

1. We shall select our suppliers and service providers fairly and transparently.
2. We seek to work with suppliers and service providers who can demonstrate that they share similar values. We expect them to adopt ethical standards comparable to our own.
3. Our suppliers and service providers shall represent our company only with duly authorised written permission from our company. They are expected to abide by the Code in their interactions with, and on behalf of us, including respecting the confidentiality of information shared with them.
4. We shall ensure that any gifts or hospitality received from, or given to, our suppliers or service providers comply with our company's gifts and hospitality policy.
5. We respect our obligations on the use of third party intellectual property and data.

### Q&A

**You head the procurement function in our company. You have tight budgetary constraints for a project that you are working on. In order to complete the project within the targeted costs, you intend to request your supplier to provide you an exceptional discount on this project order on the understanding that you would “make it up to him” in future orders. Would you be violating the Code?**

Yes, you would. Inducement in any form, including future benefits to the supplier, could compromise your ability to act objectively and in the best interests of the company and therefore must be avoided.

### REMEMBER...

Our value-chain partners would include our suppliers and service providers, distributors, sales representatives, contractors, channel partners, consultants, intermediaries and agents; joint-venture partners and other business associates.

## OUR FINANCIAL STAKEHOLDERS



Ethical behaviour in business – in every sphere and with all constituents – has been the bedrock on which the Tata group has built, and operates, its enterprises. This has been an article of faith for the group ever since its inception, a fundamental element of our cherished heritage and the essence of our way of life.

**Ratan Tata**

Chairman, Tata Sons (1991 – 2012)



## H. OUR FINANCIAL STAKEHOLDERS

1. We are committed to enhancing shareholder value and complying with laws and regulations that govern shareholder rights.
  2. We shall inform our financial stakeholders about relevant aspects of our business in a fair, accurate and timely manner and shall disclose such information in accordance with applicable law and agreements.
  3. We shall keep accurate records of our activities and shall adhere to disclosure standards in accordance with applicable law and industry standards.
-

# GOVERNMENTS



Business, as I have seen it, places one great demand on you; it needs you to impose a framework of ethics, values, fairness and objectivity on yourself at all times. It is not easy to do this; you cannot impose it on yourself forcibly because it has to become an integral part of you.

**Ratan Tata**

Chairman, Tata Sons (1991 – 2012)

## I. GOVERNMENTS

### Political non-alignment

1. We shall act in accordance with the constitution and governance systems of the countries in which we operate. We do not seek to influence the outcome of public elections, nor to undermine or alter any system of government. We do not support any specific political party or candidate for political office. Our conduct must preclude any activity that could be interpreted as mutual dependence/favour with any political body or person, and we do not offer or give any company funds or property or other resources as donations to any specific political party, candidate or campaign.

Any financial contributions considered by our Board of Directors in order to strengthen democratic forces through a clean electoral process shall be extended only through the Progressive Electoral Trust in India, or by a similar transparent, duly-authorized, non-discriminatory and non-discretionary vehicle outside India.

### Government engagement

2. We engage with the government and regulators in a constructive manner in order to promote good governance. We conduct our interactions with them in a manner consistent with our Code.
3. We do not impede, obstruct or improperly influence the conclusions of, or affect the integrity or availability of data or documents for any government review or investigation.



## OUR GROUP COMPANIES



I do not think anyone was on par with Jamsetji as an industrial visionary. But that is not the sole reason why I have been an admirer of Jamsetji. The major reason was his sense of values, sterling values, which he imparted to this group. If someone were to ask me, what holds the Tata companies together, more than anything else, I would say it is our shared ideals and values which we have inherited from Jamsetji Tata.

**J.R.D. Tata**

Chairman, Tata Sons (1938 – 1991)

## J. OUR GROUP COMPANIES

1. We seek to cooperate with our group companies, including joint ventures, by sharing knowledge, physical resources, human and management resources and adopting leading governance policies and practices in accordance with applicable law including adherence to competition law, where relevant.
2. We shall strive to achieve amicable resolution of any dispute between us and any of our group companies, through an appropriate dispute resolution mechanism so that it does not adversely affect our business interests and stakeholder value.
3. We shall have processes in place to ensure that no third party or joint venture uses the TATA name/brand to further its interests without proper authorisation.
4. Our Board of Directors shall consider for adoption policies and guidelines periodically formulated by Tata Sons and circulated to group companies.

### Q&A

**You are in the process of selecting potential vendors for an IT project in our company. In the final shortlist of two companies, one is a new start-up with limited references and a lower price-quotation, while the other is a Tata company with thirty years of implementation experience and good references, but a marginally higher quote for the same job. With all other parameters of choice being nearly equal, which company should you select for the job?**

While price is undoubtedly an important criterion for decision making, it is clearly not the only one to be evaluated. You may also need to consider good customer references, proven track record and shared value systems in order to decide on your IT partner.

**You are in the process of selecting potential vendors for a project. One of the three finalists is a group company. In reviewing the final proposals, you rank the group company second out of the three proposals based on pricing and total cost of ownership, and select the first-ranked vendor. Is this the right decision?**

Yes. You should select the vendor that, on its own merits, is the vendor that is most appropriate for your company's requirements. You should not select a group company only because of its affiliation.

## RAISING CONCERNS

We encourage our employees, customers, suppliers and other stakeholders to raise concerns or make disclosures when they become aware of any actual or potential violation of our Code, policies or law. We also encourage reporting of any event (actual or potential) of misconduct that is not reflective of our values and principles.

Avenues available for raising concerns or queries or reporting cases could include:

- immediate line manager or the Human Resources department of our company
- designated ethics officials of our company
- the 'confidential reporting' third party ethics helpline (if available)
- any other reporting channel set out in our company's 'Whistleblower' policy.

We do not tolerate any form of retaliation against anyone reporting legitimate concerns. Anyone involved in targeting such a person will be subject to disciplinary action.

If you suspect that you or someone you know has been subjected to retaliation for raising a concern or for reporting a case, we encourage you to promptly contact your line manager, the company's Ethics Counsellor, the Human Resources department, the MD/CEO or the office of the group's Chief Ethics Officer.

### Q&A

**My supervisor has asked me to do something which I believe may be illegal. I am afraid if I do not do what I am told, I could lose my job. Should I do it?**

No. Breaking the law is never an option. Discuss the situation with your supervisor to be certain that you both understand the facts. If your concerns are not resolved, contact a higher level supervisor, the Ethics Counsellor, the Legal department or report them via the company's confidential reporting system, if available.

**I feel that my supervisor is treating me unfairly for reporting a concern to the Ethics Counsellor. What should I do?**

Retaliation against anyone who raises a concern is a violation of the Code. You should therefore promptly report this action of your supervisor to the Ethics Counsellor or the MD/CEO of your company or via the company's confidential reporting system, if available.



## ACCOUNTABILITY

This Code is more than a set of prescriptive guidelines issued solely for the purpose of formal compliance. It represents our collective commitment to our value system and to our core principles.

Every person employed by us, directly or indirectly, should expect to be held accountable for his/her behaviour. Should such behaviour violate this Code,

they may be subject to action according to their employment terms and relevant company policies.

When followed in letter and in spirit, this Code is 'lived' by our employees as well as those who work with us. It represents our shared responsibility to all our stakeholders, and our mutual commitment to each other.

### SPEAK UP...

If you are unsure whether a particular action you are about to take is consistent with the principles set forth in the Code, ask yourself:

- Could it directly or indirectly endanger someone or cause them injury?
- Is it illegal/unlawful or out of line with our policies and procedures?
- Does my conscience reject it? Does it conflict with my personal values?
- Would I feel uncomfortable if the story appeared in the media? Would it shame my company, spouse, partner, parent or child?
- Does it 'feel' wrong?

If the answer to any of these questions is "Yes", please stop and consult your reporting manager, the Ethics Counsellor, the Human Resource department, the Legal department or any member of the senior management team, to assist you in making the decision.

**When faced with a dilemma:** Stop, Think, Act Responsibly

**NOTE**

The Code does not provide a comprehensive and complete explanation of all expectations from a company standpoint or obligations from a stakeholder standpoint.

Our employees have a continuing obligation to familiarise themselves with all applicable law, group-level advisories and policies, company-level policies, procedures and work rules as relevant. For any guidance on interpretation of the Code, we may seek support from our company's Ethics Counsellor or from the group's Chief Ethics Officer, as appropriate.

All joint ventures are encouraged to adopt the Tata Code of Conduct (TCOC) or a code of conduct that incorporates all elements of the TCOC.

This version of the Tata Code of Conduct supersedes all earlier versions and associated documents and stands effective from 29<sup>th</sup> July, 2015.

For any query or clarification on the Code, please contact the office of the group's Chief Ethics Officer via email at: [ethicsoffice@tata.com](mailto:ethicsoffice@tata.com).



## TATA CODE OF CONDUCT – 2015

I acknowledge that I have received the Tata Code of Conduct.

I have read the Tata Code of Conduct and I acknowledge that as a Tata employee, I am required to comply with the guidelines described therein and failure to do so may subject me to action as per my employment terms and relevant company policies.

If I have a concern about a violation, or a potential violation of the Tata Code of Conduct, I understand that there are channels available to me in my company to report such concerns. By making use of these channels when necessary, I will play my part in maintaining the high ethical standards to which we hold ourselves.

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Name: \_\_\_\_\_

Department: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

*(Please submit this declaration to your Ethics Counsellor or the Human Resource department of your company.)*







NOTES

Horizontal lines for writing notes.





For further information on the Code please contact:  
 The Ethics Office,  
 Tata Sons Ltd.,  
 Bombay House,  
 24, Homi Mody Street,  
 Mumbai – 400001, India.  
 Email: [ethicsoffice@tata.com](mailto:ethicsoffice@tata.com)

## CORPORATE SUSTAINABILITY POLICY

At Tata Power, our Sustainability Policy integrates economic progress, social responsibility and environmental concerns with the objective of improving quality of life. We believe in integrating our business values and operations to meet the expectations of our customers, employees, partners, investors, communities and public at large

- We will uphold the values of honesty, partnership and fairness in our relationship with stakeholders
- We shall provide and maintain a clean, healthy and safe working environment for employees, customers, partners and the community
- We will strive to consistently enhance our value proposition to the customers and adhere to our promised standards of service delivery
- We will respect the universal declaration of human rights, International Labour Organization's fundamental conventions on core labour standards and operate as an equal opportunities employer
- We shall encourage and support our partners to adopt responsible business policies, Business Ethics and our Code of Conduct Standards
- We will continue to serve our communities:
  - By implementing sustainable Community Development Programmes including through public/private partnerships in and around our area of operations
  - By constantly protecting ecology, maintaining and renewing bio-diversity and wherever necessary conserving and protecting wild life, particularly endangered species
  - By encouraging our employees to serve communities by volunteering and by sharing their skills and expertise
  - By striving to deploy sustainable technologies and processes in all our operations and use scarce natural resources efficiently in our facilities
  - We will also help communities that are affected by natural calamities or untoward incidence, or that are physically challenged in line with the Tata Group's efforts

The management will commit all the necessary resources required to meet the goals of Corporate Sustainability.



(Praveer Sinha)  
CEO & Managing Director

Date: 15<sup>th</sup> June, 2018



**The Tata Power Company Ltd**



*Contractor's Safety Code of Conduct*

*Document No.  
TPSMS/GSP/CSM/015 REV 05*

*Date of Issue:  
30/07/2020*

## **Contractor's Safety Code of Conduct**

<b>Reason for Change</b>	<b>Prepared By</b>	<b>Checked By</b>	<b>Approved by</b>
Revision to accommodate Existing changes in org structure and to simplify the procedure	Rajesh Sharma <i>(Head-Safety Generation)</i>	Suresh Khetwani <i>(Chief - Safety &amp; Environment)</i>  Monish Kumar <i>(Chief -Corporate Contract)</i>	V. V. Namjoshi <i>(Chief Generations)</i>

<b>The Tata Power Company Ltd</b>		<i>Contractor's Safety Code of Conduct</i>
<i>Document No. TPSMS/GSP/CSM/015 REV 05</i>		<i>Date of Issue: 30/07/2020</i>

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## 1. Objective

The Tata Power engages contractor workforce to execute, run and maintain various operating sites and facilities across locations for various business verticals including Generation, Transmission, Distribution and Renewable. The activities range from project execution, operation, maintenance to facilities management.

The management of contractor safety represents a significant challenge for management. Tata Power has a responsibility to ensure that contractors are provided with enough information and support to enable them to conduct their roles safely and without endangering health and safety of their own workforce or that of our staff.

To ensure reduction in reportable injuries and achieve goal of zero accidents, first edition of contractor safety code of conduct was launched successfully in the year 2014. Since last four years after the launch of CSCC, Tata Power could achieve the objective of reduction in reportable injuries and fatalities.

Over the period, as the system was being matured, a need was felt to make second revision of the CSCC process. Objective of second revision is improve existing CSCC system and make it user friendly.

**2. Scope:** This procedure applies to all operating and project sites of The Tata Power Company Ltd and Group companies including new businesses like EV charging, Home Automation etc.

## 3. Definitions

- 3.1. Order Manager:** Order Manager is the Tata Power representative, who has the ownership of the given job.
- 3.2. Site Safety Management Plan:** It is the safety plan agreed between Contractor and Tata Power. It will contain the entire job specific safety requirement and will be signed by the contractor.
- 3.3. Contractor:** An individual or a company that provides services to Tata Power under a signed contract.
- 3.4. Emergency:** a serious, unexpected or dangerous situation requiring immediate action, which may result in loss of revenue/property, business discontinuity. In case of Emergency\*, services may be procured by selecting the qualified vendor based on the vendor category without the safety bid evaluation. It must be approved by MB level and above.
- 3.5. Expert Service jobs:** Jobs which needs expert services of contractor which does not involve direct exposure to the potential risk or work which involves only

supervisory work such as expert for turbine overhaul, expert for boiler overhaul, expert for pump and motor, expert for compressor overhaul.

- 3.6. Head of the Division:** Business in charge of the division who is overall custodian of the generating station or transmission division or distribution division.
- 3.7. Category A Vendor:** Vendor eligible to carry out Very High & High risk (as per Tata Power Hazard Identification and Risk Analysis Procedure) and /or Long-Term Contract related to operation and maintenance (O&M) of plant. Vendors must fulfil the requirement specified for Category A in Appendix 12-CSMF-5 of this document.
- 3.8. Category B Vendor:** Vendors eligible to carry out technical jobs, that are classified under Medium /low risk. Vendors must fulfil the requirement specified for Category B in Appendix 12-CSMF-5 of this document.
- 3.9. Category C Vendor:** Vendors eligible for to carry out low or very low risk administrative and office jobs. For this he must fulfil the requirement specified for Category C in Appendix 12-CSMF-5 of this document.
- 3.10. Category D Vendor:** All Consultants, Medical Practitioners or vendors taking job from Tata Power and working from their own premises (e.g. motor rewinding at vendor's shop floor, equipment sent for repair to vendor's works etc.) are classified as Category D Vendor
- 3.11. High Risk Jobs:** A Job or its activities are considered as Very High or High Risk when Order manager apply the "Tata Power Hazard Identification and Risk Analysis" procedure and found safety risk associated with are under Very High or High category. Indicative lists of jobs are given in appendix 15 of this document.
- 3.12. Medium Risk Jobs:** Jobs or its activities are considered as medium risk when Order manager apply "Tata Power Hazard Identification and Risk Analysis" procedure and found the same as Medium Risk.
- 3.13. Low Risk Jobs:** Any job or its activities are considered as Low or Very low risk while Order manager, calculate it by applying "Tata Power Hazard Identification and Risk Analysis" procedure and found it under Low or Very Low category.
- 3.14. Long Duration Jobs:** When the duration of job is 12 months or more, it is considered as Long duration job
- 3.15. High Value Jobs:** When the value of the job contract is Rs. One Crore or more it will be considered as High value job.



## 4. Responsibilities

**4.1 Order Manager:** Order Manager is the Tata Power representative, who is responsible for:

- 4.1.1 Finalizing the Site Safety Management Plan along with Contractor, Safety Concurrences Group, Divisional Safety Head and Expert (External or Internal) if required.
- 4.1.2 Supervise and ensure work is carried out as per the Site Safety Management Plan including agreed Risk Assessment (HIRA/JSA) and Method Statement.
- 4.1.3 Conduct audit and evaluate Safety Performance of contractor.
- 4.1.4 Ensure contractors adhere to all statutory provisions.
- 4.1.5 In case any deviation is needed in agreed safety management plan or in CSCC process for execution of job, Management of Change procedure will be applicable, and approval may be obtained from divisional head /Cluster head.

**4.2 Contractor:** The person, entity or organisation who is executing the job for Tata Power under a contractual agreement and will be responsible for the following

- 4.2.1 To follow all Tata Power Critical Safety Procedure, Rules and guidelines given in Safety Terms and Conditions
- 4.2.2 Undertake job as per Site Safety Management Plan CSM-F10 and method statements agreed with Tata Power.
- 4.2.3 Raise any concerns with regard to their work and its safety with the Tata Power Order Manager.
- 4.2.4 Report all injuries, near misses, unsafe acts/conditions, and occurrences to the Tata Power Order Manager immediately.
- 4.2.5 Ensure that all sub-contractors follow the Tata Power Safety Procedure and agreed Site Safety Management Plan CSM-F10.
- 4.2.6 To follow all statutory requirements as per the laws of the land.
- 4.2.7 All vendors applying for A category jobs or submitting quote for high risk jobs shall obtain certificates of ISO 9001, ISO14001 and ISO45001 before submitting quote for high risk Jobs.

**4.3 Safety Concurrence Group:** It is Cross Functional Team constituted by Corporate Safety Team, which will have representatives from Execution department, Divisional safety and Corporate / Divisional contracts. SCG will be responsible for the following

- 4.3.1 Assessment of Safety Potential of new vendor before registration as per CSM-F1-Safety Category Qualification Form.
- 4.3.2 Safety Evaluation of the bids as per evaluation format CSM-F-9 Safety Bid Evaluation Criteria
- 4.3.3 Finalization of the Site Safety Management Plan CSM-F-10 submitted by the contractor.

4.3.4 Corporate Safety Team / Cluster Safety Head will be part of SCG during Safety Bid Evaluation for following types of jobs

4.3.4.1 High-Risk jobs to be carried out in Annual Overhaul- / Major Shutdowns and - Outages.

4.3.4.2 Capex jobs of High-Risk Category

### **5.1 Vendor Registration**

For Vendor Registration, Corporate Contract will issue following documents for evaluation of contractor's safety capability

- 1) CSM-F1 –Safety Category Qualification Form
- 2) Safety Terms and Conditions

The document Safety Terms and Conditions provides the information about Tata Power safety System to the contractor. Contractor will submit the CSM-F1- Safety Category Qualification Form with all relevant details and documents to Vendor Registration Initiator, which will in turn forward it to Safety Concurrence Group (SCG) for evaluation. The SCG will evaluate the details submitted by the contractor based on a predetermined criteria CSM-F-5 Safety Potential Evaluation Criteria for Vendor Registration and will determine the category (Category A/B/C/D) for which the contractor will be registered. As mentioned in the above criteria, a site visit may also be organized by SCG prior to registration under Category A and B. In case, the contractor does not qualify the safety criteria, the contractor will not be registered. However, he may apply afresh for registration after 6 months. Please refer Appendix 1: Process Flow Chart for Vendor Registration.

### **5.2 Bid evaluation**

At the time of placing the Purchase Requisition (PR), Order Manager is required to declare the risk involved in the of the job (i.e. High Risk / Medium Risk / Low Risk jobs, based on the RPN in HIRA. If the Job is "High Risk" or "Long Duration", then RFQ will be attached with following documents:

- 1) CSM-F7- Blank Safety Competency Form
- 2) CSM-F8 PPE requirements
- 3) Safety Terms and Conditions
- 4) Job Specific Safety Requirement (Educational and Professional Qualification, Skill & Experience Manpower, Tools and Tackles (e.g. man lifter, use of drone, use & availability of rescue kit), Work Methodology etc.)

Otherwise the RFQ will be attached only with Safety Terms and Conditions. Long term and low value jobs (see definition) are exempted from the CSCC process.

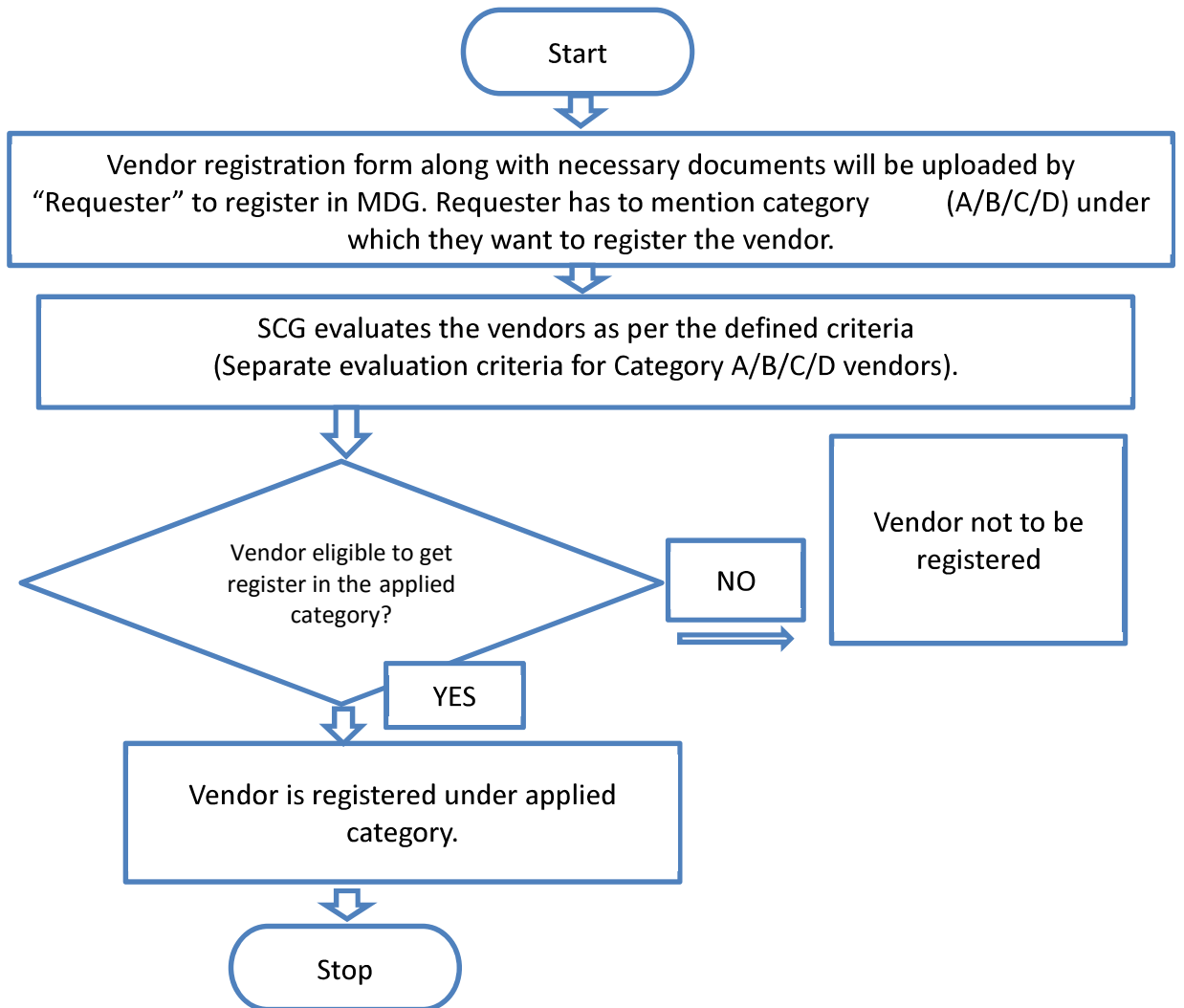
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Corporate Contracts will collect duly filled CSM-F7 Safety Competency Form along with the bid. All other stakeholders will also put their efforts to get all relevant safety data during meeting / discussions with the vendor. SCG will evaluate the document as per the CSM-F9 Safety bid evaluation criteria. If any specific condition related to Contract is required to convey to contractor, Site safety team will attach the same as Annexure for specific conditions of job and submit it to contract team along with safety bid evaluation form. Commercial bid of contractor will be considered for evaluation by contract team only if contractor is qualified in safety bid. Site Safety Management Plan, defining the complete procedure of executing the job at site will be signed by the contractor and SCG after mutual agreement. CC will attach a copy of site safety Management Plan and any specific condition of contract along with PO to the successful bidder. Please refer Appendix 6: Process Flow Chart for issuing RFQ and PO significant health and safety risk associated with it.

### **5.3 Safety Performance Evaluation**

During the time of job execution, regular site inspection will be carried out by the Tata Power officials and violations will be dealt as per CSM-F4 Safety Violation Penalty Criteria. Apart from this, monthly safety performance of the contractor will be evaluated based on the predetermined criteria as per CSM-F11 safety Performance Score and monthly score will be maintained by the Order Manager. Certain percentage of each running bill will be retained as Safety Retention amount and will be released on the basis of Safety Performance Score at certain intervals as defined in CSM- F-3- Safety Performance Evaluation Criteria. Please refer Appendix 10: Process Flow Chart for Safety Performance Evaluation. Percentage of retention amount is mentioned in safety terms and conditions.

## **Appendix 1: Process Flow Chart for Vendor Registration**



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## Appendix 2: CSM-F-1 Safety Category Qualification form

1. "Safety Category Qualification Form" is part of vendor registration form. It needs to be filled by the contractor at the time of Registration and should be submitted to Requester / order manager with all relevant documents.
2. The same will be evaluated by Safety Concurrence Group of the Division (SCG) as per the criteria given in CSM-F-5.
3. Information provided by contractor will be verified during site visit.

### Safety Category Qualification Form

**Please Consider my application for**

Category A Vendor: Vendor eligible to carry out Very High- and High-risk O&M jobs

Category B Vendor: Vendors eligible to carry out technical jobs, classified as Medium / low risk

Category C Vendor: Vendors eligible for to carry out low or very low risk administrative and office jobs

Category D vendor: All Consultants, Medical Practitioners or vendors taking job from Tata Power and working from their own premises.

Name of the Vendor:						
Sr. No	Safety Information	Remarks	Attachment			
1	Certified for i. OHSAS 18001/ ISO 45001, ii. ISO: 14001 iii. ISO: 9001 (ISO certificates to be issued from reputed accreditation agencies specified by Tata Power)	i. Y/ N ii. Y/ N iii. Y/ N	Attach copy of the certification			
2	Safety Statistics for Last Three (3) Years - LTIFR - LTISR	Yes/No		Year 1 (Last FY)	Year 2	Year 3
			LTIFR			
			LTISR			
3	Do you have Safety Policy?	Yes/No	Attach copy of the safety policy.			
4	Do you have Safety training process?	Yes/No	Attach safety training process.			
5	Do you have Safety organization structure e.g. Safety Officers and Safety Committees?	Yes/No	Attach copy of the safety organization structure.			
6	Name and address of sites where work is in progress or worked earlier	Yes/No	Site details to be attached for inspection by Officials.			

Signature :  
 Name and Designation :  
 Stamp of Organization :

### Appendix 3: Safety Terms and Conditions

Please refer the attached document Safety Terms and Conditions.

### Appendix 4: CSM- F-3- Safety Performance Evaluation Criteria

1. A certain percentage of the bill value will be retained against every running bill as safety performance retention. The amount will be released with the last invoice or every six-month based on Safety Performance Score of contractors. The retention amount will be calculated based on contract value as below.

Contract Value	Retention Amount (%)
Up to 10 Lakhs	2.5
10 – 50 lakhs	2
0.5 to 10 Cr	1.5
>10 Cr	1

2. The evaluation criteria include Lead Indicators such as CFSA (Contractor Field safety Audit) score, percentage of workers trained in TPSDI, inspection of critical equipment. Lag indicators such as Fatalities, LWDC and man days lost.
3. The retention amount saved will go to a separate Safety Improvement Fund.
4. For the contract value of more than Rs 1 Cr or contract duration more than 12 months, the retention amount shall be released half yearly based on safety performance. For all remaining contracts, the retention amount will be released with the final bill.
5. Long term jobs with low value (Less than Rs. 1 Cr.) are exempted from the safety retention. Invoice of these type of jobs can be cleared without safety retention.
6. In case of job stoppage due to safety violations / unsafe observations at the site, no time extension shall be given to the contractor, if such delays are attributable to contractor.
7. In case of fatality, limb loss or loss of property, vendor must pay for liability, legal, statutory and additional mutually agreed settlement charges imposed by the appointed committee. This charge is over and above the retention amount.
8. The committee will finalize an amount between 5 -50 lakhs based on factors such as advise by statutory authorities, contract value and impact of accident etc.
9. Safety performance bonus 1% (limiting to 50 lakhs) of the invoice value will be considered at the end of the job if the contractual safety performance score 100%.
10. During the progress of the work, concerned Supervisor/Engineer will visit and inspect the work site regularly and evaluate the safety performance of the contractor based on matrix attached herewith and apply the Consequence management policy as applicable.
11. Order Manager, divisional chief and SBU head have the authority to terminate the contract in case of three consecutive serious violations.

### Safety Performance Evaluation report- CSM-F-3

	<u>Lead Indicators</u>	<u>Unit Of measurement</u>	<u>Target</u>	<u>weight age</u>
1	% of Employee certified in TPSDI/Authorized agency	%	50%	10
2	CFSA score (Annexure 6.1)	Average Severity of Violations	1.49	20
3	Monthly inspection completed by contractor for Critical Equipment, lifting Tools & Tackles and hand tools used at site as per Tata Power Checklist	%	80	5
4	Revalidation of Condition of tools, tackles and equipment by Order Manger.	%	100	15
	<u>Lag Indicators</u>			
1	Number of Fatalities	No.	0	30
2	Number of Lost workday case (LWDC)	No.	0	10
3	Man-days Lost	No.	0	10

## Appendix 5: CSM- F-4 Safety Violation Penalty Criteria

Penalty shall be imposed on the contractors under the following circumstances for breaching the contractual agreements:

Sr No	Description of violation	Severity	Penalty
1.	Working without Permit	5	5000/-
2.	Untrained (TPSDI) worker on high-risk jobs.	5	5000/-
3.	Unhygienic/Bad condition of PPE	2	250/-
4.	Not following Tata Power Procedure & Standard	4	2000/-
5.	Unsafe Act/Condition of Severity 4	4	2000/-
6.	Unsafe Act/Condition of Severity 5	5	5000/-
7.	No Earthling of Electrical equipment	5	5000/-
8.	Damaged welding cable	5	5000/
9.	Violation of Positive Isolation Procedure (LOTO Not followed)	5	5000/
10.	ELCB of more than 30 mA/ELCB not working	5	5000/
11.	On/Off switch of welding m/c not working	5	5000/
12.	Electric cable tied with metal wire	5	5000/
13.	Leakage found DA hose / cylinder	5	5000/
14.	Use of LPG	5	5000/
15.	Use of IC engine based Three-wheeler at the work site.	5	5000/
16.	Starting the job without Toolbox Talk	5	5000/
17.	Spatter falling on DA hose / Gas-line/ pathways / Equipment	5	5000/
18.	No safety latch in crane hook	5	5000/
19.	Load raised or swung over people or occupied areas of buildings	5	5000/
20.	Persons standing in swing area of construction equipment.	5	5000/
21.	Using damaged slings.	5	5000/
22.	Unstable scaffolding/nonstandard Scaffolding in use	5	5000/
23.	Handrails and mid-rails are missing	5	5000/
24.	Safety Harness not anchored with lifeline/fixed structure	5	5000/
25.	Fall arrestor not provided/ Not being used.	5	5000/
26.	Double lifeline not used for working at height	5	5000/
27.	No rubber mat in- Electrical Distribution (DB) room	4	2000/-
28.	Water found accumulated in Electrical Distribution room/near welding machine.	4	2000/
29.	Inserting electric cables into socket, without using plug.	4	2000/
30.	Use of damaged electrical cable/two core cables.	4	2000/
31.	Inflammable material found in Distribution Room / welding areas.	4	2000/

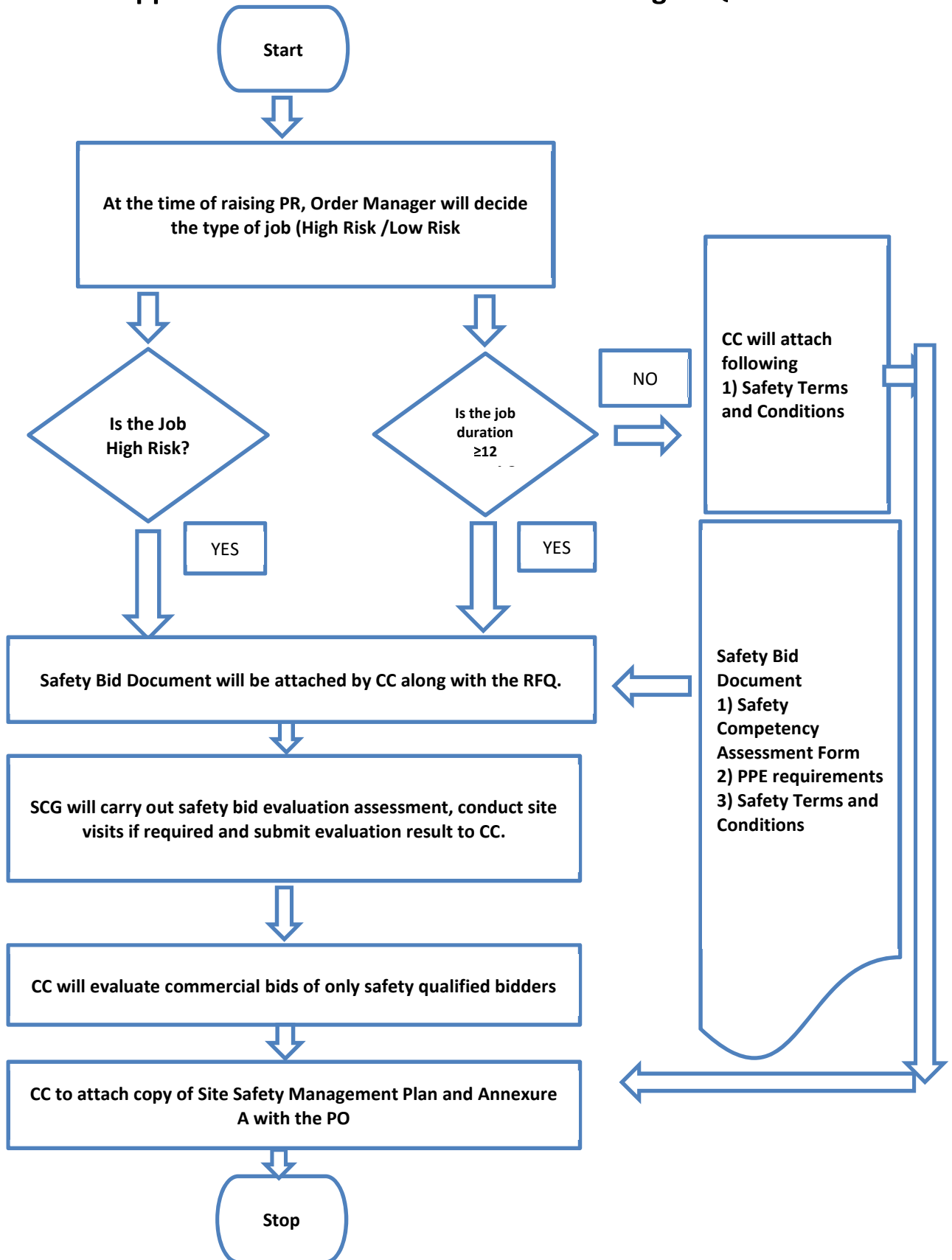


32.	Loose material falling into excavated pit	4	2000/
33.	Water logging into excavated pit /trenches	4	2000/
34.	No / inadequate Barricade	4	2000/
35.	Undercut / cave-in found on sides of excavated pits	4	2000/
36.	Grinding wheel/ Coupling/ Piling winch/other rotating parts without guard	4	2000/
37.	The HMV/Mobile Crane operator does not have a valid HMV driving license.	4	2000/
38.	The loading area is not leveled properly.	4	2000/
39.	Ladder not anchored at top	4	2000/
40.	Opening found in working platform of scaffolding/floor	4	2000/
41.	Inadequate illumination at the working area	4	2000/
42.	Loose material lying on Gantry, platform	4	2000/
43.	Cleaning with Compressed Air.	3	500/-
44.	Gas Cylinders using without cap.	3	500/
45.	Gas Cylinders stored without securing	3	500/
46.	Bringing inside any other chemicals, apart from approved by Safety dept.	3	500/
47.	Using drum for sitting or accessing height.	3	500/
48.	Misusing emergency facilities like fire hydrant line/ hose box/ spray system/ eye wash etc.	3	500/
49.	No provision of Safety net where falling materials or tools may occur	3	500/
50.	Taking electrical supply from non-designated outlet (other than socket).	3	500/
51.	Restricted gangways due to unwanted materials.	3	500/
52.	Not reporting incident.	3	500/
53.	Entering into restricted area like switch yard/ hazardous storage	3	500/
54.	Work without supervision	3	500/
55.	Parking of vehicle without applying wheel choke at right front-front and left rear-rear wheels other than passenger cars.	3	500/
56.	Heavy Vehicle without helper or co-driver.	3	500/
57.	Not wearing florescent safety jacket at site.	3	500/
58.	People travelling in load body of vehicle.	3	500/
59.	Parking of vehicles at non designated area.	3	500/
60.	Shifting heavy materials without guide ropes.	3	500/
61.	Using other than 24V lamp inside the confined space/Use of other than 24V lamps.	3	500/
62.	Angular loading/ lifting with Crane or hoist.	3	500/
63.	By passing the limit switch/ Safety Interlock.	3	500/
64.	Housekeeping activities on road without proper barricade.	3	500/
65.	Trying to board or alit from running vehicle.	3	500/

66.	Cylinder Valves of Gas cylinders not closed when not in use.	3	500/
67.	Flash-back arrester not used.	3	500/
68.	Hand Trolley wheel found damaged.	3	500/
69.	Guy ropes of required length on both sides of object are not used during movement with load.	3	500/
70.	Scotch block/wedge not provided, when the vehicle is parked.	3	500/
71.	Suitable Trolley not provided to hold the cylinders.	3	500/
72.	Locked First Aid box	3	500/
73.	Caution boards, danger signs (luminescent /red) along with emergency contact number are not found displayed.	3	500/
74.	Person found jumping barricading tape	3	500/
75.	Stacking of pipes, pile casing, drums without chock blocks/wedges	3	500/
76.	The terrain on which Heavy Equipment/Machinery moves is not reasonably hard.	3	500/
77.	Without Safety Helmet at working sites	4	250/-
78.	Without Crash Helmet (on bikes)	4	500/-
79.	Without Full body double lanyard Safety Harness (for work at height)	5	5000/-
80.	Without Hand gloves - Material Handling, Welding, Cutting,	4	100/-
81.	Without Safety goggles/ face shield - Welding/Cutting /Grinding	5	5000/-
82.	Handling Chemical without PVC Apron	5	5000/-
83.	Smoking in prohibited area (Closed Go-downs, Storage of flammable material, Storage of Gas cylinders)	5	1000/-
84.	Sleeping at Workplace	3	100/-
85.	Driving beyond speed limit	3	1000/-
86.	Seat Belt While Driving (for front seat passengers and driver)	3	500/-
87.	Driving without license	4	1000/-
88.	Heavy Commercial vehicles without reverse horn	3	500/-
89.	Nonfunctional Head light/ taillight and side indicators	3	100/-
90.	Using Mobile Phone During Driving	5	5000/-
91.	Poor visibility of registration number/ without registration number	3	100/-
92.	Broken/ without Side view mirror	3	100/-
93.	Over speeding above specified limit	3	500/-
94.	Broken/ Without Pressure gauge on Oxygen/ LPG / Acetylene cylinder.	3	500/-
95.	Without Flash back arrester on Industrial Acetylene & Oxygen cylinders.	5	5000/-
96.	Spillage of hazardous material/chemicals during transportation	4	2000/-

97.	Electrical equipment without Earthing/ ELCB/ Double Insulation Cable.	5	5000/-
98.	Lifting Tools & Tackles used without/ expired Test Certificates.	5	5000/-
99.	Housekeeping repeatedly not maintained		
100.	<ul style="list-style-type: none"> <li>• First Time</li> </ul>	3	Warning
101.	<ul style="list-style-type: none"> <li>• Second Time</li> </ul>	4	1000/-
102.	<ul style="list-style-type: none"> <li>• Third Time</li> </ul>	5	5000/-
103.	Serious Violation of House Keeping (after 1st or 2nd warning to be decided by Project Manager depending on the severity)	5	Rs.10000/- and above
104.	Repeat Violation of same nature	5	5 X Penalty for Violation
105.	Appointment of subcontractor without his Safety Bid Evaluation and/or without the permission of engineer in charge or Order manager.	5	5% of Contract Value

### Appendix 6: Process Flow Chart for issuing RFQ and PO



## Appendix 7: CSM-F-7 Safety Competency Form (Template)

**Name of the Vendor/Bidder** : -

**Name of the Sub Vendor** (If job is given to Sub Vendor) : -

**Description of the Job** : -

**Request for Quotation (RFQ) No.** :-

Vendor/Bidder to mandatorily provide the below safety competency related information.

### 1. Proposed Manpower Deployment Schedule : -

Category of Manpower Deployed	Minimum Qualification & Experience	Proposed Numbers against each category month-wise			
		Month 1	Month 2	...	Month n
Project Manager					
Site-In-Charge (Site Manager)					
Shift-in-Charge					
Safety Officers					
Supervisors					
Technicians					
a.....					
b.....					
Highly Skilled Workmen					
a.....					
b.....					
Skilled Workmen					
Semi-Skilled Workmen					
Unskilled Workmen					
<b>Total Manpower</b>					

**Instructions to Bidder to fill:**

- Bidder to provide the overall site manpower deployment schedule as above.
- Bidder to indicate (through colour code mentioned below ) their direct and sub-contracted employees  
Direct bidder employee  
Partly Direct / Partly sub-contracted  
Sub-Contracted
- Against each of the category, bidder to indicate the minimum qualification and experience of the proposed manpower.
- Rows can be added to also identify other specialised manpower e.g. specific details to be included for high risk activities operators
- Columns can be extended to the actual duration of Site activities.
- Bidder to note that if operations is in shifts, then Shift-in-charge / safety officers are required for each shift of operation.

### 2. List of Tools, Tackles, Machines and Equipment: -

Bidder/ Vendor to provide the list of tools, tackles, equipment **to be used during the job / project execution**. Bidder/Vendor to ensure that all the lifting tools and tackles, pressure vessels are duly certified by the competent person authorised by the Chief Inspector of Factories of the respective state prior to start of the job

Sr. No.	Description of Tools / Tackles	Capacity / Rating	Quantity	Make	Remarks
1					
2					
3					
4					
5					
6					
7					
...					

**3. Safety Records:**

Bidder to provide the details of fatalities and lost workday cases (LWDC), occurred in last three years (data to be provided for the last completed FY and preceding 2 years).

Description	Safety Data for Last 3 Years		
	Year 1 (Last FY)	Year 2	Year 3
	20 -	20 -	20 -
Fatalities (Nos.)			
Lost Workday Cases (Nos.)			

In case of no fatalities, LWDC during any year, the form may be filled stating NIL against the respective year. Bidders are encouraged to also submit the RCA / incident investigation reports and the learning's implemented out of the above reported incidents

**4. Job Safety Plan/ Method Statement:**

Bidder to provide / enclose a detailed Site/Job Safety Plan along with a Method statement detailing the execution philosophy (how the bidder intends to execute the Job/Project), identifying all key activities which are required to be performed by the contractor at Site. Bidder to also list down all high-risk activities and provide the Hazard Identification and Risk Assessment (HIRA) for all such high-risk activities involved in the site work.

(Use Method Statement template attached as annexure A and sample as attachment B)

**5. Management System Certification: -**

Sr.	Certification	Yes / No	If Yes, Year of Certification	If No, Target date for Certification
	ISO 9001			
	ISO 14001			
	OSHAS 18001 / ISO 45001			
	Any other (please specify.....)			

Note: Please attach certificates to support above. In case not accredited for above but applied for, application letters may be attached.

### Appendix 8: CSM-F-8 PPE requirements

The Contractor shall ensure that the following PPE of Approved standards shall be available at all time and shall be used by his employees with no exception whatsoever.

1	All contractor's employees at site	Safety Florescent Jacket (orange color), Safety helmet & safety shoes with Composite or steel toe cap
2	Workers mixing asphalt, cement, lime / concrete	Safety goggle & protective Hand gloves and footwear, Nose mask.
3	Welders / Grinders	Welding screen/goggles, safety shoes, leather hand gloves, aprons, leg guard
4	Stone breaker	Protective goggle, hearing protection, anti-vibration hand gloves and Protective clothing.
5	Electricians	Rubber hand gloves & Electrical resistant shoes.
6	Workers engaged in insulation using glass wool etc.	Respiratory mask & leather Hand gloves, goggles.
	Workers engaged in coal handling plant, ash handling plant and working in high dust area.	Dust mask, Hand gloves, protective goggles.
7	Workers working at a height of 1.8 Meter or above.	Double lanyard full body harness, fall arrestor and safety net made of reinforced nylon fiber ropes firmly supported with steel structures

• PPE shall be conforming to BIS/DGMS/DIN specifications, in good condition and shall be comfortable to his employees, when used.

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**Appendix 9: CSM- F-10 Site Safety Management Plan / Method Statement**

**Site Safety Plan / Method Statement (Template)**

This Method Statement describes the specific safe working methods which will be used to carry out the described work. It gives details of work procedure with control measures to counter health and safety issues related to this work. The listed content of this Method Statement can be changed/modified subjected to job scope / specifications, but task specific method statement once finalized & approved, that should not be modified during work execution without permission from the approving authority.

Project/Job Name			
<b>Scope of work: -</b>			
Drawing References: -			
Detail of Sub contractors involved: -			
Method Statement Prepared By: - Designation: - (e.g. Site Manager)	<u>Signature</u>	<u>Date</u>	

**1.0 Introduction** *(Describe purpose of the work, give details of type and scope of work being carried out);*

**2.0 Location of Work** *(Give site address and precise location on site where work is to be carried out. )*

**3.0 Safety Document /Specific Approval Required** *(Details of any safety documents or specific approval i.e. Client specific approval required to undertake the work)*



**5.0 Role & Responsibilities of Personnel/Parties Involved in activities:** -Clearly define role and responsibilities of all personnel involved in activity i.e. Site management staff including subcontractors' parties- Main contractor Project/Site Manager, Sub Contractor Site Manager, Project Engineer, Safety officer, Competent Supervisory Staff)

**6.0 Working/Activity Description:** - *It is important that all operatives should have clear idea of those operational sequences and responsible supervisor must verify their competency prior to their engagement in operation.*

**6.1 Pre-Working Checks**

**6.2 Resources (Equipment, tools including manpower) Details** *i.e. Equipment and Tools, specific operational equipment, test kits, lifting resources, Details of materials to be used in operation, including any reference to COSHH assessments in case of use of any chemicals, Details of the manpower allocated to the task, e.g. titles, qualifications, competences, direct manpower, contractors. Details of plant, tools and equipment to be used for the work, including the availability of relevant statutory documents, checks or inspections etc. Details of fencing, barriers, cones, chains, dangers notices, warning signs etc.*

**Tools required for work:**

Sr.No	Tools /Equipment /Machine	UOM	Required Qty.	Remark
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

**6.4 Operational Sequence of work:** - Full description of the work, setting out the methodology in a sequential manner, including any reference to any identified operational restraints. Also refer here sec. 5.0 responsibilities part for every step of work sequence).








Sr.No	Activity	Details of job sequence	Risk Involved	Control Checks
1.		1.		
2.				
3				
4				
5.				

**6.7 Final Checks & restoration of work area after completion of work :-** Those checks to be carried out by responsible supervisor in witness of his line hierarchy by use of specific checklist of certain operational checks and once those completed satisfactory, PTW (if applicable) to be closed and isolation arrangements to be restored by removing barricades/cautionary tags.

**7.0 Task Specific Hazards:** - Refer to Task Specific Risk Assessment and attach in appendix

**Attachment:** - Specific Risk Assessment

In addition, please provide below control measures in risk assessment (as applicable).

Fall Protection Measures: (Where Work at height cannot be avoided)							
Control Measures for Electrical Hazards							
Others Hazard if any (please provide details)							
Hazardous Substances to be used in job : (Attach MSDS if required)							
	Yes /No	Yes /No	Yes /No	Yes /No	Yes /No	Yes /No	Yes /No


**7.0 Emergency Provisions:** -Relevant operational possibility of a programme in the case of emergency situation i.e. electrical supply restoration. In addition emergency response provisions i.e. first aiders, fire fighting, and first aid arrangements, nearest onsite/offsite emergency response also to be considered during emergency planning.

**8.0 "5S issues" / Waste Disposal/ Housekeeping and Environmental issues: -Details waste disposal processes and or housekeeping activities, Details of environmental impacts and control measures.**

**9.0 Personal Protective Equipment (PPE):- (Tick on PPE requirements for the task/Job**

Required Personnel Protective Equipment:	 Safety Boots	 Hard Hats	 Safety Gloves	 Hearing Protection	 Eye Protection	 Respiratory Protection	Other: 1. Hi-Viz 2. Coveralls 3.
--	---	--	--	---	---	---	---

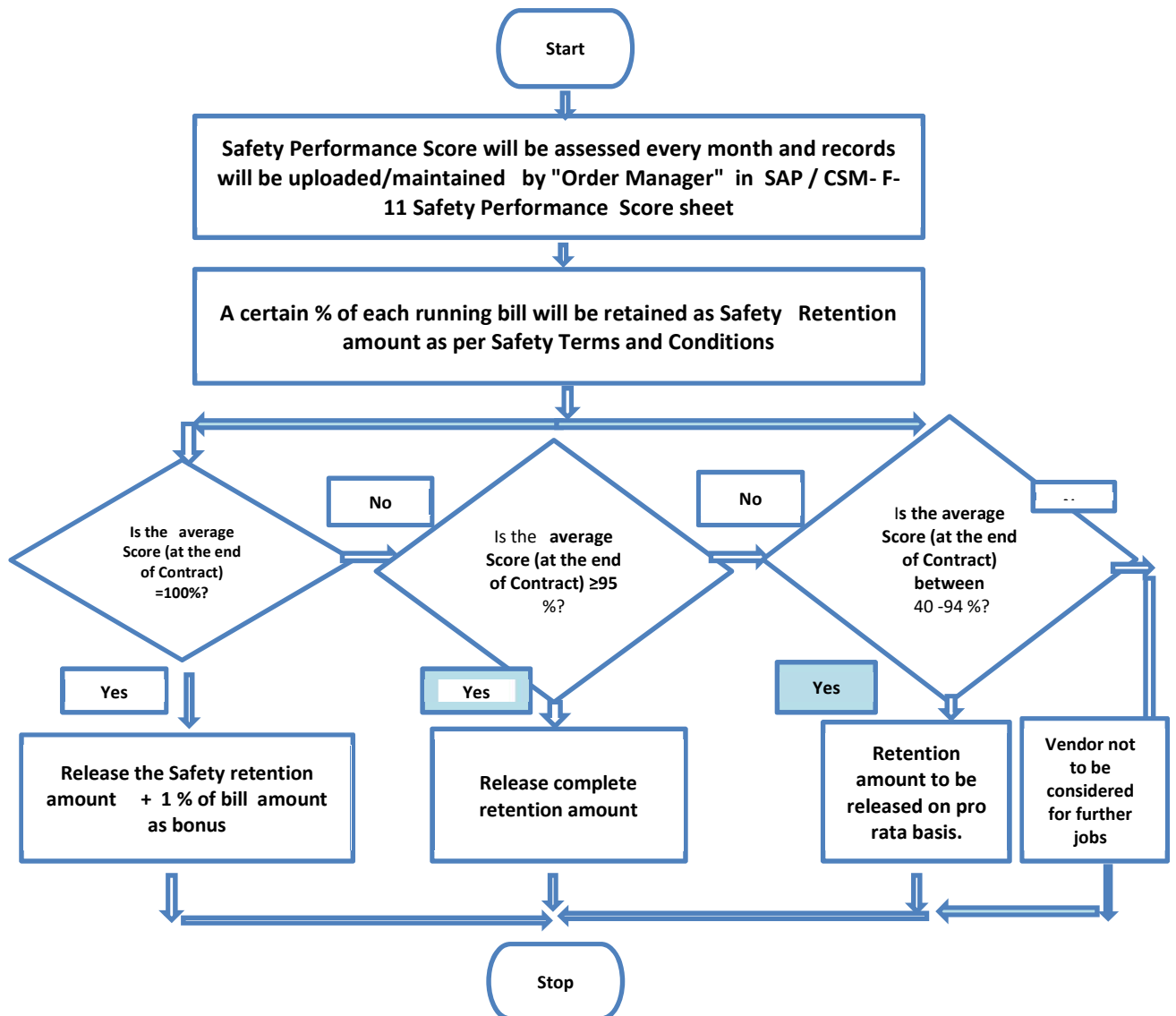
**10.0 First Aid facilities and Nearby Hospitals Details**

	Name of On-Site First Aider:	
	First Aid Box Location:	
	Location of Nearest Hospital:	

**11.0 Occupational Health, Fitness and COVID-19 related Preparedness:**

1. Please give a brief writeup / methodology of your organization planned to avoid impact of the COVID-19 pandemic at Tata Power working site.
2. Please give brief details of occupational health and hygiene related interventions planned by your organisation to ensure good health and fitness of workforce at Tata Power site.

### Appendix 10: Process Flow Chart for Safety Performance Evaluation



### Appendix 11: CSM- F-11 Safety Performance Score

Sr. No	Parameter	Unit of Measurement	Target	Weight age	Actual Performance	Actual Score
<b>Lead Indicator</b>						
1	% of Employee certified in TPSDI/Authorized agency	Number	50%	10		
2	CFSA score (Annexure 6.1)	Average Severity of Violations	1.49	20		
3	Monthly inspection completed for Critical Equipment, lifting Tools & Tackles and hand tools used at site	Number	80%	10		
4	Condition of critical tools, tackles and equipment	Number	100%	10		
<b>Lag Indicator</b>						
1	Number of Fatalities	No	0	30		
2	Number of Lost workday case (LWDC) (reportable)	No	0	10		
3	Man-days Lost	Man-days	0	10		
					<b>Final Score</b>	
					<b>Invoice Value</b>	
					<b>Amount to be released</b>	

**Safety Performance Evaluation Criteria**

**Lead Indicators**

	<b>Target</b>			
% of Employee certified in TPSDI/Authorized agency	50%	100%	Less than 100%	
Score		10	5	
	<b>Target</b>			
CFSA score	<=1.49	1.5 to 2.5	2.51 to 3.5	>=3.51
Score	20	15	10	0
	<b>Target</b>			
Monthly inspection completed for Critical Equipment, lifting Tools & Tackles and hand tools used at site	>=80%	79 to 50%	<50%	
Score	10	7	0	
	<b>Target</b>			
Condition of critical tools, tackles and equipment	100%	<100%		
Score	10	0		

**Lag Indicators**

Number of Fatalities	0	>0	
Score	30		0
Number of LWDC (reportable)	0	>0	
Score	10		0
Number of man days lost	0	1 to 5	>5
Score	10	5	0

## Appendix 12: CSM-F-5 Safety Potential Evaluation Criteria for Vendor Registration

At the time of vendor registration, vendor will be registered under 3 categories

- 1) **Category A**- Vendors eligible to carry out High risk Jobs
- 2) **Category B**- Vendors eligible to carry out technical jobs that are low risk
- 3) **Category C**- Vendors eligible to carry out administrative and office jobs
- 4) **Category D**- Outsourced Jobs / Consultants /Medical Practitioners / Suppliers etc

For vendors to be registered under **Category A**, a safety potential evaluation will be carried out based on following parameters.

Sr. No	Description	Weight	Actual	Remarks
		age (%)	Score	
1	Does the contractor have a valid ISO 45001/ OHSAS 18001/ Certification?	30		
2	During site visit check for safety adequacy at site	30		Annexure - 12.1
3	Check the Safety statistics of Contractor	10		Annexure - 12.2
4	Check the Safety orientation & training process of Contractor	15		Annexure 12.3
5	Check the organizational structure for safety professionals & engineers / supervisors.	10		Annexure - 12.4
6	Certified/skilled workers as a percentage of overall workforce	5		
	Total	100		

### Evaluation Criteria for Category B

Sr. No	Description	Weight	Actual	Remarks
		age (%)	Score	
1	Does the contractor have a valid ISO 9001 certification?	30		
2	During site visit check for safety adequacy at site	30		Annexure -12.1
3	Check the Safety statistics of Contractor	10		Annexure -12.2



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4	Check the Safety orientation & training process of Contractor	15		Annexure -12.3
5	Check the organizational structure for safety professionals & engineers / supervisors.	10		Annexure -12.4
6	Certified/skilled workers as a percentage of overall workforce	5		
	<b>Total</b>	<b>100</b>		

### **Evaluation Criteria for Category C**

Sr. No	Description	Weight age (%)	Actual Score	Remarks
1	Does the contractor have a valid ISO 9001 certification?	40		
2	Check the Safety statistics of Contractor	40		Annexure - 12.2
3	Check the Safety orientation & training process of Contractor	20		Annexure - 12.3
	<b>Total</b>	<b>100</b>		

### **Annexure 12.1: Evaluation Criteria for Category D:**

Category D does not require any evaluation as it is for outsourced job outside the Tata Power company premise.

### **Annexure 12.2**

Check List – Adequacy of Safety Statistics of Service Provider			Actual Marks obtained	Remarks
Sr. No	Description	Marks		
1	Check the safety statistics for last 3 years (LTIFR and LTISR)	Statistics available	5	
		Statistics not available	0	
2	Check the trend LTIFR for last 3 years	LTIFR value	Marks	
		0 to 0.2	5	
		0.21 to 0.3	2.5	
	>0.3	0		
3	Check the trend of LTISR last 3 years	LTISR value	Marks	
		0 to 2	5	
		2 to 3	2.5	
	>3	0		
4	Has there been any Prosecution/Conviction for any contravention with regard to Safety & Health provisions under the Factories Act /Electricity Act/ BOCW Act and Rules framed there under?	No Prosecution	10	
		Prosecution	0	
		To be provided in written on letter head		
	<b>Total</b>		<b>25</b>	

**Annexure 12.3**

Check List – Adequacy of Safety orientation & training process of Service provider			Actual Marks obtained	
1	Records of safety trainings provided to safety officer/supervisor/workmen during last 1 year as percentage(%) of total employed by service provider	<b>Safety Officer</b>	Marks	
		≥80% of employees	5	
		50 to 79 % of employee	2.5	
		<50%	0	
		<b>Safety Supervisor</b>	Marks	
		≥80% of employees	10	
		50 to 79 % of employee	6	
		<50%	0	
		<b>Workmen</b>	Marks	
		≥80% of employees	10	
		50 to 79 % of employee	6	
		<50%	0	
<b>Total</b>			<b>25</b>	

**Annexure 12.4**

Check List – Adequacy of organizational structure for safety professionals & engineers / supervisors.			Actual Marks obtained	
1	Check availability of number of safety officers from government recognized institute as per workforce strength.		Marks	
		1 in 50 employees	10	
		1 in 100 employae	6	
		Any other	0	
3	Check availability of qualified workforce from government recognized institute/TPSDI.		Marks	
		100% of safety officers qualified	5	
		50 – 99% of safety officers qualified	3	
		<50	0	
<b>Total</b>			<b>15</b>	

### Appendix 13: CSM-F-9 Safety Bid Evaluation Criteria.

The User has to select whether the job is high risk/ long duration at time of raising the PR.

- 1) The decision whether job is “**high risk**” or not has to be made by order manager on the basis of Risk involved (Risk Priority Number in HIRA) of the Jobs. An indicative list of high-risk jobs is attached as annexure
- 2) If a technical job is of low risk with estimated duration of the contract is 1 year or more the job should be treated as “**long duration**”.
- 3) All Safety bids will be evaluated by Safety Concurrence Group. Structure of SCG will be declared by Corporate safety. Corporate safety team will audit bid evaluation process of a few selected jobs and Quality of evaluated safety Bids.
- 4) Records of jobs sent by for Safety Bid evaluation shall be maintained by Corporate Contract team in existing tracing sheet along with other jobs.
- 5) For Safety Bid Evaluation will be based on following parameters.

		Minimum Requirement	Weight age (%)	Score Obtained
Manpower	<b>Safety Officer (1 per 500 workers)</b>	<p><b>Qualification-</b> Officer shall possess Advance Diploma In Industrial Safety by state technical board.</p> <p><b>Experience-</b> Minimum 1-year experience in relevant field as mentioned in the job in PR.</p>	5	
	<b>Safety Supervisor (1 per work site up to max. 50 workers)</b>	<p><b>Qualification-</b> Supervisor shall possess ITI/ Diploma in relevant field.</p> <p><b>Experience-</b> Minimum 2-year experience in relevant field as mentioned in the job in PR.</p> <p><b>Training –</b> Trained and certified by TPSDI or equivalent institute in relevant safety procedures.</p> <p><b>Note:</b> On request of the contractor/Users -TPDSI should vet &amp; certify the skilled &amp; experienced</p>	5	

		Technician if Technical Qualification is not adequate.		
	<b>Technician (Skilled workers as electrician, rigger, fitter, welder, cable jointer, line men etc)</b>	<b>Experience-</b> Minimum 2 year experience in relevant field as mentioned in the job in PR.  <b>Training</b> – Trained and certified by TPSDI or equivalent institute in relevant safety procedures.	5	
<b>Tools &amp; Tackles</b>	Equipment / Machines/ Tools & Tackles(lifting and shifting tools)	The list of Equipment /Machines / Tools and tackles to be used for job to be submitted by the contractor. Evaluation of the list will be carried out based on 1) Suitability as per the relevant job 2) Make and age of the tools from authorized agencies defined by the user. 3) Certification by the competent authority of respective state.	30	
<b>Safety Records</b>	Safety Records	Safety Records for last 3 years (as per vendor or as per our knowledge) – Recommendation?	15	
<b>Safety Plan</b>	HIRA/Contract Job Safety Plan	Adequacy of HIRA and Job Safety Plan with respect to relevant job. More weight age will be given to vendor for using mechanized work and advanced tools and equipment	20	
<b>Accredited Bodies certificate</b>	ISO-9001	ISO-9001	2	
	ISO-14001	ISO-14001	3	
	OHSAS 18001 ISO 45000	OHSAS 18001/ISO 45000	15	
<b>Total Score</b>				

6) Vendor entitled to carry out the job only when qualified for the safety evaluation as follows:

Contractor is qualified in safety bid only if his total score is more than 70% in all category 1 jobs such as high risk/long duration.

- 7) The Corporate Contract has to ensure that the vendor provides the filled "Safety Competency Form" along with the quotation.
- 8) Corporate Contract will forward the Safety Competency Form received from the contractor to the Safety Concurrence Group for evaluation.
- 9) In case SCG wants to visit the site, the Safety Competency will be based on evaluation at the time of site visit Annexure 13.1

**Annexure -13.1:**

<b>Checklist to be used: During site visit to check the adequacy Safety systems.</b>			
		Observation	Score* (1-5)
1	Check the adequacy of safety policy and Safety Management system of the contractor.		
2	Does the contractor have written down safety procedures?		
3	Check the records of Near miss, unsafe act, unsafe conditions and incidents.		
4	Check the organization setup to implement the safety systems at site (safety officer, safety supervisor)		
5	Check whether safety meeting and toolbox talk carried out regularly and records maintained or not.		
6	Is the process of incident investigation adequate or not?		
7	Verify incident reporting and recording system		
8	Check the usage of equipment/tools and tackles.		
9	Check for housekeeping at site		
10	Check the use of PPEs and general behavior of workforce towards safety		
	<b>Total Score</b>		
	<b>Site Visit Score</b>		

Score\*- rating on the scale of 1-5 to be given based on the observations on site. Score of 1 is the lowest and core of 5 is the highest.

### Appendix 14: CSM-F-11.1 CFSA Format

CONTRACTOR FIELD SAFETY AUDIT														
Project Name :														
Date:														
Description of Severity rating:						Audit Team:								
1 = Untidy area, minor issues, sets poor example														
2 = Restricted access, unacceptable trash, disorderly														
3 = Rule or procedure violation, potential injury														
4 = Unsafe condition, serious injury potential														
5 = Immediate serious injury potential, stop activity immediately and correct		Audit Time:						10:00hrs -11:30 hrs						
Weather:						cloudy								
Area	Description	Responsible		Number Personnel Observed		Violations			Remarks	Leading Indicators				
		Engineer	Contractors	Good Citizens	Violators	Number of Violations	Severity	Violations x Severity		4 & 5	PPE	Unsafe Act	Unsafe Condition	
1														
	<b>Sub Totals</b>			0	0	0	0	0			0	0	0	0
	<b>% of Observed People Working Safely</b>													
	<b>Number of Violations</b>													
	<b>Average Severity of Violations</b>													
	<b>Number of Severity 4 &amp; 5 Violations</b>													
	<b>% of 4 &amp; 5 Violations</b>													
	<b>Approximate Number of Workers Observed</b>													
	<b>Number of People on Site</b>													
	<b>% of Workers Observed</b>													

## Appendix 15: Indicative List of High-Risk Jobs

To access the exhaustive list of High-risk jobs, please refer the following documents

- 1) High Risk Jobs- Generation
- 2) High Risk Jobs- T&D
- 3) High Risk Jobs- Renewable

### Indicative List of High-Risk Jobs -Generation Cluster

Sl. No.	Jobs				
1	Demolition / Painting of Chimney				
2	Survey Sounding Jobs in Sea				
3	Dredging at Coal Birth Jetty				
4	Maintenance / Testing and Replacement of Extra High Voltage (132 KV etc.) Switchyard equipment				
5	Maintenance of EOT Cranes				
6	Deep excavation (5 feet or more) near existing buildings /Structure s				
7	Working inside confined spaces (entry through manhole)				
8	Operation Maintenance of elevators				
9	Working on Live control Circuits for identification of faults				
10	Cable laying and termination Jobs				

### Indicative List of High-Risk Jobs - T&D Cluster

Sl. No.	Jobs				
1	Transmission Line Tower Erection on columns, near live lines, In congested areas, In creeks, In the Sea				
2	Conductor Stringing on Tower Using Tensioner & Puller in the area such as Line Crossing, Near Live lines, Congested Areas, Road Crossing, Bridge Crossing, Railway line Crossing, In creeks ,In the Sea				
3	Cable Pulling by Using winch Machine in City and Rural Areas				
4	Hot Washing of HT and Extra HT lines, Towers and switchyards equipment				
5	Installation of Lifts				
6	Installation of EOT Cranes				
7	Tower Dismantling				
8	Working on H Frame /Pole mounted Transformers				
9	Excavation in operational Area heaving power cables in receiving station				
10	Identification and spiking of cable / disconnection of cables from poles				



### Indicative List of High-Risk Jobs - Renewable Cluster

Sl. No.	Jobs					
1	Working on Electrical Panels					
2	Hi Potting of Equipment					
3	Battery commissioning and maintenance					
4	Working on the nasal of Wind Turbine					
5	Working on live electrical switchyard, material Handling and Equipment installation					
6	Roof Top Solar Panels Installation and maintenance					
7	Working in live Electrical Switchyard, Material Handling, equipment installation					
8	All maintenance activities that requires climbing on Towers /Structures / Transformer/ GODs					
9	Loading and Unloading of Solar Panels on trucks					
10	Structural Repair /Dismantling work at height.					



# **STANDARD TECHNICAL SPECIFICATION COVER SHEET**

**Specification No. : ENG-EHV-1001**

**Specification Name : Technical Specification for 33/11kV 5MVA and 8 MVA Power Transformer**

<b>SWARUP NAYAK</b>	<b>SHANTAPRIYA JENA</b>	<b>JYOTIPRAKASH MOHANTY</b>	<b>Vijender Goyal</b>	<b>KHAJAN BHARDWAJ</b>	<b>POURUSH GARG</b>
Prepared by	Reviewed by	Reviewed by	Reviewed by	Approved by	Released by
TPCODL	TPNODL	TPWODL	TPSODL	TPCODL	TPCODL
07-12-2022	07-12-2022	07-12-2022	07-12-2022	07-12-2022	07-12-2022

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**1. SCOPE:**

This Specification provides for design, engineering, manufacture, assembly, stage inspection, final inspection and testing before dispatch, packing and unloading at destination Sub-station / stores by road transport, transit insurance, of 5 MVA and 8 MVA, 33/11 KV Power Transformer(s), complete with all fittings, accessories, associated equipment, spares, required for its satisfactory operation in any of the sub-stations of the Purchaser.

The Transformer shall be of outdoor type with tap changers as detailed below.

**5.00 MVA - ON Load Flange Mounted type Tap Changer**

**8.00 MVA - ON Load Flange Mounted type Tap Changer**

Such of the parts that may have not been specifically included, but otherwise form part of the transformer as per standard trade and/or professional practice and/or are necessary for proper operation of transformer, will be deemed to be also included in this specification. The successful bidder shall not be eligible for any extra charges for such accessories etc. notwithstanding the fact that at the time of an initial offer bidder had segregated such items and quoted for them separately.

**2. APPLICABLE STANDARDS:**

The equipment ( and the materials used ) covered by this specification shall unless otherwise stated, be designed, manufactured and tested in accordance with the latest editions of the following Indian standards & other relevant standards for components, BEE & CEA guidelines with latest amendment from time to time, thereof, some of which are listed below:

SI.No	Reference Standard	Reference Standard Name
1	IS 5	Specification for Colors for Ready Mixed Paints and Enamels
2	IS 104	Specification for ready mixed paint, brushing, zinc chrome, priming
3	IS 335	Specification for New insulating oils
4	IS 649	Methods for testing steel sheets for magnetic circuits of power Electrical apparatus.
5	IS 1576	Solid Pressboard for Electrical Purposes - Specification
6	IS 2026	Specification for Power Transformers
7	IS 2099 / IEC-61037	Specification for Bushings for Alternating Voltages Above 1000 Volt
8	IS 2362	Determination of Water content in oil by Karl in oil Fischer Method- Test Method

9	IS 2544	Specification for Porcelain post insulators for systems with nominal Voltage Greater than 1000V
10	IS 2705	Specification for Current Transformers
11	IS 3401	Specification of Silica Gel
12	IS 3637/ IEC-364	Specification for gas operated relay (Buchholz relay).
13	IS 4253: Part II	Specification for cork composition sheets - Part II: Cork and Rubber
14	IS 4257 (PART I)	Dimensions for Clamping Arrangements for Porcelain Transformer Bushings - Part I : For 12 kV to 36 kV Bushings
15	IS 5082	Specification for Wrought Aluminum and Aluminum Alloy Bars, Rods, Tubes, Selection, Plates and Sheets for Electrical purposes
16	IS 5561	Specification for Electric Power Connectors.
17	IS 6103	Specification for Method of Testing of specific resistance (Resistivity) of electrical insulating liquids
18	IS 6262	Method of test for power factor and dielectric constant of electrical Insulating liquids
19	IS 6600	Guide for Loading of Oil-immersed Transformer.
20	IS 6792/ IEC-156	Method for Determination of Electric Strength of Insulating Oil
21	IS 8468	On-load tap changers
22	IS 8603 (PART-1)	Dimensions for Porcelain Transformer Bushings for Use in Heavily Polluted Atmospheres - Part I: 12 kV, 17.5 kV, 24 kV and 36 kV Bushing
23	IS 9335	Specification for Cellulosic Papers for Electrical Purposes
24	IS 10028:	Code of Practice for Selection, Installation and Maintenance of Transformers
25	IS 12444	Specification for Continuously Cast and Rolled Electrolytic Copper Wire Rods for Electrical Conductors.
26	IS 13964	Methods of Measurement of Transformer and Reactor Sound level
27	IS 3639	Specification for fitting & accessories of Power Transformer

28	IS 1866	Code of practice for maintenance of transformer oil
29	IEC 60156	Insulating liquids - Determination of the breakdown voltage at Power frequency - Test method
30	IS 2074	Ready Mixed Paint, Air Drying, Red Oxide Zinc Chrome, Priming – Specification
31	IS 2932	Enamel, Synthetic, Exterior: (a) Undercoating (b) Finishing – Specification
32	IEC 60296	Specification for unused mineral insulating oils for transformers And switchgear
33	IEC 60529	Degrees of protection provided by enclosures (IP Code)
34	IEC 60437	Radial Interference test on high-voltage insulator
35	IEC 61936-1	Power Installation exceeding 1kV.
36	C.B.I.P Publication	Manual on Transformers

*\*In case of any conflict on any technical particular in the specification, the stricter requirement mentioned in the relevant standard shall be valid.*

### 3. CLIMATIC CONDITIONS:

1	Maximum ambient temperature	50 deg C
2	Max. Daily average ambient temp	35 deg C
3	Min Ambient Temperature	0 deg C
4	Maximum Humidity	95%
5	Average Annual Rainfall	1500mm
6	Average No. of rainy days per annum	120
7	Altitude above MSL not exceeding	1000m
8	Wind Pressure	300 Km/hr
9	Earthquakes of an intensity in horizontal direction	equivalent to seismic acceleration of 0.3g
10	Earthquakes of an intensity in vertical direction	equivalent to seismic acceleration of 0.15g (g being acceleration due to gravity)

TPCODL service area has heavy saline conditions along the coast and High cyclonic Intensity winds with speed upto 300 Kmph. The atmosphere is generally laden with mild acid and dust in suspension during the dry months and is subjected to fog in cold months.

#### 4. GENERAL TECHNICAL REQUIREMENTS:

4.1 The transformer shall conform to the following specific parameters.

Sl.no.	Parameters	Desired Values	
1	Rated MVA (ONAN rating)(MVA)	5 MVA	8 MVA
2	No. of phases	3	
3	Type of installation	Outdoor	
4	Frequency	50 Hz (± 5% )	
7	Rated voltage		
	a) High voltage winding	33 KV	
	b) Low voltage winding	11 KV	
8	Highest continuous system voltage		
	a) HV Winding	36 KV	
	b) LV	12 KV	
9	No.of Windings	Two Winding Transformer	
10	Type of Cooling	ONAN	
12	Method of connection		
	HV	Delta	
	LV	Star	
13	Vector Group	Dyn11	
14	System Earthing (Neutral terminal to be brought out)	Neutral LV side to be solidly earthed	
15	Percentage impedance voltage on normal tap at Base MVA <b>(Tolerance shall be as per IS 2026 Part-1,Clause 9, Table No.1)</b>	7.15 %	8.35%
16	Transformer shall be suitable for continuous operation at a voltage of 110% on each operating tap. Transformer shall be suitable to withstand 120% of the loading on each tap.		
17	Transformer shall be capable of delivering the rated current at a voltage equal to 105% of rated voltage, without exceeding the temperature rise specified.		
18	Over Voltage operating capability and duration	112.5 % of rated voltage ( continuous )	
19	Maximum Flux Density	1.6 Tesla	
20	Basic Insulation levels for windings(Neutral should not be shaded) :-		
	a) 1.2 / 50 microsecond wave shape Impulse withstand (KVP)	33KV : 170 11KV: 95	
	b) Power frequency voltage withstand (KV rms)	33KV : 70 11KV: 28	
21	Type of winding insulation	Uniform	

22	Withstand time for three phase short circuit at LV Bushings	3 Seconds
23	Permissible Temperature Rise over ambient temperature of 50 deg C	
	a) Of top oil measured by thermometer.	45 Deg C
	b) Of winding measured by resistance.	55 Deg C
24	Minimum clearances in air (mm) :-	
	HV	Phase to Phase: 400 Phase to ground: 320
	LV	Phase to Phase: 280 Phase to ground: 160
25	Core Material	CRGO Silicon Steel, M3 or better
26	Class of Insulation	A/A
27	Terminals	
	a) HV winding	36 KV oil filled communicating type porcelain bushings (Anti-fog type)
	b) LV winding	17.5 KV porcelain type of bushing (Antifog type )
28	Insulation levels for windings :-	
	a) 1.2 / 50 microsecond wave shape Impulse withstand (KVP)	33KV : 170 11KV: 95
	b) Power frequency voltage withstand (KV rms)	33KV : 70 11KV: 28
	c) Creepage distance (min)	33KV : 900 mm 11KV: 300 mm
29	Material of HV & LV Conductor	Electrolytic copper
30	Maximum current density for HV and LV winding for rated current	2.4 A / mm <sup>2</sup>
31	Polarisation index i.e ratio of megger values at 600 sec. to 60 sec for HV to earth, L.V to earth and HV to LV .	Shall be greater than or equal to 1.5, but less than or equal to 5
32	Core Assembly	Boltless Type
33	WTI & OTI	1 nos each
34	Losses	The losses shall not exceed the value given below
	a) No load loss (fixed losses) KW	5 MVA=3.6 KW 8 MVA=4.2 KW
	b) Load losses at 75°C KW	5 MVA=20 KW 8 MVA=32 KW

35	Wheels	The transformer shall be provided with four flanged bi-directional rollers suitable for rail gauges in both the axis for movement of the transformer in either direction. (Rail in TPCODL Scope)
36	Over fluxing capability	Transformers shall be designed for continuous over fluxing withstands capability due to +10% to -10% voltage variation on HV side and frequency variation of ±3%. Combined variation of voltage and frequency shall be within ±10%.
37	Auxiliary Supply	
	a) AC	415 Volts 3 phase 4 wire, ungrounded (Provision to connect neutral to be made in the terminal block). Two 415 V sources shall be made available by TPCODL
	b) DC	24/48V (DDE)
38	No Load Current	No Load Current shall be 0.5% of full load current. Tolerance for No-Load Current shall be +30% of the declared value.
39	Core Grounding	The core and frame grounding connection shall be brought out through a suitable bushing for provision of external grounding. The bidder shall submit the drawing clearly showing the details of core grounding.
40	On Load Tap changer (OLTC) on HV Side	
	a) Type	On Load (Flanged type)
	b) Range	+ 4.686% to -20.606 % in steps of 1.56%
	c) Number of Steps	16 (17 Position)
	d) Principal Tap Position	5th
	e) Manual / Automatic	Yes (Both)
	f) Remote / Local	Yes (Both)
	g) IS	8468-2006
	h) All contacts should be SCADA compatible and suitable for connection to TMU	Yes
	i) Separate Conservator and OSR, PRV & MOG	Yes
	j) Potential free contacts for SCADA shall be Provided	Yes
	k) 415 V Auto change over facilities for OLTC Motor shall be Provided	Yes
	l) Flow of Power	Bidirectional



m) Surge Relay	Yes
n) Whether separate tap winding provided for OLTC	Yes
o) RTCC	No
p) SCADA and TMU compatibility	Yes

**WTI CT for LV Side**

Core	Purpose	CTR for 5 MVA & 8 MVA	Class	Burden	Knee Point Volt	Imag at Vk/2	ISF	Rct
I	WTI	262/1A (5 MVA) 420/1A (8MVA)	0.5	30 VA	-	-	<10	-

**4.2 PERFORMANCE**

- I. The transformer 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.
- II. Transformer shall be capable of operating under natural cooled condition up to specified load.
- III. The transformer shall be designed with particular attention to the suppression of maximum harmonic voltage, especially the third and fifth harmonics so as to minimize interference with communication circuit.
- IV. The transformer shall be able to withstand thermal and mechanical stresses caused by symmetrical or asymmetrical fault on any winding.
- V. The transformer and all its accessories including CTs etc. shall be designed to withstand thermal and mechanical effects of any external short circuits to earth and short circuits at the terminals of any winding for a period of 3 sec without any damage/injury.
- VI. Loading of the transformer shall be as per IS: 6600, IS: 2026 part-7, IEC 60076-7
- VII. Transformer shall be compatible for Operation along with Tap Changer Control panel or Transformer Monitoring Unit (TMU). Supply of TMU is not in scope of Bidder.

**5. GENERAL CONSTRUCTION:**

**5.1 GENERAL:**

- I. All transformers shall be provided with detachable, flanged, bi-directional wheels for movement and mounting on rail gauge. TPCODL shall provide rail tracks grouted in concrete foundation. Bidder shall provide means for locking the wheels in positions parallel to and at right angles to the longitudinal axis of the tank.
- II. Transformer shall be two winding type, with cold rolled grain oriented, silicon-steel laminations having excellent magnetic properties, insulated and clamped to minimize vibration and noise. Laminations shall be insulated from each other with material having high inter-lamination insulation resistance and rust inhibiting property All covers and seals shall be oil and airtight and shall not be affected by mineral or synthetic oil action.

- III. All fasteners of M10 and below size should be of stainless steel. All fasteners of M12 and above size should be hot dip galvanized. To achieve a good quality corrosion free painting, bidder should provide epoxy plus polyurethane paint with minimum paint thickness of 120 microns.
- IV. The framework, clamping arrangement and general structure of the cores of each transformer shall be of robust construction, having proper support structure and shall be capable of withstanding any shock to which they may be subjected during transport, installation and service. Detailed calculation for selection of bolts shall be submitted. The framework and the core bolts shall be efficiently insulated from the core so as to reduce the eddy-currents to a minimum.
- V. The limbs and the yokes of the core shall have similar sections to minimize heating and noise arising from transverse flux. The joints in the laminated magnetic circuit shall be interleaved.
- VI. The core clamping frame shall be provided with lifting eyes having ample strength to lift the complete core and winding assembly. The core assembly of oil immersed transformers shall be electrically connected to the transformer tank for effective core earthing.
- VII. The neutral terminal shall be brought out through neutral bushing from the tank and the same shall be brought up to the skid level, duly insulated by means of suitably rated epoxy insulators. The neutral conductor lead shall be of copper conductor designed to carry the maximum Earth Fault Current with solidly earthed neutral. The bidder shall justify the voltage/current rating of the neutral bushing chosen during detailed engineering. The voltage rating of the neutral bushing shall be chosen considering the probable voltage rise for neutral floating conditions. The current rating shall be chosen considering solidly earthed neutral. The neutral shall be formed at the bottom of the winding and brought to LVN bushing through a separate path.
- VIII. Top sampling valve shall be internally/externally piped and brought out of the tank sideways at skid level.
- IX. Transformer with all accessories shall be of free-standing type. Transformer accessories shall be designed in such a way that no supporting posts/structures are necessary other than the rail.
- X. The sets of radiator banks shall be connected to the main tank through a header pipe welded to the tank. Design wherein an individual radiator is connected to the main tank is not acceptable. Individual radiator tubes shall be connected to the main tank thru butterfly valves at both ends of radiator tubes. Arrangement shall be made for a suitable gap between main tank and radiator tubes.
- XI. Transformer conservator shall have Silica gel breather.
- XII. The oil level shall be higher than HV bushing terminal.
- XIII. **The part of the HV bushing terminal to which overhead conductor is connected should not be involved either in the oil sealing arrangement or air release arrangement. This is to be specifically confirmed by the bidder at the time of offer.**
- XIV. Two separate parts shall perform the two functions of receiving the jumper and oil sealing.
- XV. Air seals are not acceptable at HV bushing terminals.
- XVI. The oil shall be supplied in non-returnable drums. The quantity shall be of 10% excess over the requirement of transformer at 30°C.
- XVII. Magnetic oil level indicator shall comprise with 2 nos. mercury contact/switch (for High / Low oil level alarm).
- XVIII. Breather shall be used for main tank and Silica gel/ Silica gel beads breather with clear sight glass & oil sealing arrangement shall be used for OLTC purpose.
- XIX. The transformer shall be suitable for operation at full rated power on all tap positions without exceeding the applicable temperature rise. The transformer shall be designed to suppress harmonic content, especially the third and fifth, so as to eliminate distortion in the waveform and consequent additional insulation stress, noise on communication system and undesirable circulating currents between the neutrals at different transformer stations.
- XX. The design of each transformer shall be such that the risk of accidental short-circuits due to birds or vermin are obviated.
- XXI. All outdoor apparatus, including bushing insulators and fittings shall be so designed that they do not collect water at any point.

- XXII. All electrical connections and contacts shall be of ample cross sections for carrying the rated current without excessive heating. All such contacts shall be tinned copper to avoid bi-metallic affect.
- XXIII. Each transformer shall be designed for minimum no-load and load losses within the economic limit and as per the Indian Standards.
- XXIV. Ground terminals shall also be provided on marshalling box, OLTC local control panel and cable end box to ensure effective earthing.
- XXV. For continuity of earth connection, all gasket joints shall be provided with minimum two numbers tinned copper strip jumpers of adequate size.
- XXVI. Rain Guard shall be provided for LV compartment, Bucholz Relay, OSR, PRV, SPR, and Marshalling Box so that rain water can enter to the junction box of these relays/ cubicles. Wiring shall be bottom entry.
- XXVII. At the time of erection and commissioning, authorized person of the bidder shall be present at the site till completion of the work.
- XXVIII. Cable trays of appropriate size to be provided at necessary locations.

**5.2 CORE:**

- I. The core shall be of high grade cold rolled, non-ageing, grain oriented, annealed silicon steel lamination (CRGO), having low loss & good grain properties, coated with hot oil proof insulation, bolted together to the frames firmly to prevent vibration or noise.
- II. The grade of core shall be M3 or better. The core shall be stress relived by annealing under inert atmosphere if required, especially suitable for transformer.
- III. All core clamping bolts (If any) shall be effectively insulated. Only one grade and one thickness of core shall be accepted and no mixing of different grades shall be allowed.
- IV. The complete design of the core must ensure permanency of the core losses with continuous working of the transformers.
- V. The value of the maximum flux density allowed in the design & grade of laminations used shall be clearly stated in the offer.
- VI. The successful bidder is required to submit the following documents with regard to the procurement of core material:
  - a) Invoice of supplier
  - b) Mill's test certificate
  - c) Packing list
  - d) Bill of landing
  - e) Bill of entry certificate by custom
  - f) Description of material, electrical analysis, physical inspection certificate for surface defects, thickness and width of the material
  - g) Subjecting to at least 10% of the transformer to routine tests and no load and load loss measurement
- VII. TPCODL shall impose heavy penalty or black list bidders using seconds/ defective CRGO sheets or load losses found to be more than stipulated limit.
- VIII. After being sheared the laminations shall be treated to remove all burrs. Both sides of steel laminations shall be so constructed that eddy currents will be minimum.
- IX. The core frame shall be provided with lugs suitable for lifting the complete core and coil assembly of the transformer.
- X. The core and the coil shall be so fixed in the tank that shifting will not occur when the transformer is moved or during a short circuit.
- XI. All steel sections used for supporting the core shall be thoroughly sand blasted after cutting, drilling and welding. Each core lamination shall be insulated with a material that will not deteriorate due to pressure and hot oil.
- XII. The supporting frame work of the core shall be so designed as to avoid presence of pockets which would prevent complete emptying of tank through drain valve or cause trapping of air

during oil filling. Adequate lifting lugs shall be provided to enable the core and windings to be lifted.

XIII. Core Grounding:

- a) The grounding lead from the core shall be brought out of the tank through a 11kV class bushing and grounded externally.
- b) A protective cover shall be provided for the bushing.
- c) The core grounding rod (stem) through the bushing shall be solid rod (stem).
- d) The design of core grounding arrangement shall be such that the grounding links shall not come out of core during installation as well service conditions.
- e) The supplier shall submit a drawing clearly showing the details of core grounding.
- f) The core / frame grounding's both connections shall be brought out through a suitable bushing for provision of external grounding.

**5.3 WINDINGS:**

- I. The windings shall be so designed that all coil assemblies of identical voltage ratings shall be interchangeable, and field repairs to the windings can be made readily, without special equipment.
- II. The coils shall be supported between adjacent sections by insulating spacers, and the barriers bracings and other insulation used in the assembly of the windings shall be arranged to ensure a free circulation of the oil and to reduce hot spots in the windings.
- III. Coils should be transposed to minimize magnetic forces and extra supports shall provide for inter-disc connection.
- IV. All materials used in the insulation and assembly of the winding shall be new, insoluble, non-catalytic and chemically inactive in the hot transformer oil and shall not soften or otherwise be adversely affected under the operating conditions.
- V. The current density of coil shall not exceed 2.4 Amps/ sq mm at min tap of respective PTR's higher rating.
- VI. All threaded connections shall be provided with locking facilities. All leads from the winding to the terminal board and bushings shall be rigidly supported to prevent injury from vibration. Guide tubes shall be used where practicable.
- VII. The winding shall be brought out through bushing and provided with suitable terminal connectors, the details of which will be forwarded later.
- VIII. The windings shall be clamped securely in place so that they will not be displaced or deformed during short circuits. The assembled core and windings shall be vacuum-dried and suitably impregnated before removal from the treating tank. The copper conductors used in the coil structure shall be best suited to the requirements and all permanent current carrying joints in the windings and the leads shall be brazed.
- IX. Sharp bends should be avoided in the windings as far as possible, where unavoidable such bends should be reinforced with extra insulation tapes.
- X. The tolerance for the winding resistance measurement for different phases but at same taps shall be limited to 1%.
- XI. The change in impedance values between the winding (HV/LV) shall not exceed  $\pm 10\%$  of nominal impedance value as specified at all taps on HV/LV side.
- XII. The windings shall be brought out through bushing. The windings shall be designed to withstand the specified thermal and dynamic short-circuit stresses.
- XIII. The end turns of the high voltage windings shall have reinforced insulation to take care of the voltage surges likely to occur during switching or any other abnormal condition.
- XIV. Winding shall be suitable for connection of reactors or capacitors which would be subjected to frequent switching. All the windings shall be capable of withstanding stresses that may be caused by such switching.
- XV. Primary and secondary windings shall be constructed from high- conductivity (copper conductors), Double Paper Covered (DPC) copper conductor.

- XVI. The insulation between core and bolts and core and clamps shall withstand 2.5 kV for one minute.
- XVII. Proper bonding of inter layer insulation with the conductor shall be ensured. Test for bonding strength shall be conducted as per standards.
- XVIII. All turns of windings shall be adequately supported (by which material) to prevent movement. The core/coil assembly shall be securely held in position to avoid any movement under short circuit conditions.
- XIX. The joints in the winding shall be avoided but if it is necessary then, these shall be properly brazed and the resistance of the joints shall be less than that of parent conductor. Crimping is not allowed at any joints.

**5.4 INSULATING PAPER AND INSULATING PRESS BOARD :**

- I. The bidder shall submit characteristics along with make for all the type of insulation papers and Pressboards to be used with the offer.
- II. Inter layer insulation both for HV and LV windings shall be DPC and compressed pressboard of reputed make (subject to approval of TPCODL).
- III. For Winding insulation, only Double Paper Covered insulation is acceptable with laying in opposite direction to each other and each paper must have overlapping more than 25% of its width.
- IV. Kraft paper and Pressboard should be made of pure Cellulose from soft wood pulp manufactured from sulphate process. No additive, adhesive or coloring matter shall be present.
- V. Kraft paper and Pressboard should be of class A (105°C) insulation material.
- VI. All spacers, axial wedges / runners used in windings shall be made of pre-compressed solid pressboard.
- VII. All axial wedges/runners shall be properly milled to dovetail shape so that they pass through the designed spacers freely.
- VIII. Insulation shearing, milling and punching operations shall be carried out in such a way, that there should not be any burr, sharp edges and dimensional variations.
- IX. Kraft paper self-adhesive tape to be used for bonding of insulating paper layer, spanner and paperboards that are immersed in the oil filled transformer.

Below required values could be verified if required at any stage of the inspection and it should fulfill the requirement as per below table

<b>Characteristics</b>	<b>Kraft Paper</b>	<b>Pressboard (all Sizes)</b>
1. Dimension	As specified by bidder with $\pm 5\%$ tolerance.	As specified by bidder with tolerance as per IS1576.
2. Apparent Density	$>0.80 \text{ g/cm}^3$	as per IS1576 w.r.t Thickness
3. pH of Aqueous extract	6-8%	6-8%

4. Electrical strength i) in air ii) In Oil	7KV/mm -----	12KV/mm 35KV/mm
5. Ash content	Maximum 1%	Maximum 0.7
6. Moisture content	Maximum 8%	Maximum 8%
7. Oil absorption	-----	Minimum 9%

Bidder has to submit the test certificates as per IS-9335, IS-1576 for all type of insulating materials covering above stated parameters along with below parameters during stage inspection:

1. Substance (Grammage) (g/m<sup>3</sup>)
2. Compressibility
3. Tensile strength
4. Conductivity of water extract
5. Shrinkage in air
6. Flexibility
7. Cohesion between plies<sup>1</sup>.
8. Elongation
9. Air permeability
10. Tear index
11. Heat stability

**5.5 TRANSFORMER TANK :**

- I. The transformer tank and cover shall be fabricated from good commercial grade low carbon steel suitable for welding and shall be of adequate thickness.
- II. The tank shall be welded Type .Top cover shall be Flanged type . All seams shall be welded and where practicable they shall be double welded.
- III. The main tank body of the transformer, excluding tap changing compartments and radiators, shall be capable of withstand pressure of 760 mm of Hg.
- IV. The tank material shall be as per IS: 2026 or equivalent with ultrasonic testing done for elimination of defects in rolled plates.
- V. The welding shall be as per prior approved WPS (Welding Procedure Specs) by trained and tested welders. Calculations and documents should be submitted bidders.
- VI. The welding plan shall be shown in general i.e. Category-wise or for each type of weld in the mechanical fabrication drawing, which shall be submitted to TPCODL
- VII. All fittings like elbows, bends etc. shall be seamless as per applicable American or Indian Standards.
- VIII. No resistance welding of fasteners shall be done anywhere on the transformer.
- IX. To ensure oil tightness, recessed neoprene or equivalent gaskets shall be used.
- X. Manholes with welded flange and bolted covers shall be provided on the tank.
- XI. The manhole shall be of sufficient size to afford easy access to the lower ends of all the bushings, OLTC terminals etc. to permit replacement of auxiliaries without removing tank covers.
- XII. Suitable guides shall be provided for positioning the various parts during assembly or dismantling.

- XIII. Adequate space shall be provided between the cores and windings and the bottom of the tank for collection of any sediment.
- XIV. All joints including bolted as well as flanged, shall have machined matching surfaces/inner edges with smooth finish, to ensure leak proof joints.
- XV. Lifting eyes or lugs shall be provided on all parts of the transformer requiring independent handling during assembly or dismantling. In addition, the transformer tank shall be provided with lifting lugs and bosses properly secured to the sides of the tank, for lifting the transformer either by crane or by jacks.
- XVI. The design of the tank, the lifting lugs and bosses shall be such that the complete transformer assembly filled with oil can be lifted with the use of these lugs without any damage or distortions.
- XVII. The tank shall be provided with two nos. of suitable copper alloy lugs for the purpose of grounding.
- XVIII. The grounding pads should be mirror finished. Two grounding pads, located on opposite sides of the tank shall be provided with two tapped holes for connecting it with station ground mat. Necessary hardware like M10 GS bolts and spring washers shall also be provided for connections. All outer nuts & bolts should be stainless steel type.
- XIX. Each tank shall be equipped with the following valves with standard flange connection for external piping,
  - a) One drain valve located on the low voltage side of the transformer and placed to completely drain the tank. At the option of the TPCODL's a large valve may be furnished with an eccentric reducer. This valve shall be equipped with a small sampling cock.
  - b) One filter valve located at the top of the tank on the high-voltage side. The opening of this valve shall be baffled to prevent aeration of the oil.
  - c) One filter valve, located slightly above the bottom of the tank.
  - d) One relief valve to operate at a pressure below the test pressure for the tank.
  - e) Other two nos. valves shall also be provided, as required for proper functioning of the transformer.
  - f) A suitable locking arrangement shall be provided for locking these valves in close/open position.
- XX. All valves should be provided with clear open/close position indications. Wherever rising spindle type valves are provided the valves should be clockwise rotating for closing operations. Any valve opening should not create hindrance to other operation.
- XXI. For the auxiliary lead wiring from individual instrument to marshalling box, the cables shall be provided in the conduits.
- XXII. All the transformers shall be provided with a ladder having 'anti-climbing' device.
- XXIII. Transformer tank shall be of welded sheet steel construction and provided with gaskets steel cover plates.
- XXIV. Base shall be suitably reinforced to prevent any distortion during lifting. Base channels shall be provided with skids and pulling eyes to facilitate handling.
- XXV. All seams shall be electrically double welded for absolute oil tightness.
- XXVI. Suitable arrangement shall be made for mounting HV and LV lightning arrestors of the transformer.
- XXVII. Guards shall be provided for drain, bottom sampling and filter valves to prevent oil pilferage.
- XXVIII. Minimum Thickness for the transformer shall be as follows:
  - a) Tank Side wall (mm) 8 for 5 MVA & 8 MVA
  - b) Tank Top Cover (mm) 10 for 5 MVA & 12 mm for 8 MVA
  - c) Tank Bottom Plate (mm) 10 for 5 MVA & 12 mm for 8 MVA

## 5.6 PAINTING

- I. Before painting, surface preparation shall be done by sand blasting and procedure for sand blasting has to be submitted by the Vendor along with the bid. The surface preparation for all external surface prior to painting or coating shall be witnessed by customer or shall be treated as customer hold points. After sand blasting at all edges Belzona E metal to be applied.
- II. Before shipment all steelwork not under oil shall be painted with a primary coat of anti-corrosive paint of durable nature and two coats of battleship grey paint (Shade 631 of IS: 5). Paint shall be epoxy type. The interior surfaces shall be painted as per bidder's standard practice. All the paint including primer shall be applied after testing such as air test, hydraulic test etc. Bidder shall submit their procedure for painting for TPCODL's approval, along with the offer.
- III. Painting of Marshalling box: Two coats of red oxide primer & two coats of synthetic enameled paint after chemical treatment.
- IV. Metal parts not accessible for painting shall be made of corrosion resistant material.
- V. Paint shall be as per Indian Standard/International Standard for quality, surface preparation, application method, thickness check and any other test.
- VI. Additional paint shall be supplied along with the transformer for applying touch up paint at site during installation. The shade of the paint used shall be shade 631 as per IS: 5.
- VII. Paint thickness shall be min 120 Microns

**5.7 SURFACE PREPARATION AND PAINTING**

- I. The paint shall be applied by airless spray.
- II. Steel surfaces shall be prepared by proper cleaning method (IS-9954) to grade Sq.2.5 of ISO 8501-1 or chemical cleaning including phosphating of the appropriate quality (IS 3618).
- III. Heat resistant (Hot oil proof) paint shall be used for the inside surface and whereas for external surface one coat of thermosetting powder paint or one coat of epoxy primer (zinc chromate) followed by two coats of polyurethane (P.U.) base paint. as per table given below:

S.No.	Paint type (should be UV restraint, non-fading)	Area to be painted	No of coats	Total dry film thickness (min); micron
1	<b>Thermosetting powder paint</b>	Inside	01	30
		Outside	01	60
2	<b>Liquid Paint</b>			
a.	Epoxy (primer)	Outside	1	45
b.	P.U. Paint (finish paint)	Outside	2	35 (each)
c.	Hot oil resistant paint	Inside	1	35

The two coats shall be of oil and weather-resistant nature with final coat as flossy and non-fading paint of shade 631 as per IS 5 or RAL 7032.

- IV. The dry film thickness shall not exceed the specified minimum dry film thickens by more than 25%.
- V. Any damaged part shall be cleaned to bare metal with an area extending 25 mm around its boundary. A priming coat shall be immediately applied followed by full paint finish equal to that originally applied and extending 50 mm around the perimeter of the original damage. The repainted surface shall present a smooth surface which shall be obtained by carefully chamfering the paint edges before and after priming.
- VI. Painting shall not affect by weather changes & performance against pilling out or fading etc. to be guaranteed for 5 Years.



## 5.8 BUSHINGS:

- I. Bushings provided by the bidder shall be as per IS2099-1986. The bushings shall have high factors of safety against leakage to ground and shall be so located as to provide adequate electrical clearance between bushings and grounded parts. Bushings of identical voltage rating shall be interchangeable. All bushings shall be equipped with suitable terminals of approved type and size and all external current carrying contact surfaces shall be plated, adequately. The insulation class of the high voltage neutral bushing shall be properly coordinate with the insulation class of the neutral of the high voltage winding.
- II. All main winding leads shall be brought out through outdoor type bushings as specified which shall be so located that the full flashover strength will be utilized and the adequate phase clearance shall be realized.
- III. Each bushing shall be so coordinated with the transformer insulation that all flash-over will occur outside the tank.
- IV. All porcelain used in bushings shall be of the wet process, homogeneous and free from cavities or other flaws. The insulation (porcelain) shall be without any joint. The glazing shall be uniform in colour and free from blisters, burns and other defects. Stresses due to expansion and contraction in any part of the bushing shall not lead to deterioration.
- V. In case of oil communicating type bushing (33kV & 11kV), venting screw of the hollow stud, shall be provided with suitable gasket as per IS 4253-2 (latest amendment), to avoid oil leakage problem through the same. Angle of inclination to vertical for any bushing shall not exceed 30 deg. All bushings shall have puncture strength greater than the dry flash-over value.
- VI. Main terminals shall be solder less terminals, and shall be of the type and size specified in the drawings. The spacing between the bushings must be adequate to prevent flashover between phases under all conditions of operation.
- VII. The Bidder shall give the guaranteed withstand voltages for the above and also furnish a calibration curve with different settings of the co-ordination gap, to the TPCODL to decide the actual gap setting. Bidder's recommendations are also invited in this respect.
- VIII. The following routine tests shall be carried out on all bushings in the presence of TPCODL's representative, in addition to any other specified in the IS:
  - a) Visual examination
  - b) One minute dry withstand test
  - c) Oil tightness test
- IX. The bushings shall have a link type isolating facility for tap for maintenance tests viz. power factor measurement etc. (Terminal shall be provided for the measurement of power factor and tan delta).
- X. Bushing shall be as per the approved make only. All Type test report should be submitted along with bid.
- XI. **Termination Arrangement on 11KV and 33KV Side :**

### **Option 1: (33KV Indoor AIS/GIS and 11KV indoor AIS )**

- a. For 33 KV side cable termination, Palm Connector & Extended Busbar of suitable size (60mm X 10mm) for termination of 1 runs of 3C x 400 sqmm. Proper supporting arrangement for extended bus bar and cables shall be provided.

For 11 KV side cable termination, Palm Connector & Extended Busbar of suitable size (60mm X 10mm) for termination of 2 runs of 1C x 630 sqmm. . Proper supporting arrangement for extended bus bar and cables shall be provided.

- b. Copper bus bar for connecting transformer bushings to cables with support insulators and insulation sleeve
- c. Frame for cable mounting with HDPE cleats.
- d. Detailed size of all the item shall be submitted during detailed engineering for approval.
- e. Suitable Bimetallic Connector to be supplied wherever applicable

**Option 2 : (33KV Outdoor Switchyard and 11KV indoor AIS )**

- a. On 33KV side, suitable provision to connect Zebra/Panther/Dog/Coyote Conductor.
- b. For 11 KV side cable termination, Palm Connector & Extended Busbar of suitable size (60mm X 10mm) for termination of 2 runs of 1C x 630 sqmm. . Proper supporting arrangement for extended bus bar and cables shall be provided
- c. Frame for cable mounting with HDPE cleats.
- d. Detailed size of all the item shall be submitted during detailed engineering for approval.
- e. Suitable Bimetallic Connector to be supplied wherever applicable

**5.9 RADIATORS**

- I. The radiators shall be shall be epoxy/Polyurethane painted. The entire surface including edges should be cleaned property before painting to avoid peeling of paint at the edges.
- II. Bidder shall submit procedure for surface preparation and painting of radiators along with the bid.
- III. The color shade for the radiator shall be shade 631 as per IS: 5.
- IV. Tank mounted radiators shall be of the detachable type with bolted and gasketed flanged connections. Proper continuous earthing (may be through Transformer body) should be ensured.
- V. The following accessories shall be provided for radiator:
  - a. Shut off valves and blanking plates on transformer tank at each point of
  - b. Top and bottom shut off valves and blanking plates on each radiator.
  - c. Lifting Lugs
  - d. Top Oil filling Plugs
  - e. Air release plug on top
  - f. Oil Drain Plug at Bottom.
  - g. Top Oil Filling Pump.

**All radiators shall be tested for.**

- a. Vacuum test for one hour
- b. Hydraulic pressure test using transformer oil for one and half hour (as per ASME)
- c. Air test can be done in place of hydraulic pressure test provided.
- d. Water tank will be made available for submerging the radiators into water for leak detection.
- e. All the tests shall be done in black condition (i.e. before applying any paint).
- VI. The transformer design shall be such that the radiators and conservator can be mounted on either side of the tank connection

**5.10 INTERNAL EARTHING**

- I. Provision of complete earthing of transformer and associates should be ensure by bidders. Earthing of Main tank, OLTC Conservator, Radiator, NIDS and other shall be ensured through

50X6mm GI flat with double hole provision wherever applicable with minimum 80-100mm length.

- II. Provision of continuity of earthing shall also ensure for gasket arrangement, doors and all other extended/open able arrangements with flexible copper wire of adequate size.

**5.11 OIL:**

- I. Oil for first filling, together with 10% extra shall be supplied with each transformer. The oil shall comply in all respects with the provisions of IS 335 & IEC No.60296 latest amendment. Particular attention shall be paid to deliver the oil free from moisture having uniform quality throughout in non-returnable steel drums.
- II. The oil shall be of EHV grade and shall have the following main characteristics or equivalent (the requirements indicated are determined in accordance with the test methods as per IS: 335). The oil in the transformer shall be filled up to 'Transport filled level' before dispatch of the transformer.
- III. The maker of the oil shall be as per approved list and should comply below mentioned technical requirements:

Sl.no.	Characteristics	Requirement as per IS 335	Method of Test
1	Appearance	The oil shall be clear and transparent and free from suspended matter or sediment temperature.	A sample of Oil shall be examined in 100mm thick layer at 27deg C
2	Density at 29.5° C (max)	0.89 g/cm3	IS 1448 (P:16):1990
3	Kinematic Viscosity @ 27° C. (Max.)	270C	IS 1448 (P:25):1976
4	Interfacial tension Min.	0.04 N/m	IS:6104:1971
5	Flash Point (Closed CUP)	140° C	IS 1448 [P:21]:1992
6	Pour Point (max)	-6° C	IS 1448 [P:10]:1970
7	Neutralization Value (total acidity) max.	0.03 mg/KOH/g	IS 1448 [P:2]:1967
8	Corrosive sulphur (In terms of classification of copper strip)	Non Corrosive	IS 1448 (Part-I)/Annex B of IS:335
9	Electric Strength (Breakdown voltage)	The sampling shall be done in accordance with the procedure laid down in IS 6855: 1973.	IS 6792 : 1992
	i) New untreated oil	30 kV (rms)	
	If the above value is not attained, the oil shall be filtered		
	ii) After Filtration Min	70 kV (r.m.s.)	

10	Dielectric Dissipation Factor (tan-delta) at 90°C, max.	0.002	IS:6262-1971
11	Specific resistance (resistivity) ohm/cm/min		IS:6103-1971
	a)At 90° C, Min	35 X 1012 ohm-cm	
	b)At 27° C, Min	1500 X 1012 ohm-cm	
12	Water content, max. per million	30 (avg. 20 ppm)	Karl Fischer Method
13	Oxidation Stability		Appendix C of IS:335
	(i) Neutralization value after oxidation Max.	0.40 mg. KOH/g	
	(ii) Total sludge, after oxidation, max.	0.1 percent by weight	
14	Tan delta at 90° C after ageing test (max)	0.2	IS 6262:1971
15	Saponification Value	Max. 1.0 mg. KOH/g	Appendix E IS-335
16	Presence of oxidation inhibitor	The oil shall contain anti-oxidant additives.	IS 13631 : 1992

**Ester Oil (If Applicable) :**

In case of Natural Ester oil or Synthetic Ester Oil below are the requirements to be fulfilled:  
All transformers shall be filled to the required level with new, unused, clean, Natural or Synthetic Ester oil as per TPCODL approval. The use of recycled ester oil is not acceptable. Ester shall be filtered and tested for break down Voltage (BDV) and moisture content before filling. Ester shall be filled under vacuum. The Dielectric strength and water content shall meet the requirement given in TPCODLSpecification ENG-GEN-4004. Ester oil shall be procured from approved vendor of TPCODL only.

Bidder has to provide the oil data in below table:

SNo.	Description	Unit	As furnished by bidder
1	Type of oil		
2	Oil Qty. for first filling	Ltr.	
3	Grade of Oil		
4	Maker's name		
5	BDV at the time of first filling	kV	

**5.12 GASKET**

- I. All bolted connection to the tank shall be fitted with suitable oil-tight gaskets which shall give satisfactory service under the operating conditions. Gaskets shall be NRBC (Nitrile Rubber Bonded Cork )
- II. Special attention shall be given to the methods of making the oil-tight joints between the tank and the cover as also between the cover and the bushings and all other outlets to ensure that the joints can be remade satisfactorily and with ease, with the help of semi-skilled labor.
- III. Where compressible gaskets are used, steps shall be provided to prevent over compression.
- IV. All the bolts provided shall be of hot dip galvanized.
- V. All bolts shall be provided with one spring washer and two numbers of flat washers and with locking bolts.
- VI. All gasket joints shall be provided with equalizing links to extend earth connections.
- VII. All Gasket should be fixed such a way that there should not be any damage during operation.

### 5.13 OIL PRESERVING EQUIPMENT

- I. Oil preserving equipment shall be conservator (expansion tank) type. The conservator shall have two filter valves, one at the bottom at one end, the other at the top, opposite end, in addition to the valve specified in the Accessories for the main tank. The conservator or expansion tank shall also have a shutoff valve and a small drain valve and sampling cock, the latter so arranged as not to interfere with oil lines. The oil level gauges (prismatic and magnetic) shall be mounted on the conservator or expansion tank. The top of the conservator shall have contact with atmosphere through two silica gel / Envirogel breathers to facilitate replacement of breather without having to keep Buchholz relay inoperative. The breathers shall have clear transparent, UV stabilized /retardant Polycarbonate with min. 3 mm thickness.
- II. Conservator oil preservation bag (atmoseal bag) shall be provided with a design such that it can be installed at site with ease without any special tools and tackles. The price for COPS bag shall be clearly mentioned in the price schedule at the specified place. With COPS type conservator shall supply air or nitrogen filing arrangement with all accessories needed at the time of commission and pressure gauge arrangement shall be provided for monitoring COPS bag pressure.
- III. Proper valve arrangement (Two top valve & one bottom valve on conservator) is to be provided for proper oil filling.
- IV. Prismatic oil level indicators with red colour float shall be provided on main tank and OLTC tank Conservator. Dual contacts are required for both MOGs (Main Tank & OLTC conservator).
- V. Separate conservator tank shall be provided for OLTC.

### 5.14 OLTC CONSERVATOR TANK

- I. Tank with air release valve on top.
- II. Prismatic Oil level indicator with red color float.
- III. Magnetic Oil Level Indicator (MOG), round in shape having a diameter of 100 mm.
- IV. Bend assembly with flange - This includes two pipes, one connecting tank with OSR and another connecting OSR with OLTC along with two shut off valves. The diameter of this pipe shall be suitably sized for 5 MVA & 8 MVA mm tanks, The complete assembly formed after attaching both the pipes to OSR and connecting with the tank should be at an angle of 5 degrees with respect to the horizontal. Also, the pipe should be off set from the tank at an angle of 32 degrees in the horizontal plane.
- V. Silica gel/Silica gel beads breather along with the explosion vent assembly
- VI. Mounting structure with eight nut bolts (S/S) for attachment
- VII. Tank shall be fabricated from good commercial grade low carbon steel.

- VIII. All joints, bolted or flanged, shall have machined matching surfaces/inner edges with smooth finish, to ensure leak proof joints.
- IX. All joints, bolted or flanged, shall have machined matching surfaces/inner edges with smooth finish, to ensure leak proof joints.
- X. The inside surface of the tank shall be painted with one coat of hot oil resistant varnish with two coats of red oxide zinc chromate primer conforming to IS:2074 followed by two coats of fully glossy finishing paint conforming to IS:2932 and yellow in color.
- XI. The outside surface shall be painted with two coats of red oxide zinc chromate primer conforming to IS: 2074 followed by two coats of fully glossy finishing paint conforming to IS: 2932 of shade 631 of IS 5.
- XII. Two Lifting lugs should be provided.

S.No	Description	5 MVA	8 MVA
1	Diameter	To be furnished by the bidder	To be furnished by the bidder
2	Length of tank	To be furnished by the bidder	To be furnished by the bidder
3	Thickness of sheet	To be furnished by the bidder	To be furnished by the bidder
4	Weight	To be furnished by the bidder	To be furnished by the bidder
5	Air release valve on top	Required	Required
6	Prismatic oil level indicator with red color float	Required	Required
7	MOG	Required	Required
8	Bend assembly with two shut off valves	Required	Required
9	Silica gel/Envirogel breather with explosion vent assembly	Required	Required
10	Mounting structure	Required	Required
11	Eight nut bolts (S/S) with mounting structure	Required	Required
12	Inside surface finishing	The transformer shall withstand the short circuit at its terminals for the specified fault levels for minimum duration of 3 seconds.	

13	Outside surface finishing	As the Transformers will be installed in areas prone to earthquakes, they shall be designed to withstand seismic forces equivalent to 0.3 g acceleration. Necessary devices for clamping the wheels to the rails shall also be provided along with any other suitable anti earthquake clamping arrangement.
14	Color of tank's external paint	631 acc. to IS 5
15	Lifting hooks	Required

**5.15 ON LOAD TAP CHANGER**

- I. OLTC shall have the entire feature to meet the requirement. The equipment shall conform to the latest applicable Indian standard / IEC standard. Equipment complying with any other authoritative standards such as British, VDE etc. shall also be considered if offered.
- II. The OLTC gear shall be designed to complete successfully tap changes for the maximum current to which transformer can be loaded i.e. 120% of the rated current. Devices shall be incorporated to prevent tap change when the through current is in excess of the safe current that the tap changer can handle. The OLTC gear shall withstand through fault currents without injury.
- III. When a tap change has been commenced it shall be completed independently of the operation of the control relays and switches. Necessary safeguards shall be provided to allow for failure of auxiliary power supply or any other contingency which may result in the tap changer movement not being completed once it is commenced.
- IV. OLTC shall be a separate compartment & should be external to transformer tank. Oil in compartments which contain the making and breaking contacts of the OLTC shall not mix with oil in other compartments of the OLTC or with transformer oil. Gases released from these compartments shall be conveyed by a pipe to a separate oil conservator or to a segregated compartment within the main transformer conservator. A OSR with shut off valves and MOG shall be installed between OLTC and conservator tank. The OLTC conservator shall be provided with prismatic oil level gauges with red color float. The length and alignment of the MOG and OSR pipe shall be such that, the transformer does not trip by the vibration of the pipe.
- V. Oil in compartments of OLTC which do not contain the make and break contacts, shall be maintained under conservator head through valve pipe connections. Any gas leaving these compartments shall pass through the OSR relay before entering the conservator. The cable entry of OSR should be from bottom end instead from side
- VI. Oil filled compartments shall be provided with filling plug, drain valve with plug, air release vent, oil sampling device, inspection opening with gasket and bolted cover with lifting handles.
- VII. The OLTC motor shall be provided with 415 V auto changeover facilities. Tap position indication along with the various alarms of tap changer shall be indicated in the marshaling box.

- VIII.** Separate OLTC tank should be provided at a height lower than that of the main conservator tank so that the same is easily accessible for maintenance.
- IX.** OLTC driving mechanism and its associated control equipment shall be mounted in an outdoor, weather proof cabinet, which shall include:
- a) Driving motor (415 V - 3 phase, 50 Hz, AC squirrel cage)
  - b) Motor starting contactor with thermal overload relays, isolating switch and HRC fuses.
  - c) Duplicate sources of power supply with automatic changeover from the running source to the standby source and vice versa.
  - d) End Limit Switch shall be provided to prevent operation beyond extreme taps & Contacts shall be provided for operation through SCADA.
  - e) Limit switch to cut off electrical operation on insertion of manual handle (Contacts shall be provided for operation through SCADA).
  - f) Local/Remote selector switches shall be provided with status indication.
  - g) Control switch: Raise/off/lower (spring return to normal type). (Contacts shall be provided for operation through SCADA).
  - h) Remote/local selector switch (maintained contact type). (Contacts shall be provided for operation through SCADA).
  - i) Mechanical tap position indicator showing rated tap voltage against each position and resettable maximum and minimum indicators.
  - j) Limit switches to prevent motor over travel in either direction & final mechanical stops.
  - k) Brake or clutches to permit only one tap change at a time on manual operation.
  - l) Emergency manual operating device (hand crank or hand wheel).
  - m) Electrically interlocked reversing contactors (preferably also mechanically interlocked).
  - n) 240V, 50 HZ, AC space heaters with switch and MCB.
  - o) Interior lighting fixture with lamp door switch and MCB.
  - p) Gasketed and hinged door with locking arrangement.
  - q) Terminal blocks, internal wiring, earthing terminals and cable glands for power and control cables.
  - r) Necessary relays, contactors, current transformers etc.
  - s) Thermal device or other means shall be provided to protect the motor and control circuit. All relays, switches, fuses etc. shall be mounted in local OLTC control cabinet and shall be clearly marked for the propose of identification.
  - t) A five digit counter shall be fitted to the tap changing equipment to indicate the number of operation completed.
  - u) The equipment shall be suitable for supervisory control and indication with make before break multi-way switch, having one potential free contact for each tap position. This switch shall be provided in addition to any other switch/switches which may be required for remote tap position indication.'
  - v) Operation from the local or remote control switch shall cause one tap movement only until the control switch is returned to the off position between successive operations.
  - w) OLTC shall be provided with PRV.
  - x) Suitable manholes covers should be provided on the sidewalls to give access to the selector switches of the OLTC. There should be ample access for opening /Reconnecting tap-leads to the OLTC from all sides.



y) Suitable valves shall be provided to take sample of oil from the OLTC chamber during operation of the transformer.

**X.** The following electrical control features shall be provided:

- a) Positive completion of load current transfer, once a tap change has been initiated, without stopping on any intermediate position, even in case of failure of external power supply.
- b) Only one tap change from each tap change impulse even if the control switches or push button is maintained in the operated position.
- c) Cut-off of electrical control when manual control is resorted to. It shall not be possible to operate the electric drive when the manual operating gear is in the use.
- d) Cut-off of a counter impulse for a reverse tap change until the mechanism comes to rest and resets the circuits for a fresh operation.
- e) Cut-off of electrical control when it tends to operate the tap beyond its extreme position. Mechanical limit switches shall be provided for this purpose to achieve suitable interlocking.

**XI. Automatic / Parallel Operation with OLTC**

OLTC shall be able to do automatic / parallel operations through Transformer Monitoring Unit (TMU).

**XII. ALARMS:**

The following alarms shall be provided with the additional contact arrangement for connection to SCADA.

- a) End Limit Switch
- b) Manual Operation Insertion
- c) A.C. supply failure
- d) Drive motor autotripped
- e) Tap Stuck up change delayed
- f) OSR trip
- g) MOG Alarms
- h) PRV Trip
- i) TC in Progress.
- j) Any other protective feature, if considered essential by the Bidder.

**XIII.** Tap Changer Control panel or Transformer Monitoring Unit (TMU): This equipment is not required to be supplied by the bidder of the transformer.

**XIV.** Auxiliary Power Supply of OLTC, and Power Circuit :

- a) Two auxiliary power supplies, 415 volt, three phase four wire shall be provided by the Purchaser for OLTC and power circuit.
- b) All loads shall be fed by one of the two feeders through an electrically interlocked automatic transfer switch housed in the marshalling box for on load tap changer control .
- c) Design features of the transfer switch shall include the following:
  - 1. Provision for the selection of one of the feeder as normal source and other as

standby.

2. Upon failure of the normal source, the load shall be automatically transferred after an adjustable time delay to standby sources.
3. Indication to be provided at marshalling box for failure of normal source and for transfer to standby source and also for failure to transfer.
4. Automatic re-transfer to normal source without any intentional time delay following re-energization of the normal source.
5. Both the transfer and the re-transfers shall be dead transfers and AC feeders shall not be paralleled at any time.

**XV. Manual Control:**

The cranking device for manual operation of the OLTC gear shall be removable and suitable for operation by a man standing at ground level.

The mechanism shall be complete with the following :

- a. Mechanical tap position indicator which shall be clearly visible from near the transformer.
- b. A mechanical operation counter.
- c. Mechanical stops to prevent over-cranking of the mechanism beyond the extreme tap positions.
- d. The manual control considered as back up to the motor operated load tap changer control shall be interlocked with the motor to block motor start-up during manual operation. The manual operating mechanism shall be able to show the direction of operation for raising the HV terminal voltage and vice- versa.

**5.16 OIL SURGE RELAY**

**Oil Surge Relay** should be according to the following general technical parameters as mentioned in below table.

SNo.	Description	Unit	Requirements
1	Type of relay		Magnetic reed switch type OSR with 1 set of potential free contact to be used for 48V
2	No. of Switching systems		1
3	Suitable for OLTC		
4	Nominal Pipe Bore	mm	Suitable size
5	Type of Flange		Square
6	Diameter of flange	mm	78 square
7	Diameter of bolt circle	mm	72
8	Number of the bolts		4
9	Size of the bolts		M10
10	Flange Thickness	mm	6 mm
11	Surge Test (TRIP )	cm/s	70 to 130
12	Velocity Test	cm/s	70 to 130

13	Relay operating range: Oil Temperature	10°C to 100°C
14	Relay operating range: Oil Viscosity	66 to 75 centistokes at 10°C, 2 to 3.5 centistokes at 100°C
15	Element Test	With oil, at 1.75Kg/cm <sup>2</sup> for 15 minutes,
16	High Voltage Test	Shall be able to withstand 2000 V at 50 Hz for 1 minute
17	Insulation Resistance Test	Shall be Greater than 10 Mega ohms with 500 V megger
18	Porosity Test	With oil, at 1.5 kg/cm <sup>2</sup> for 4 hours - There shall not be any leakage or mechanical damage
19	Mechanical Strength Test	With oil at 8 kg/cm <sup>2</sup> for 1 minute
20	Resistance of the Switch	Not to exceed 0.1 ohm across the electrodes of magnetic switch
21	Cable entry in terminal box	From bottom side

**5.17 PRESSURE RELEASE VALVE**

- I. Spring-loaded Pressure Relief Device (PRV) with mechanical flag indicator shall be provided on the main tank top of the transformer.
- II. Oil splashguard along with draining arrangement (with wire net on both side) up to ground level to be provided for prevention of oil splashing.
- III. Arrangement for air-release through a gate valve should be provided at the base of the PRV.
- IV. The PRV shall not be located in the vicinity of the Marshalling Box or OLTC Box for safety of operating personnel.
- V. A pair of potential free contacts shall be provided to trip the transformer on action of the pressure relief device.
- VI. It shall have the limit switch with 2NO and 2NC contacts, flag, switch operated rod etc.
- VII. PRV shall be tested for all the applicable test such as Leakage Test, Switch operation, break down test.

SNo	DESCRIPTION	UNIT	REQUIREMENT
1	Operating pressure		0.56 Kg/sq cm
2	Port opening diameter		150 mm
3	Operating time		Instantaneous
4	Contact rating		3A at 48 V DC magnetic blowout micro switch
5	Operating temperature		0 to 100 degree celcius
6	Valve resetting		Automatic
7	Switch		Limit switch DPDT
8	Accuracy class		+ - 1 %
9	Switch resetting		Manual
10	Number of switch		1 limit switch

11	Mechanical protection degree		IP67
12	Suitable for transformer rating	MVA	As per tender
13	Cable Entry		1" conduit
14	Packing		Supplier shall ensure that the equipment covered by this specification shall be prepared for rail/road transport (local equipment) and be packed in such a manner so as to protect the equipment from damage in transit.
15	Marking		The unit shall be appropriately marked as TPCODL and with the name of the vendor, Manufacturer type/ serial no. and year of manufacturing at suitable location.
16	Warranty		2 years from the date of purchase of Transformer. In case any defects are found, the vendor shall replace the product free of cost.
17	Test Reports		Test certificates to be provided : 1) Protection Class. 2) Cold & Dry Test 3) Vibration Test 4) Salt spray Test 5) Micro switch rating Test
18	Acceptance test		Following tests shall be carried out: 1) Physical Test- Dimensions 2) Switch operation test 3) Valve operation test 4) Leakage Test 5) Insulation Test

### 5.18 BUCHHOLZ RELAY

**One double float gas detector relay (Buchholz relay)** with alarm and tripping contacts to detect accumulation of gas and sudden changes of oil pressure complete with shut off valves between Relay and Conservator Tank flange-couplings to permit easy removal without lowering oil level in the main tank, a bleed valve for gas venting and test valve. The installation shall be weather proof to avoid any water seepage inside the relay. The cable entry should be from bottom end of Buchholz relay instead from side. **Marking of Magnetic reed type switches shall be available on Buchholz Relay.**

Buchholz Relays should be according to the following general technical parameters as mentioned in below table.

S.No	Description	Unit	Requirements
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1	Type of relay		Magnetic reed switch type Buchholz relays suitable for nominal pipe bore of 50 mm with 2 sets of potential free contacts suitable for 48V.
2	No. of Switching systems		2
3	Suitable for Transformer Rating	MVA	As per tender
4	Nominal Pipe Bore	mm	80
5	Type of Flange		Round
6	Diameter of flange	mm	185
7	Diameter of bolt circle	mm	145
8	Number of the bolts		4
9	Size of the bolts		M16
10	Flange Thickness	mm	16
11	Surge Test (TRIP )	cm/s	90 to 160
12	Gas Volume (ALARM)	cc	200 to 300
13	Velocity Test	cm/s	90 to 160
14	Relay operating range: Oil Temperature		10°C to 100°C
15	Relay operating range: Oil Viscosity		65 to 75 centistokes at 10°C, 2 to 3.5 centistokes at 100°C
16	Element Test		With oil, at 1.75Kg/cm <sup>2</sup> for 15 minutes,
17	High Voltage Test		Shall be able to withstand 2000 V at 50 Hz for 1 minute
18	Insulation Resistance Test		Shall be Greater than 10 Mega ohms with 500 V megger
19	Porosity Test		With oil, at 1.5 kg/cm <sup>2</sup> for 4 hours - There shall not be any leakage or mechanical damage
20	Mechanical Strength Test		With oil at 8 kg/cm <sup>2</sup> for 1 minute
21	Resistance of the Switch		Not to exceed 0.1 ohm across the electrodes of magnetic switch
22	Cable entry in terminal box		From bottom side

### 5.19 OTI

A dial-type indicating thermometer of robust pattern mounted on the side of the transformer at a convenient height to read the temperature in the hottest part of the oil and fitted with alarm and trip contacts and contacts for switching in and switching out the cooling system at predetermined temperatures.

### 5.20 WTI

In one winding of each phase as described below:

- I. It shall be indicating type, responsive to the combination of top oil temperature and winding current, calibrated to follow the hottest spot temperature of the transformer winding.
- II. The winding temperature detector shall operate a remote alarm in the event the hottest spot temperature approaches a dangerous level and in the case of ONAN (Oil Natural and Air Natural) Thus WTI shall have 4 independent NO contacts for alarm and trip and spare.

**Note:**

- I. **Equipment for remote winding and oil temperature Indicators** including these to be installed in the TPCODL control room shall be provided. Pocket with heater coil and CT for RTD for winding hot spots shall be provided.
- II. **For purpose of remote recording and data acquisition system**, Top oil temperature detector along with suitable transducer and other necessary devices to provide two sets of 4-20 mA signals with PT-100 type of sensors.
- III. Tap changer indicator of OLTC along with suitable transducer and other necessary devices to provide two sets of 4-20 mA signals along with one set of 1-16K resistance output shall be provided.
- IV. All digital outputs for remote annunciation/control/DAS shall be provided with two changeover (NO) contacts for alarm condition and two changeover (NO) contacts for trip condition. The OTI & WTI shall be provided with micro switches, instead of mercury switches for alarm and trip purpose. All the interconnected wiring between TJB, Marshalling box and OLTC etc. shall be done by the bidder and schematics drawings of the same shall be supplied.

**5.21 VALVE**

- I. Valves shall be of forged carbon steel upto 50mm size and of gun metal or of cast iron bodies with gunmetal fittings for sizes above 50mm. They shall be of full way type with screwed ends and shall be opened by turning counter clockwise when facing the hand wheel. There shall be no oil leakage when the valves are in closed position.
- II. Each valve shall be provided with an indicator to show the open and closed positions and shall be provided with facility for padlocking in either open or closed position. All screwed valves shall be furnished with pipe plugs for protection. Padlocks with duplicate keys shall be supplied along with the valves.
- III. All valves except screwed valves shall be provided with flanges having machined faced drilled to suit the applicable requirements, Oil tight blanking plates shall be provided for each connection for use when any radiator is detached and for all valves opening to atmosphere. If any special radiator valve tools are required the OEM shall supply the same.
- IV. Each transformer shall be provided with following valves on the tank:
  - a) Drain valve so located as to completely drain the tank & to be provided with locking arrangement.
  - b) Two filter valves on diagonally opposite corners of 50mm size & to be provided with locking arrangement.
  - c) Oil sampling valves not less than 8mm at top and bottom of main tank & to be provided with locking arrangement.
  - d) One 15mm air release plug.
  - e) Valves between radiators and tank.
  - f) Drain and filter valves shall be suitable for applying vacuum as specified in the specifications.

### 5.22 MOG:

One magnetic-type oil-level gauge each in Main Tank and OLTC Tank with low and high level alarm contacts for main tank MOG and low level alarm for OLTC tank MOG and a dial showing minimum, maximum and normal oil levels. The gauge shall be readable from the transformer base level. It should have cable disconnecting facility at top of MOG, to facilitate testing of MOG. Along with MOG, prismatic type oil level indicator (glass window) shall also be provided on conservator.

SNo	DESCRIPTION	UNIT	REQUIREMENTS
1	Mounting Pad Diameter	Mm	150
2	Electric Switch		Two no's Micro Switches / Mercury switch
3	Contact Rating		5 Amps 240V AC, 0.25 Amp 48V DC.
4	Switch Operation		Normally open, closes when oil level drops to near empty condition. Switch recovers automatically on rising of oil level
5	Mounting of indicator		Vertical
6	Dial Marking		Maximum, Minimum, 1/4, 1/2 & 3/4
7	Movement of float arm		In the plane perpendicular to seating face
8	Conservator Dia	Mm	500-700 mm (As per Tank Size and OEM Type Tested Design)
9	Air cell in conservator		Yes
10	Switches for		Low Oil level Alarm, High oil level Alarm.
11	Colour		Black marking with white/yellow background.
12	Readable from transformer base level		Yes
13	Cable disconnecting facility at top of MOG to facilitate testing of MOG		Yes
14	Mechanical Protection degree		IP55
15	Suitable for transformer rating	MVA	As per tender requirement
16	Packing		Supplier shall ensure that the equipment covered by this specification shall be prepared for rail/road transport (local equipment) and be packed in such a manner so as to protect the equipment from damage in transit.
17	Marking		The unit shall be appropriately marked as "TPCODL" and with the name of the vendor, Manufacturer type / serial no. and year of manufacturing at suitable location.

18	Warranty	2 years from the date of purchase of Transformer. In case any defects are found, the vendor shall replace the product free of cost.
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**5.23 Marshalling Box**

- I. Marshalling Box suitable for distribution of 3 phase 4 wire, 415V power to various equipment shall be provided. Separate ground mounted marshalling box shall be provided for radiator banks, WTI, OTI, transducers, at least two (2) sets of 4-20mA converter cum indicator etc. and similarly tank mounted marshalling box shall be provided for HV/LV CT cable terminals. Two point earthing provision should be provided with 50X6mm GI flat with pad type connector, length should be of min. 80 mm. The marshalling box should include indication circuit with 48V DC supply. All cables and conduits between the transformer and control cabinet shall be included in the scope of supply by bidder. All the wiring shall have provision for connection to SCADA.
- II. Two sets of independent, potential free contacts shall be provided for various alarms/trips as detailed below. The auxiliary voltage for alarm/ trip circuit shall be 48V DC for 33/11kV Transformer). DC system is required for
  - a. Buchholz alarm
  - b. OTI alarm
  - c. WTI alarm (HV/LV based on WTI CT available)
  - d. MOG (main) alarm
  - e. MOG (OLTC) alarm
  - f. Buchholz trip
  - g. OTI trip
  - h. WTI trip (HV/LV based on WTI CT available)
  - i. OSR trip
  - j. SPR trip
  - k. PRV trip
  - l. AC supply fail
  - m. Motor Auto Trip

Two sets of spare potential free contacts shall be provided for all alarms for remote annunciation through TPCODL SCADA panels suitable Transducers shall be provided for 4-20mA signals for tap position indication to the TPCODL SCADA panel. The variation in output signals shall be linear for the complete tapping range.

In addition to above, following potential free contacts/signals shall be provided in the marshalling box, for its interfacing with transformer monitoring unit or other approved make by TPCODL.

SNo	Item	Provision
1	Supply of ON lamp 3 nos. R,Y,B	To be provided
2	Secondary of Control Transformer from the OLTC	Terminals shall be provided in Marshalling box
3	Tap Position Indicator	4-20 MA Signal in Marshalling box
4	Over Current Relay contact	Potential Free Contact in Marshalling box



5	Local remote Switch in OLTC	Potential Free Contact in Marshalling box
6	Raise Lower Switch	Potential Free Contact in Marshalling box
7	Hand interlocking Switch	Potential Free Contact in Marshalling box
8	Tap Change in progress	Potential Free Contact in Marshalling box
9	Odd even Switch	Potential Free Contact in Marshalling box
10	Maximum position reached	Potential Free Contact in Marshalling box
11	Minimum position reached	Potential Free Contact in Marshalling box
12	OTI	4-20mA Signal in Marshalling box
13	Annunciation - Oil level low & High (Main) - Oil level low (OLTC) - Winding Temp. High (HV+ LV) - Oil Temp High - B' relay Alarm - Winding temp trip (HV+LV) - Oil temp trip - B' relay trip - PRV trip for main & OLTC both - OSR trip - SPR trip	Potential Free Contact in Marshalling box
14	Auto manual selector switch	Potential Free Contact in Marshalling box
15	Supply ON lamp 3 nos. (R,Y,B)	To be provided
16	Secondary of Control Transformer from the OLTC	TBs shall be provided

- III. The Enclosure shall be weather proof, sheet steel construction, not less than 3 mm thick. Degree of protection shall be IP55 minimum with Canopy. It shall be provided with two hinged doors one at front and one at back with locking knobs facilities. The doors shall open through 1800. Doors shall have glass window for viewing of OTI & WTI from outside when door is closed. Doors and glass windows shall have proper gaskets for vermin proof and dust tight arrangement. Proper extended rain shed shall be provided.
- IV. Accessories: All accessories shall be mounted properly in suitable channel inside the box. The MCBs shall be mounted on a DIN channel by a MS plate with cutout for MCBs knobs. This shall be covered by a hinged door on the front. Power cable wiring of MCBs to individual contactors shall be done through good quality copper cable of suitable rating with ferrule marking and suitable lugs at both ends. 2.5sqmm stranded copper cable with ring type lugs

shall be used for control cabling purpose. All instrument and wiring shall be completely accessible.

SNo	Item	Make	Rating	Quantity
1	Main Incomer MCB 3 Pole	Siemens/ABB/L&T	63 A	02 Nos.
2	3 Pole MCB	Siemens/ABB/L&T	6 A	12 Nos.
3	3 Pole MCB	Siemens/ABB/L&T	10A	10 Nos.
4	3 Pole MCB	Siemens/ABB/L&T	16 A	10 Nos.
5	Connector/Terminals	Wago or Phoenix, (Suitable for tinging type lugs)	Suitable for 2.5 sq.mm. control cable	To accommodate all the wiring as mentioned below. Additional 10% terminals shall be provided as spare
6	Contactors, starter and relays	Siemens, L&T, English Electric		

V. Following Tests shall be carried out on the Marshalling Box:

- a. Functional tests / 2kV withstand.
- b. Dimensional checks.
- c. Make and operation of contactors, relays.
- d. Factory test report attached for bought out items.
- e. Test for Enclosure Protection.

**5.24 Nitrogen Injection Drain & Stir System**

- I. Fire prevention and extinguishing system shall work on the oil drain, nitrogen injection and stir method. The system shall operate during internal fault in transformer or external fire on transformer, which includes fire due to bursting of transformer bushing and Fire in OLTC tank.
- II. Fire detector provided on the transformer shall take minimum time for detection of fire and initiate the fire protection system on receipt of other required signals.
- III. System shall operate on station's DC auxiliary supply (48 VDC). The system shall be capable of working in Auto/Remote Electrical/Local manual modes.
- IV. Provision shall be available to keep the system "ISOLATED" / "OUT OF SERVICE" which is necessary for preventing any mal-operation during transformer maintenance.
- V. The protection system shall be compatible of being hooked on to the SCADA or fire alarm system. Suitable spare contacts shall be made available for operation of fire system. System using PLC shall be only considered.
- VI. Fire protection system shall operate in Auto mode under two logic:
  - a) In Transformer Explosion prevention Logic it shall operate on receipt of minimum three positive feedback signals, namely differential relay, pressure relief valve or

rapid pressure rise relay or Buchholz relay and electrical isolation of transformer through master trip relay or HV & LV circuit breaker in series to avoid any mal-operation of system .

- b) In Transformer Fire Prevention logic, Fire protection system shall operate in Auto mode on receipt of minimum three positive feedback signals, namely fire detector, pressure relief valve or rapid pressure rise relay or Buchholz relay / OSR (in case of fire in OLTC and electrical isolation of transformer through master trip relay or HV & LV circuit breaker in series to avoid any mal-operation of system.
  - c) Provision shall be made in system so that any of the above two logic can be disabled by operator from local panel only.
  - d) Supply and installation of Rapid Pressure Rise Relay shall be in the scope of the bidder.
- VII. Fire protection system shall operate in Remote electrical mode on receipt of signal for electrical isolation of transformer and by operating switch provided in a box which shall be accessible only after breaking the glass cover on control panel.
- VIII. The Local manual operating system shall be used only in case if the system fails in Auto mode/ Remote electrical mode/ power failure. System if kept in manual mode must be clearly visible by a different alarm / LED.
- IX. The system shall start operation in auto or remote electrical or local manual, initially draining a pre- determined quantity of oil from the tank top through outlet valve to reduce the tank pressure and simultaneously closing Isolation valve in the conservator line and then inject nitrogen gas with appropriate flow rate at high pressure from lower side of the tank through inlet valves to create stirring action and reduce the temperature of top oil surface below flash point to extinguish the fire.
- X. Isolation valve in the conservator line shall operate mechanically on transformer oil flow rate with electrical signal for monitoring on control panel. However in case of bursting of transformer bushing conservator oil should be isolated from main transformer tank without any additional signal to operate isolation valve.
- XI. Provision shall be available so that in case of accidental leakage of Nitrogen, the same should not affect the operation of Transformer
- XII. The system shall have built in facility for monitoring or display of the following.
- a. Open /Close status of valves.
  - b. Healthiness of all sensors.
  - c. Operation of PRV
  - d. Healthiness of control cable
  - e. Healthiness of control supply
- XIII. Provision shall be available for annunciation (along with audible alarm) and a mimic panel of the following.
- a. Detection of fire due to external causes
  - b. Low nitrogen pressure.
  - c. System initiated
  - d. Tank pressure beyond the set limit

- e. Operating signal cable faulty.
  - f. Operation of conservator isolation valve (PNRV)
  - g. Supply Failure
- XIV. However, bidder shall confirm whether it is advisable to initiate the system even when transformer is not electrically isolated due to stuck breaker problem etc.
- XV. The system shall have built-in-on-line testing facility, which will be operable without affecting the functioning of the transformer.
- XVI. All valves used in system shall be stainless steel ball / butterfly type and of Legris make or equivalent as per the purchaser's approval. Limit switches shall be provided wherever required.
- XVII. The connecting cables shall be fire retardant low smoke (FRLS) armored cable. Cables passing along the top of the transformer shall be the fire survival (FS) type.
- XVIII. The Pipe Line used for the system shall be of Class 'C' type.
- XIX. All the hardware used in the system shall be stainless steel.
- XX. Limit switches used in the panel shall be of Schmersal make or equivalent as per the purchaser's approval.
- XXI. Control cable gland used in system shall be of Lapp, Germany make or equivalent as per the purchaser's approval.
- XXII. Fire extinguishing cubicle shall be of 3mm thick CRCA sheet with PU painting and IP 55 enclosure protection class and shall accommodate nitrogen gas cylinder of adequate capacity and associated accessories like regulator, high pressure tubing etc.
- XXIII. The remote control panel, to be mounted inside the control room shall accommodate the necessary control units, operating switches push buttons etc. and also alarm annunciation unit.
- XXIV. The bidder shall, furnish the complete details including bill of materials of the fire prevention and extinguishing system offered. The list of all accessories including FRLS, fire survival cable, pipes, valves, sensors, control cubicle, nitrogen gas cylinder etc. shall be listed out and furnished in the offer.
- XXV. The bidder shall ensure that fire prevention and extinguishing system offered is full proof and reliable. Installation, testing and commissioning of the fire protection system shall also be in the successful bidder's scope.
- XXVI. Bidder shall ensure that fire prevention and extinguishing system shall not affect the normal operation of power transformer.
- XXVII. Fire protection scheme to the power transformer should have authentic certification regarding performance similar to one issued by LAPEM (MEXICO)/TAC/RDSO /any other approved standard laboratory.
- XXVIII. Similar units offered by bidder shall be in successful operation for a minimum period of two years.
- XXIX. The bidder shall also furnish performance certificate for similar systems in proof of the satisfactory operation.
- XXX. NIDS is to be supplied with transformer unless specified elsewhere in the Bidding document.
- XXXI. Drawing shall be prepared as per the layout and OGA of the transformer to avoid any major fabrication at site. Complete drawing and GTP should be submitted for approval.

- XXXII. Bidder shall also ensure overall product & installation quality.
- XXXIII. In all conditions transformer shall have provision for future implementations of NIDS.
- XXXIV. In any condition OEM (PTR) guarantee shall remain the same as mention in clause no. 11 of this specification.

**5.25 CENTRE OF GRAVITY & CENTRE LINE MARKING**

**CENTRE OF GRAVITY**

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

**CENTRAL LINE MARKING**

Central line of the transformer, tank, etc. shall be marked properly with indication to avoid any confusion during installation of the transformer

**5.26 ANTI RUSTING CORROSION TREATMENT**

- I. The bidder shall ensure that all fabrication i.e. transformer tank, radiators, marshalling boxes and other accessories are treated for highest quality performance for the entire life of the transformer. The Bidder shall submit plan for extra measures he is taking for prevention of corrosion, along with the offer.
- II. Finishes on transformer and appurtenant parts, edges (exposed to atmosphere)
- III. No gas cut edge on surface shall be acceptable unless smoothly ground to plane surface without irregular projections and corners (which cannot be blasted to the required roughness).
- IV. For all radiators (If Specifically Mentioned) the following painting procedure shall be followed. The metal spray (99.95% assay zinc) to a thickness about 100 microns with surface roughening and two coats of paints with proper supervision and quality checks. Bidder shall indicate separate price for metal spray of radiators.
- V. In this corrosion prevention measure it is imperative that the job is fully monitored for optimizing the proper conduct of the procedure as given in the various national standards. The coating shall be as per BS: 2569 (latest revision). The coating requirement shall be to BS: 5493 Gr. SC10Z.
- VI. The Bidder shall submit a Quality Plan, giving the parameters and checking methods, (major, critical, minor).
- VII. The paint shade used shall be shade 631 as per IS: 5.

**5.27 MAKE OF MAJOR COMPONENTS & RAW MATERIALS**

The BA shall procure the following constituent items from the designated vendors as follows:

S.no	RAW MATERIAL/EQUIPMENT	MAKE
a)	Copper	M/S Sterlite, M/S Hindustan Copper, M/S Hindalco.
b)	Core	M/S AK Steels, POSCO, Kawasaki/ JFE, Nippon Steel.

c)	Insulation paper and Pressboards	ITC paper, ABB, Raman Boards- Mysore, Senapathy Whiteley – Bangalore
d)	Transformer Oil ( Mineral oil)	Savita, Apar, Gandhar
e)	Gaskets & Corks	Nu Cork, Anchor Corks
f)	Steel For Tank	M/s, TATA Steel, M/s SAIL, M/s. JSW Steel, M/s. IISCO, M/s. RINL/Vizag Steel, M/s. Jindal Steel,
g)	Dehydrating Breather	Yogya, Anushree, Electrical engineers
h)	Bucholz, PRD, SPR, OTI , WTI, and other devices	Reputed make to be approved by TPCODL during detailed engineering.

Also, Bidder has to provide all test certificates from original manufacturers & relevant sourcing documents. BA shall also have shot blasting facility.

## 6. NAME PLATE AND MARKING RATING PLATE

- I. A stainless steel rating plate, of at least 1 mm thickness, shall be fitted to each transformer in a visible position and shall carry all the information as specified in the standards. **QR code shall be provided on name plate. QR code shall content the name plate details, approved GTP/Drawing and a video of overall functionality of transformer & associate components.**
- II. **Sign writing shall also be provided as per the format attached with this specification.**
- III. The letters on the rating plate shall be engraved black on the white/silver back ground.
- IV. Fixing screws for outdoor use shall be of stainless steel or any other corrosion resistant metals.
- V. The Name plate shall be embossed with “PO no. with date” & “TPCODL”.
- VI. Danger notice shall have red lettering on a white background or they may be pictorial as approved by the TPCODL
- VII. The name plate shall contain following information:
  - a. Type of transformer (Two Winding Transformer)
  - b. Relevant standard.
  - c. Manufacturer’s Name
  - d. Manufacturer’s Serial No.
  - e. Year of Manufacture (MM/YYYY)
  - f. No. of phases
  - g. Rated kVA
  - h. Rated frequency
  - i. Rated Voltage
  - j. Rated current
  - k. Connection symbol
  - l. Percentage impedance voltage at rated current.
  - m. Type of cooling (ONAN).

- n. Total Mass
- o. Mass and Volume of insulating Oil.
- p. Connection diagram showing the internal connections.
- q. Temperature rise
- r. Insulation levels of the windings, including neutral end of windings with non-uniform insulation.
- s. Transportation weight
- t. Untanking weight.
- u. Core and windings weight
- v. Table giving the tapping voltage, tapping current and tapping power for each tapping.
- w. Values of short circuit impedance on the extreme tapings and on the principal tapping and indication of the winding to which the impedance is related.
- x. A table of all guaranteed particulars.
- y. Quantity of oil required for normal filling.
- z. HV and LV phase to phase clearances.
- aa. Vector diagram
- bb. Indication of the winding which is fitted with tapping.
- cc. Table giving the tapping voltage, the tapping current and the tapping power of each winding, for each tap.
- dd. Value of short circuit impedance on the extreme tapping and on the principal tapping and indication of the winding to which the impedance is related.
- ee. Information of the ability of the transformer to operate at a voltage exceeding 110% of the tapping voltage or for the principal tapping and 110% of the rated voltage.
- ff. Tan delta value of insulating oil and kraft paper of transformer.

## VALVE SCHEDULE PLATE

The name plate shall contain information of all the valves, their locations, quantities and schematic for the valves

## OLTC PLATE

The name plate shall contain following information:

- I. Type
- II. S.No.
- III. Year of Manufacturing (MM/YYYY)
- IV. Motor
  - a. Operating Voltage
  - b. Normal Working Current
  - c. Max. rated Though current
- V. Phase
- VI. Frequency (Hz)
- VII. Steps (Numbers)
- VIII. Step Voltage
- IX. Weight / Volume
  - a. Tap Changer Without Oil (Kg)
  - b. Oil (Kg)
  - c. Total

- X. Control Voltage (V)
- XI. Transition Resistance (Ohms)

**MARSHALLING BOX & OLTC BOX:**

- I. Manufacture's Name
- II. Manufacture's Serial No.
- III. Year of Manufacturing (MM/YYYY)
- IV. Purchase Order No.

The following shall be clearly mentioned / Engraved on the Plate: "TPCODL". Engraved drawing of control circuit, CT / PT circuit and TB shall be available on Marshalling Box and OLTC Box.

**OIL FILLING INSTRUCTION PLATE FOR CONSERVATOR**

The name plate shall contain

- I. Step wise process for filling oil in conservator
- II. Table of fittings with functions
- III. Conservator diagram with oil filling process
- IV. Precautions in detail

**7. TESTS:**

All routine, acceptance & type tests shall be carried out in accordance with the IS 2026 relevant standards, & TPCODL approved QAP. All routine & acceptance tests shall be witnessed by the TPCODL/his authorized representative. All the components and fittings shall also be type tested as per the relevant standards.

Following tests shall be necessarily conducted on the Power Transformers in addition to others specified in IS/IEC standards. Test for the OLTC shall be done as per the IS 8468

**7.1 ROUTINE TESTS**

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

- 1) Measurement of Winding Resistance.
- 2) Measurement of voltage ratio, polarity and vector group check.
- 3) Measurement of short impedance and load loss at 50% and 100% load.
- 4) Measurement of no load losses and magnetizing current at rated frequency and 90%, 100% and 112.5% of rated voltage
- 5) Measurement of insulation resistance.
- 6) Dielectric Test.
- 7) Test on -Load Tap Changer.
- 8) Measurement of Zero-sequence impedance on three phase transformer.
- 9) All CTs and resistance of image coil for winding temperature indicator shall be checked for ratio test, polarity and knee point voltage test.
- 10) Determination of Capacitances and dissipation factor winding-to-earth and between windings.



- 11) Magnetic balance test.
- 12) Measurement of Magnetizing current at low voltage.
- 13) Vacuum withstand test on tanks and radiators.
- 14) The total Losses shall comprise of the No Load Losses, Load Losses ( $I^2R$  loss + stray loss) and Auxiliary Losses at rated output duly converted at 75 °C average winding temperature and shall also be indicated in the test report. Load losses shall be that corresponding to rated load on HV, LV windings.
- 15) Physical Verification of complete Transformer with all assembly including test rollers, radiators etc.
- 16) Voltage Regulation at rated load and at unit, 0.9, 0.8 lagging power factor.
- 17) Measurement of Acoustic Noise Level.
- 18) Measurement of the power taken by the fans
- 19) Functional tests on auxiliary equipment:-
  - a. Test on OTI and WTI
  - b. High Voltage test on insulation test for Auxiliary Wiring
  - c. High Voltage test on insulation test for Auxiliary Wiring
- 20) Test on Oil filled in Transformer:-
  - a. Dielectric strength of oil
  - b. Water content
  - c. Dielectric dissipation factor (tan delta at 90° celcius)
  - d. Resistivity.
- 21) Induced over voltage withstand test.
- 22) Separate Source voltage withstand test.
- 23) Oil Pressure test on completely assembled transformer at 0.35kg/sq.cm for 8 hrs.
- 24) BDV and moisture content of oil in transformer

## 7.2 TYPE TESTS

The type tests to be carried out by the Bidder shall include but not limited to the following:

- 1) Measurement of winding resistance.
- 2) Measurement of voltage ratio and check of voltage vector relationship.
- 3) Measurement of impedance voltage / short-circuit impedance (Principal tapping) and load loss.
- 4) Measurement of no load loss and current.
- 5) Measurement of insulation resistance.
- 6) Dielectric Test.
- 7) Temperature rise for determining the maximum temperature rise after continuous full load run. The ambient temperature and time should be stated in the test certificate.
- 8) Tests on on-load tap-changer.
- 9) Short Circuit withstand test.
- 10) Test to verify IP55 of Marshalling and cable boxes(if applicable)
- 11) Lightning Impulse voltage test with chopped wave.

**Note: The bidder shall submit the test report from CPRI or ERDA for the tests mentioned above.**

Following type tests shall be carried out on one transformer of each rating, at the works of the bidder, in presence of TPCODL representative.

- a. Temperature rise test including DGA (DGA shall be done before & after the heat run test)
- b. Impulse Test (Including chopped wave on all the three limbs of HV & LV)

### **TYPE TESTS, ROUTINE TEST & ACCEPTANCE TEST OF MOG & OSR**

All routine, acceptance & type tests shall be carried out in accordance with the relevant IS/IEC. All routine & acceptance tests shall be witnessed by the TPCODL/his authorized representative. All the components shall also be type tested as per the relevant standards. Following tests shall be necessarily conducted on the Joint and Termination Kits in addition to others specified in IS/IEC standards

#### **Type Test**

- a) Porosity test
- b) High voltage and insulation resistance test
- c) Elements test
- d) Gas Volume test
- e) Loss of oil and surge test
- f) Mechanical strength test
- g) Velocity calibration test

#### **Routine Tests**

- a) Porosity test
- b) High voltage and insulation resistance
- c) Elements test
- d) Gas Volume test
- e) Loss of oil and surge test

#### **Acceptance Tests**

- a) Visual Inspection
- b) Porosity test
- b) High voltage and insulation resistance
- c) Elements test
- d) Gas Volume test
- e) Loss of oil and surge test
- f) Mechanical strength test
- g) Velocity calibration test

### **TYPE TEST ON NITROGEN INJECTION DRAIN AND STIR SYSTEM (NIDS)**

The NIDS shall be subjected to the operational test at manufacturing works of Nitrogen Injection Fire Prevention and extinguishing system in presence of TPCODL's representative. The manufacture's test certificates of various accessories of NIDS shall be furnished at the time of Inspection to the inspecting officer. Complete GTP & Drawing including mounting, support structure, earthing provision should be submitted for approval. NIDS valve opening should not create any hindrance to other parts operation

### **SPECIAL TEST**

The following tests shall be carried out by mutual agreement between the TPCODL and the bidder. All Tests shall be done as per the relevant standard. Test certificates shall be submitted for bought out items. High voltage withstand test shall be performed on auxiliary equipment and wiring after complete assembly.

- a. Measurement of the harmonics of the No-Load Current
- b. Determination of transient voltage transformer characteristics
- c. Measurement of insulation resistance to earth of the windings, and / or measurement of Dissipation factor ( $\tan \delta$ ) of the insulation system capacitances. (These are reference values for comparison with later measurement in the field. No limitation for the values are given here.)
- d. Lightning impulse test on Neutral terminals
- e. Long duration induced AC voltage test (ACLD) transformer winding  $72.5 < U_m \leq 170kV$
- f. Magnetic circuit (isolation) test
- g. SFRA Test.

### **7.3 ACCEPTANCE TEST :**

- 1) At least 10% transformer of the offered lot (minimum of one) shall be subjected to all the tests mentioned under the section 'ROUTINE Test' in presence of TPCODL representative at the place of manufacture before dispatch without any extra charges. The testing shall be carried out in accordance with IS: 2026.
- 2) Oil Leakage test for acceptance shall be conducted at pressure of 0.35kg/sq.cm for one hour as per IS2026.
- 3) Temperature Rise Test (on one unit of first lot against every Rate contract / PO for each rating, for further lots against the same RC, TPCODL reserves the right to perform Temperature rise if required) [As per IS 2026 (Part 2) Clause no.4]
- 4) The painted surface shall pass the Cross Adhesion Test (IS1180 part 1 clause no. 21.4.d).
- 5) At stage inspection -Checking of weight, dimensions, fitting and accessories, tank sheet thickness, oil quantity, material finish and workmanship, physical verification of core coil assembly and measurement of flux density on one unit of each rating of the offered lot with reference to the GTP and contract drawings.
- 6) At Final inspection, the incoming raw material and its movement/consumption record in the related jobs of TPCODL will be verified by inspecting officer. In case of any deviation or non-availability of such records, the offered lot may get rejected.

### **8. TYPE TEST CERTIFICATES:**

The Bidder shall furnish the type test certificates of the Two Winding Power Transformer for the tests as mentioned above as per the corresponding standards. All the tests shall be conducted at CPRI / ERDA as per the relevant standards. Type tests should have been conducted in during the period not exceeding 5 years from the date of opening the bid. In the event of any discrepancy in the test reports, i.e. any test report not acceptable or any/all type tests (including additional type tests, if any) not carried out, same shall be carried out without any cost implication to the TPCODL

**9. PRE-DISPATCH INSPECTION:**

1. Equipment shall be subject to inspection by a duly authorized representative of the TPCODL. Inspection may be made at any stage of manufacture at the option of the TPCODL and the equipment if found unsatisfactory as to workmanship or material, the same is liable to rejection.
2. Bidder shall grant free access to the places of manufacture to TPCODL’s representatives at all times when the work is in progress.
3. Inspection by the TPCODL or its authorized representatives shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specifications.
4. Material shall be dispatched after specific MDCC (Material Dispatch Clearance Certificate) is issued by TPCODL.

Following documents shall be sent along with material:

- a. Test reports
- b. MDCC issued by TPCODL
- c. Invoice in duplicate
- d. Packing list
- e. Drawings & catalogue
- f. Guarantee / Warrantee card
- g. Delivery Challan
- h. Other Documents (as applicable)

5. In respect of raw material such as core stampings, winding conductors, insulating paper and oil, bidder shall use materials manufactured/supplied by standard manufacturers and furnish the manufacturers’ test certificate as well as the proof of purchase from these manufacturers (excise gate pass) for information of the TPCODL. The bidder shall furnish following documents along with their offer in respect of the raw materials:

- a. Invoice of supplier
- b. Mill’s certificate
- c. Packing List
- d. Bill of Landing
- e. Bill of entry certificate by custom

6. After the main raw-material i.e. core and coil material and tanks are arranged and transformers are taken for production on the shop floor, to ensure the quality of transformers, the inspection shall be carried out by the TPCODL’s representative at following stages:

**a. Stage Inspection I** – Bidder has to facilitate for stage inspection of Tank, HV and LV windings and Core of the offered transformers. Dye Penetration test to be done in presence of TPCODL representative. Bidder has to facilitate for stage inspection of Tank, HV and LV windings in one inspection call without any extra charges. Multiple inspections calls for stage inspection-I will not be considered and the delay will be accountable at bidder end. At this stage checking of weights, dimensions, tank sheet thickness, Pressure and vacuum test and quality of material, finish & workmanship as per GTP/QA Plan and approved drawings. During stage inspection TPCODL reserves the rights to dismantle the assembled core to ensure that the CRGO laminations used are of good quality.

**b. Stage inspection II** – Bidder has to facilitate for stage inspection -II for Core coil assembly of the offered transformers in without any extra charges. The testing shall be carried out in accordance with IS: 2026 and as per GTP/QA plan/Drawing.

Note: For Stage inspection, Annexure –I will be referred.

**c. Final Inspection** - Bidder has to facilitate for final inspection once the offered transformer is ready for dispatch. Inspection will be done as per w.r.t tests mentioned in Clause 7.2 and inspection test plan format in Annexure-II.

7. To ascertain the quality of the transformer oil, the original manufacturer's tests report shall be submitted at the time of inspection. Arrangements shall also be made for testing of transformer oil, after taking out the sample from the manufactured transformers and tested in the presence of TPCODL's representative.

8. The Bidder shall intimate the TPCODL in advance for inspection, so that an officer for carrying out inspection could be deputed, as far as possible within 07days (Within Delhi)/ 12 Days (outside Delhi) from the date of intimation.

9. Further, about the readiness of the transformers, for final inspection for carrying out tests as per relevant IS/IECs shall be sent by the Bidder along with routine test certificates. The inspection shall normally be arranged by the TPCODL at the earliest after receipt of offer for pre-delivery inspection.

10. In case of any defect/ defective workmanship observed at any stage by the TPCODL's Inspecting officer, the same shall be pointed out to the Bidder in writing for taking remedial measures. Further processing shall only be done after clearance from the inspecting officer / TPCODL.

11. All tests and inspection shall be carried out at the place of manufacture unless otherwise specifically agreed upon by the manufacturer and TPCODL at the time of purchase/tender.

12. The manufacturer shall offer the inspector representing the TPCODL all reasonable facilities, without charges, to satisfy him that the material is being supplied in accordance with this specification. This will include Stage Inspection during manufacturing stage as well as during Acceptance Tests.

13. The bidder shall provide all services to establish and maintain quality of workmanship in his works and to ensure the mechanical / electrical performance of components, compliance with drawings, identification and acceptability of all materials, parts and equipment as per latest quality standards of ISO 9000.

14. The TPCODL has the right to have the test carried out at his own by an independent agency wherever there is a dispute regarding the quality supplied. TPCODL has right to test 1% of the supply selected either from the stores or field to check the quality of the product. In case of any deviation TPCODL have every right to reject the entire lot or penalize the bidder, which may lead to blacklisting, among other things. .

## 10. INSPECTION AFTER RECEIPT AT SITE/STORE:

### Inspection at site:

After erection at site, the transformers shall be subjected to the following tests and the bidder shall guarantee results of test certificates under service conditions.

- a. Measurement of winding resistance
- b. Measurement of voltage ratio and check of voltage vector relationship
- c. Measurement of magnetizing current.
- d. Magnetic balance test on three phase transformer
- e. Magnetic circuit (isolation) test
- f. Measurement of short circuit Impedance at low voltage
- g. Insulation resistance measurement
- h. Dielectric Test on oil.
- i. Determination of Capacitances and dissipation factor winding-to-earth and between windings.
- j. Bushing Capacitance and  $\tan \delta$

- k. Test on other Auxiliaries
- l. No-Load and Excitation current

This is for bidder's information that tests at site may be in bidder's scope based on mutual agreement between bidder and TPCODL's. However, in any case bidder shall be required to send their engineer to confirm that the erection & commissioning is done in a satisfactory manner.

TPCODL holds the discretion to obligate the bidder to carry out certain additional tests (e.g. SFRA, HV tan delta etc.) on transformer, for cross-checking and confirming the quality of incoming equipment owing to damages/deterioration that might have been caused during transportation/handling etc.

**Inspection at Store:**

- a) The material received at TPCODLstore shall be inspected for acceptance and shall be liable for rejection, if found different from the reports of the pre-dispatch inspection and one copy of the report shall be sent to Project Engineering department.
- b) In case the transformers proposed for supply against the order are not exactly as per the tested design, the Bidder shall be required to carry out the short circuit test and impulse voltage withstand test at its own cost in the presence of the representative of the TPCODL. The supply shall be accepted only after such test is done successfully, as it confirms on successful withstand of short circuit and healthiness of the active parts thereafter on un-tanking after a short circuit test. Apart from dynamic ability test, the transformers shall also be required to withstand thermal ability test or thermal withstand ability will have to be established by way of calculations.
- c) The TPCODLreserves the right to conduct all tests on Transformer after arrival at site / stores and the manufacturer shall guarantee test certificate figures under actual service conditions.
- d) The TPCODLreserves the right to conduct short circuit test and impulse voltage withstand test in accordance to IS, afresh on each ordered rating at TPCODLcost, even if the transformer of the same rating and similar design are already tested. This test shall be carried out on a transformer to be selected by the TPCODLeither at the manufacturer's works when they are offered in a lot for supply or randomly from the supplies already made to TPCODLstores. The findings and conclusions of these tests shall be binding on the bidder.
- e) Test at TPCODLstore/Site: after receipt of transformers at TPCODLstores/Site, following minimum tests will be carried out.
  - 1. Total weight of the transformer. (It should be as per the offer, subjected to tolerance as per approved drawings & GTPs)
  - 2. Oil level in the transformer
  - 3. Verifications of all the fittings
  - 4. Physical verification of all the transformers for any damages, oil leakage, quality of painting etc.
- f) Test at site: The TPCODLreserves the right to conduct all tests on Transformer after arrival at site/stores and the manufacturer shall guarantee test certificate figures under actual service conditions.

### 11. GUARANTEE:

- I. Bidder shall stand guarantee towards design, materials, workmanship & quality of process/ manufacturing of items under the contract for due and intended performance of the same, as an integrated product delivered under this contract.
- II. In the event any defect is found by the TPCODL up to a period of 48 months from the date of commissioning or 60 months from the date of last supplies made under the contract, whichever is earlier.
- III. Bidder shall be liable to undertake to replace/rectify such defects at his own costs, within mutually agreed timeframe, and to the entire satisfaction of the TPCODL, failing which the TPCODL will be at liberty to get it replaced/rectified at Bidder's risks and costs and recover all such expenses plus the TPCODL's own charges (@ 20% of expenses incurred), from the Bidder or from the "Security cum Performance Deposit" as the case may be.
- IV. In case of Two Winding Power Transformer fails within the guarantee period the TPCODL will immediately inform the Bidder who shall take back the failed Two Winding Power Transformer within 15 days from the date of intimation at his own cost and replace / repair the transformer within forty five days of date of intimation with a roll over guarantee.
- V. The outage period i.e. period from the date of failure till unit is repaired / replaced shall not be counted for arriving at the guarantee period. Bidder shall further be responsible for 'free replacement' for another period of THREE Years from the end of the guarantee period for any 'Latent Defects' if noticed and reported by the TPCODL.

### 12. PACKING AND TRANSPORT:

- I. Bidder shall ensure that all the equipment covered under this specification shall be prepared for rail/road transport in a manner so as to protect the equipment from damage in transit.
- II. The packing may be in accordance with the bidder's standard practice but he should give full particulars of packing for the approval of the TPCODL. Special arrangement should be made to facilitate handling and to protect the projecting connections from damage in transit.
- III. The transformer shall be shipped filled with oil upto transport oil level guage. If transformer is transported without Oil or Partially filled, the tank shall be filled with Nitrogen under pressure complete with gas cylinder reducer, connection and pressure gauges. (After testing dew point of the Nitrogen filled. Dispatch clearance will be given only after achieving satisfactory dryness i.e. dew point measurement results). These accessories will be part of purchase. However, if neutral grounding transformer and reactors are included in the scope, these can be transported with oil. (Whichever way desired by the TPCODL depending on the size etc.)
- IV. Provisions for monitoring of oil and gas pressure during transport and storage and a make-up Nitrogen cylinder shall be made .
- V. Bushings shall be packed in proper containers for transport.
- VI. All parts shall be adequately marked to facilitate field erection.
- VII. Boxes and crates shall be marked with the contract number and shall have a packing list enclosed showing the parts contained therein .
- VIII. Unloading, dragging of transformer up to 50mtrs & keeping it on foundation at TPCODL site/stores will be in the scope of supplier. The bidder shall take care of this point while quoting the rates for Freight & Insurance charges.

### 13. TENDER SAMPLE:

The sample shall be not applicable

**14. QUALITY CONTROL:**

1. The bidder shall submit with the offer Quality assurance plan indicating the various stages of inspection, the tests and checks which will be carried out on the material of construction, components during manufacture and bought out items and fully assembled component and equipment after finishing.
2. As part of the plan, a schedule for stage and final inspection within the parameters of the delivery schedule shall be furnished.
3. The TPCODL's engineer or its nominated representative shall have free access to the manufacturer's/sub-supplier's works to carry out inspections.
4. The Bidder shall invariably furnish following information along with his bid, failing which the bid shall be liable for rejection. Information shall be separately given for individual type of equipment offered.
  - i. Statement giving list of important raw materials, names of sub-suppliers for the raw materials, list of standards according to which the raw materials are tested.
  - ii. List of tests normally carried out on raw materials in the presence of Bidder's representative, copies of test certificates.
  - iii. Information and copies of test certificates as in (i) above in respect of bought out accessories.
  - iv. List of manufacturing facilities available.
  - v. **Level of automation achieved and list of areas where manual processing exists.**
  - vi. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspection.
  - vii. List of testing equipment available with the bidder for final testing of equipment along with valid calibration reports shall be furnished with the bid. Manufacturer shall possess 0.1 class instruments for measurement of losses.
  - viii. Quality Assurance Plan (QAP) withholds points for TPCODL's inspection.
5. The successful Bidder shall within 30 days of placement of order, submit following information to the TPCODL.
  - a. List of raw materials as well as bought out accessories and the names of sub-Suppliers selected from those furnished along with offer.
  - b. Type test certificates of the raw materials and bought out accessories.
6. The successful Bidder shall submit the routine test certificates of bought out accessories and central excise passes for raw material at the time of routine testing.

**15. TESTING FACILITIES:**

Bidder shall have adequate in house testing facilities for carrying out all routine tests, acceptance tests and pre-dispatch inspection as per relevant International / Indian standards. The bidder shall have minimum testing facilities in house for following:

- a. Heat run test
- b. SFRA
- c. Pre dispatch inspection as per clause no. 9 above

**16. MANUFACTURING FACILITIES:**

- a. The successful bidder will have to submit the bar chart for various manufacturing activities clearly elaborating each stage, with quantity.
- b. This bar chart should be in line with the Quality assurance plan submitted with the offer.
- c. Cat-A approval is mandatory to start manufacturing.



## 17. SPARES, ACCESSORIES AND TOOLS

1. Bidder shall provide a list of recommended spares with quantity and unit prices for 5 years of operation after commissioning.
2. The TPCODL may order all or any of the spare parts listed at the time of contract award and the spare parts so ordered shall be supplied as part of the definite works.
3. The TPCODL may order additional spares at any time during the contract period at the rates stated in the Contract Document.
4. Bidder shall give an assurance that spare parts and consumable items will continue to be available through the life of the equipment which shall be 25 years minimum.
5. However, the TPCODL shall be given a minimum of 12 months' notice in the event that the Bidder or any sub-vendor plans to discontinue manufacture of any component used in this equipment.
6. Any spare apparatus, parts or tools shall be subject to the same specification, tests and conditions as similar material supplied under the Contract. They shall be strictly interchangeable and suitable for use in place of the corresponding parts supplied with the equipment and must be suitably marked and numbered for identification.
7. The bidder shall also provide the following mandatory spares along with the transformer.
  - a. HT Bushing (1 no.)
  - b. LT Bushing (1 no.)
  - c. Neutral Bushing (1 no.)
  - d. Bucholtz Relay (1 no.)
  - e. Valves ( 1Set)
  - f. OTI, WTI ( 1 each)
  - g. PRV (1 no); OSR (1 no); MOG (1 no)
  - h. Transducers for OTI, WTI, PTI
  - i. Air cell (1 no.)
  - j. Fan contactor with overload relay (1 no.)
  - k. Cooling fan (1 no.)
  - l. Set of gaskets (1 no.)
  - m. Set of mandatory spares for tap changer (1 no.)
  - n. Oil – 10% extra
  - o. Radiator tube plug – 5 No
  - p. Radiator tube valves – 2 No
  - q. Radiator tube plug oil seals – 12 No
  - r. MCCB (1 no.)
  - s. MCB (1 no.)
  - t. L/R switch (1 no.)
  - u. R/L switch (1 no.)
  - v. OLTC counter (1 no.)
  - w. Space heater & thermostat (1 no.)
  - x. Bushing CT for HV (1 no.)
  - y. Bushing CT for Neutral (1 no.)
  - z. Bushing CT for LV (1 no.)

## 18. DRAWINGS AND DOCUMENTS:

1. Following drawings and documents shall be prepared based on TPCODL specifications and statutory requirements and shall be submitted with the bid:
  - a. Completely filled in Technical Particulars and compliance to each clause of the specification General Technical Requirements to Additional Details.
  - b. Description of the transformer and all components including brochures.
  - c. General arrangement for Transformer.
  - d. Bill of material.
  - e. Experience Certificate and list
  - f. Type test certificates.
  - g. List of makes of major components as listed above.
2. Drawings / documents to be submitted after the award of the contract are as under:

Sr. No	Description	For Approval	For Review Information	Final Submission
1	Technical Parameters	√	√	√
2	GA Drawing of Transformer	√	√	√
3	HV and LV bushing internal view with terminal connector	√	√	√
4	Internal coil arrangement with dimensions	√	√	√
5	Breather Drawing		√	√
6	Rating Plate	√	√	√
7	Cooling calculation with no. of radiators and fins mentioned specifically	√	√	√
8	Prismatic oil level gauge drawing			√
9	Installation Instruction		√	√
10	QA & QC Plan		√	√
11	Test Certificates	√	√	√
12	Shipping drawings showing dimensions and weights of each package.	√	√	√
13	Assembly drawings and weight of main component parts.	√	√	√
14	Drawings giving Weights for foundations	√	√	√
15	Tap changing and name plate diagram.	√	√	√
16	Schematic control along with logic block diagram and wiring diagram for all auxiliary equipment.		√	√
17	Schematic diagram showing the flow of oil in the cooling system as well as each limb and winding. Longitudinal and cross-sectional views showing the duct sizes, cooling pipes etc.	√	√	√

18	Large scale drawings of high and low tension windings of the transformers showing the nature and arrangement of insulation and terminal connections.	√	√	√
19	Bushing drawing and specifications.	√	√	√
20	Crane requirement for assembly and dismantling.		√	√
21	Overhead Conductor Connections.		√	√
22	Foundation drawing of transformer, radiator supports, etc.	√	√	√
23	Valve Schedule details	√	√	√
24	HV , LV Bushing fixing and connection Details		√	√
25	Radiator drawing and their fixing arrangement.		√	√
26	Marshaling junction box details	√	√	√
27	Thermo junction box details.	√	√	√
28	Neutral arrangement	√	√	√
29	Drawing showing conservator with air bag and oil filling instructions	√	√	√

In addition to the above, the following drawing / information for each item pertaining to marshalling box and OLTC shall also be supplied.

30	General arrangement drawing of the marshaling box	√	√	√
31	Shipping drawings showing dimensions and weight of each package	√	√	√
32	Drawing giving the weight for its foundation.	√	√	√
33	Schematic control drawing and TB schedule / wiring diagram for all elements	√	√	√
34	Valve Schedule	√	√	√
35	Test report of all bought out elements.	√	√	√
36	The tightening torque chart	√	√	√

**3. List of Calculations to be submitted:**

1. All the calculations shall be step by step showing the use of formulas and other practical considerations. **Concise calculations in table or excel sheet shall not be accepted.** Also, the reference (only standard sources as IS, IEC or any such standard is acceptable) of the formulas shall be mentioned.
2. Resistance Calculation ( 75 deg. C )
3. Load Losses Calculation ( at 75 deg. C )
4. No load Losses.
5. Stray Losses.

6. Weight of Copper (Bare and with Insulation also).
  7. Weight of Core.
  8. BH curve & Loss/Kg graph of core material offered.
  9. Flux Density calculations.
  10. Current Density Calculations.
  11. Short Circuit withstand.
  12. Temperature Rise Calculations.
  13. Conservator Volume calculations
  14. Cooling Calculations showing cooling with tank and radiators separately with no. of radiators and fins mentioned specifically (For both Mineral oil and Ester oil)
  15. Calculation sheet for Lifting lug design and mounting lug design to be submitted by Bidder.
4. **Additional Documents to be submitted :**
- a. List of raw materials as well as bought out accessories and name of sub-suppliers selected from those furnished along with offer.
  - b. Type test certificates of the raw materials and bought out accessories.
  - c. The successful Bidder shall submit the **routine test certificates of bought out accessories** and central excise passes for raw material at the time of routine testing.

All the documents & drawings shall be in English language. After the receipt of the order, the successful bidder will be required to furnish all relevant drawings/parameters/calculation to TPCODL for approval.

#### 5. Instruction Manuals:

Bidder shall furnish softcopies of nicely bound manuals (In English language) covering erection and maintenance instructions and all relevant information and drawings pertaining to the main equipment as well as auxiliary devices.

#### 19. SCHEDULE- "A" GUARANTEED TECHNICAL PARTICULARS:

Sl. No.	Description	Unit	As furnished by Bidder
1.0	Tapings on HV winding ON Load a) Range b) Number of steps c) Principal tap		
2.0	For ON load taps, specify details of OLTC gear(incl. type & make)		
2.1	Manual/automatic control		
2.2	Remote/local control		
2.3	If remote control, whether the remote Control cubicle included in Bidder's scope of supply		
2.4	Voltage class of OLTC		
2.5	Current rating of OLTC		

2.6	a) Location of OLTC with respect to HV winding (attach sketch). b) Location of OLTC (In Tank/Outside Tank)		
2.7	Whether separate tap winding provided for OLTC		
2.8	Whether Selector and diverter chamber are separate		
2.9	Total oil in the OLTC in selector switch		
	-- In diverter switch		
3.0	Winding		
3.1	Maximum current density in winding	Amps/m <sup>2</sup>	
3.2	Use of continuously transposed conductor (CTC) in LV winding.	Yes/No	Yes
3.3	Area of cross section of winding conductor (HV/LV/Reg).	mm <sup>2</sup> (Min)	
3.4	Description of winding insulation		
3.5	Nature of insulation	Class	
3.6	Bare weight of copper in windings without paper insulation and leads.	Kg (Minimum)	
3.7	Details of winding and winding conductor		
4.0	Tank :		
4.1	Approximate thickness		
	Sides	mm	
	Bottom	mm	
	Cover	mm	
4.2	Material of tank		
5.0	Maximum temperature-rise above an ambient of (deg.C) a)Top oil b)Windings c) Temperature Gradient between Oil and Winding	°C °C °C	
6.0	Total loss at rated voltage at principal tapping and rated frequency.	kW	
7.0	Component losses: at 90%, at 100%, and At 110% :		
7.1	Maximum Guaranteed No load loss at rated voltage on principal tapping and at rated frequency :	kW	
7.2	Calculated No load loss at rated principal tapping & rated frequency. Submit necessary calculations	kW	
7.3	Maximum guaranteed I <sup>2</sup> R loss at rated current for the principal tapping at 75°C.	kW	
7.4	Calculated I <sup>2</sup> R loss at rated current for the principal tapping at 75°C. Submit necessary calculations.	kW	

7.5	Calculated additional losses (Eddy + stray losses) at rated current for the principal tapping at 75°C. Submit necessary Calculations.	kW	
7.6	Maximum guaranteed additional losses (Eddy + stray losses) at rated current for the principal tapping at 75°C.	kW	
7.7	Maximum Guaranteed auxiliary losses	kW	
7.8	Auxiliary losses at rated current for principal tripping:	kW	
7.9	Maximum Calculated total Losses (sum of sr.no.19.2+19.4+19.5+ 19.7) submit necessary calculation.	kW	
7.10	Guaranteed Total Losses (sum of sr. no. 19.1+19.3+19.6+19.7) submit necessary calculation.	kW	
8.0	Impedance voltage at rated current for the principal tapping HV LV (Percent) Note: (The above impedance values shall be on full MVA rating of transformer i.e. For 2 winding transformer on 5 mva or 8 mva base )	%	
9.0	Reactance at rated current and rated frequency (On full MVA rating of transformer i.e.For 2 winding transformer on 5 mva or 8 mva base ) i) HV LV ii) No load current at rated voltage and rated frequency	%	
10.0	a)Partial discharge level : b)Noise level : c)Harmonic content in charging current :		
11.0	Insulation level		
11.1	Separate source power-frequency voltage withstand : i)HV winding ii)LV winding iii)LV neutral	kV rms kV rms kV rms	
11.2	Induced over voltage withstand i)HV winding ii)LV winding iii)LV neutral	kV rms kV rms kV rms	
11.3	Full wave lightning impulse withstand voltage nd i)HV winding ii)LV winding iii)LV neutral	kV peak kV peak kV peak	
11.4	Uniform/Graded Insulation i)HV winding ii)LV winding iii)LV neutral	kV peak kV peak kV peak	

12.0	a) External short circuit withstand capacity b) External short circuit withstand capacity i) for HV side ii) for LV side c) Duration of external short withstand capacity	MVA kA kA In Sec.	
13.0	Efficiencies at 75 deg.C at unity power factor : a) At full load b) At 3/4 full load c) At 1/2 full load d) At 1/4 full load	% % % %	
14.0	Efficiencies at 75 deg.C at 0.8 power factor : a) At full load b) At 3/4 full load c) At 1/2 full load d) At 1/4 full load	% % % %	
15.0	a) 415 V single phase short circuit impedance b) Percentage variation between phases.		
16.0	Regulation at full load at 75 deg.C a) At unity power factor b) At 0.8 power factor lagging	% %	
17.0	Terminal arrangement: a) High voltage b) Low voltage c) Neutral (LV) d) HV terminal phase spacing e) LV terminal phase spacing f) Any other information		
18.0	Approximate masses: a) Core b) Winding c) Bare weight of copper in windings without paper insulation and leads d) Tanks, fittings and accessories. e) Oil f) Total mass	Kg Kg Kg Kg Kg Kg	
19.0	Approximate quantity of oil required for filling (main tank) OLTC Overall maximum dimensions of the transformer complete with accessories : a) Length b) Breadth c) Height	mm mm mm	
	Untanking height Reference standards		

20.	<p>Details of HV Bushings line</p> <p>a) Voltage class, b) Current rating, c) 1.2/50 s impulse withstand d) Make e) Type f) Creepage distance, total g) Creepage distance, protected. h) Year of manufacture. i) Qty. of oil in oil filled bushing</p>	<p>kV A kV (rms)</p> <p>mm mm MM/YYYY Y Ltr.</p>	
21	<p>Details of LV Bushings line (LV line end)</p> <p>a) Voltage class, b) Current rating, c) 1.2/50 s impulse withstand d) Make e) Type f) Creepage distance, total g) Creepage distance, protected. h) Year of manufacture. i) Qty. of oil in oil filled bushing</p>	<p>kV A kV (rms)</p> <p>mm mm MM/YYYY Y Ltr.</p>	
22.0	<p>Details of Neutral Bushings</p> <p>a) Voltage class, b) Current rating, c) 1.2/50 s impulse withstand d) Make e) Type f) Creepage distance, total g) Creepage distance, protected. h) Year of manufacture. i) Qty. of oil in oil filled bushing</p>	<p>kV A kV (rms)</p> <p>mm mm MM/YYYY Y Ltr.</p>	
23.0	<p>Details of Core Grounding Bushings</p> <p>a) Voltage class, b) Current rating, c) 1.2/50 s impulse withstand d) Make e) Type f) Creepage distance, total g) Creepage distance, protected. h) Year of manufacture. i) Qty. of oil in oil filled bushing</p>	<p>kV A kV (rms)</p> <p>mm mm MM/YYYY Y Ltr.</p>	



24.0	<p>Details of LV Cable Connection</p> <p>a) Clearances</p> <p>i) Phase to Phase</p> <p>ii) Phase to Earth</p> <p>b) Drawing enclosed</p> <p>c) Length Of Each phase Bus Bars. The Bus bars are suitable for how many numbers of 1Cx 1000 sq mm, 11kV, XLPE cable.</p>		
25.0	<p>Designed Fault Levels:</p> <p>a) HV</p> <p>b) LV</p>	<p>MVA</p> <p>MVA</p>	
26.0	<p>Core</p> <p>a) Material &amp; Grade</p> <p>b) thickness in mm</p> <p>c) Type of core</p> <p>d) Operating flux density</p> <p>e) Maximum flux density</p> <p>f) Over fluxing capability for 10% voltage &amp; 3% frequency variation</p> <p>g) Specific No load loss for the grade of core chosen at the specified flux density.</p> <p>h) Net weight of CRGO lamination in core. (Kg minimum).</p> <p>( Please submit copy of graph in support of this)</p>	<p>Yes / No</p> <p>Watts/Kg</p>	
27.0	<p>Details of CTs on HV Bushings (Line )</p> <p>a) No. of cores</p> <p>b) Ratio for each core</p> <p>c) VA burden - for each core (along with Imag and VK wherever necessary)</p> <p>d) Accuracy class of each core</p> <p>e) Year of manufacture.</p> <p>f) Short time thermal current rating</p> <p>i) Current</p> <p>ii) Rated time</p>	<p>kA</p>	
28.0	<p>Details of CTs on LV Bushings.(Line )</p> <p>a) No. of cores</p> <p>b) Ratio for each core</p> <p>c) VA burden - for each core (along with Imag and VK wherever necessary)</p> <p>d) Accuracy class of each core.</p> <p>e) Year of manufacture.</p> <p>f) Short time thermal current rating</p> <p>i) Current</p> <p>ii) Rated time</p>	<p>kA</p>	
29.0	<p>Rail gauge (along both axis)</p>		

30.0	Whether Neutral end surge diverter recommended by bidder		
31.0	If yes details of surge diverter a) Type b) Make kV class kV rating		
32.0	Tertiary winding if any kept isolated then the bidder to state whether one terminal to be earthed or any other precautions required during service conditions		
33.0	On load tap changer Particulars a) Make b) Type, designation c) Suitable for auto/manual operation d) Rated voltage kV e) Basic insulation level (BIL) of OLTC (kV peak) f) One minute power frequency voltage withstand of OLTC g) Rated current (A) h) No. of steps i) Step voltage (V) j) Rated voltage of drive motor V k) Whether diverter and selector chambers are separate. l) Rated voltage of control circuit V m) Time to complete tap changing operation from any one step to next higher or lower tap. i) On auto operation - Sec. ii) On manual operation through push button - Sec. n) List of routine tests to be carried out on tap changer o) Location of the taps with respect to the terminals of the tapped winding p) Drawing or pamphlet number of the technical and descriptive particulars of the OLTC, enclosed with the bid. q) Separate conservator and Buchholz relay provided for OLTC (Yes/No) r) RTCC (Remote Tap Changer Control Panel) i. List of tap changer Annunciation ii. Two sets of potential free contacts for SCADA provided. iii. Two sets of 0/20 mA output for tap position indication provided. iv. 415 V Auto changeover facility for OLTC motor provided.		

34.0	<p>Marshalling Box</p> <p>a) Derived control supply Voltage</p> <p>b) 415 V /control supply auto-changeover facility provided.</p> <p>c) Local OTI/WIT provided.</p> <p>d) Remote OTI/WIT provided.</p> <p>e) Two sets of 0/4-20 mA signals for OTI/WIT provided.</p> <p>f) List of annunciations.</p> <p>g) Two sets of potential free contacts for annunciations provided.</p>		
35.0	Whether Marshalling boxes (ground as well as tank) provided as per specifications		
36.0	<p>Surface Preparation/Painting</p> <p>1) Material used fir Adequate rust proofing done on transformer and radiator (Details of measures to be enclosed)</p> <p>2) Type of paint (epoxy/enamel)</p> <p>3) Whether galvanized radiator offered as alternative.</p>		
37.0	<p>Conservator Oil preservation system Details (Air bag)</p> <p>a) Material of separator/Air bag</p> <p>b) Details of air pressure for the separator</p> <p>i. Design pressure</p> <p>ii. Working pressure</p> <p>iii. Bursting pressure (Puncture strength)</p> <p>c) Procedure of oil filling with air bag to be enclosed.</p> <p>d) Any precautions to be taken during maintenance of transformer with air bag to be mentioned here.</p>		
38.0	General arrangement drawing of the transformer indicating details of HV/MV/LV terminals and over all dimensions enclosed		Yes/No
39.0	Neutral Bushing Calculation to be submit.		Yes

**20. SCHEDULE “B” DEVIATIONS:**

**(TO BE ENCLOSED WITH TECHNICAL BID)**

All deviations from this specification shall be set out by the Bidders, clause by Clause in this schedule. Unless specifically mentioned in this Schedule, the tender shall be deemed to confirm the purchaser's specifications:



**Specification No:** ENG-EHV-1001

**Specification Name:** Technical Specification for 33/11kV 5MVA and 8 MVA Power Transformer

SL. No	Clause No.	Details of deviation with justifications

We confirm that there are no deviations apart from those detailed above.

Seal of the Company:

Signature

Designation

# **STANDARD TECHNICAL SPECIFICATION COVER SHEET**

**Specification No. : ENG-EHV-1002**

**Specification Name : Technical Specification for 33/11kV 12.5/16 MVA Power Transformer**

<b>SWARUP NAYAK</b>	<b>SHANTAPRIYA JENA</b>	<b>JYOTIPRAKASH MOHANTY</b>	<b>Vijender Goyal</b>	<b>KHAJAN BHARDWAJ</b>	<b>POURUSH GARG</b>
Prepared by	Reviewed by	Reviewed by	Reviewed by	Approved by	Released by
TPCODL	TPNODL	TPWODL	TPSODL	TPCODL	TPCODL
07-12-2022	07-12-2022	07-12-2022	07-12-2022	07-12-2022	07-12-2022

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**1. SCOPE:**

This Specification provides for design, engineering, manufacture, assembly, stage inspection, final inspection and testing before dispatch, packing and unloading at destination Sub-station / stores by road transport, transit insurance, of 12.5/16 MVA Power Transformer(s), complete with all fittings, accessories, associated equipment, spares, required for its satisfactory operation in any of the sub-stations of the Purchaser.

The Transformer shall be of outdoor type with tap changers as detailed below.

**12.5/16 MVA - ON Load Flange Mounted type Tap Changer**

Such of the parts that may have not been specifically included, but otherwise form part of the transformer as per standard trade and/or professional practice and/or are necessary for proper operation of transformer, will be deemed to be also included in this specification. The successful bidder shall not be eligible for any extra charges for such accessories etc. notwithstanding the fact that at the time of an initial offer bidder had segregated such items and quoted for them separately.

**2. APPLICABLE STANDARDS:**

The equipment ( and the materials used ) covered by this specification shall unless otherwise stated, be designed, manufactured and tested in accordance with the latest editions of the following Indian standards & other relevant standards for components, BEE & CEA guidelines with latest amendment from time to time, thereof, some of which are listed below:

SI.No	Reference Standard	Reference Standard Name
1	IS 5	Specification for Colors for Ready Mixed Paints and Enamels
2	IS 104	Specification for ready mixed paint, brushing, zinc chrome, priming
3	IS 335	Specification for New insulating oils
4	IS 649	Methods for testing steel sheets for magnetic circuits of power Electrical apparatus.
5	IS 1576	Solid Pressboard for Electrical Purposes -Specification
6	IS 2026	Specification for Power Transformers
7	IS 2099 / IEC-61037	Specification for Bushings for Alternating Voltages Above 1000 Volt
8	IS 2362	Determination of Water content in oil by Karl in oil Fischer Method- Test Method

9	IS 2544	Specification for Porcelain post insulators for systems with nominal Voltage Greater than 1000V
10	IS 2705	Specification for Current Transformers
11	IS 3401	Specification of Silica Gel
12	IS 3637/ IEC-364	Specification for gas operated relay (Buchholz relay).
13	IS 4253: Part II	Specification for cork composition sheets - Part II: Cork and Rubber
14	IS 4257 (PART I)	Dimensions for Clamping Arrangements for Porcelain Transformer Bushings - Part I : For 12 kV to 36 kV Bushings
15	IS 5082	Specification for Wrought Aluminum and Aluminum Alloy Bars, Rods, Tubes, Selection, Plates and Sheets for Electrical purposes
16	IS 5561	Specification for Electric Power Connectors.
17	IS 6103	Specification for Method of Testing of specific resistance (Resistivity) of electrical insulating liquids
18	IS 6262	Method of test for power factor and dielectric constant of electrical Insulating liquids
19	IS 6600	Guide for Loading of Oil-immersed Transformer.
20	IS 6792/ IEC-156	Method for Determination of Electric Strength of Insulating Oil
21	IS 8468	On-load tap changers
22	IS 8603 (PART-1)	Dimensions for Porcelain Transformer Bushings for Use in Heavily Polluted Atmospheres - Part I: 12 kV, 17.5 kV, 24 kV and 36 kV Bushing
23	IS 9335	Specification for Cellulosic Papers for Electrical Purposes
24	IS 10028:	Code of Practice for Selection, Installation and Maintenance of Transformers
25	IS 12444	Specification for Continuously Cast and Rolled Electrolytic Copper Wire Rods for Electrical Conductors.
26	IS 13964	Methods of Measurement of Transformer and Reactor Sound level
27	IS 3639	Specification for fitting & accessories of Power Transformer
28	IS 1866	Code of practice for maintenance of transformer oil



29	IEC 60156	Insulating liquids - Determination of the breakdown voltage at Power frequency - Test method
30	IS 2074	Ready Mixed Paint, Air Drying, Red Oxide Zinc Chrome, Priming – Specification
31	IS 2932	Enamel, Synthetic, Exterior: (a) Undercoating (b) Finishing – Specification
32	IEC 60296	Specification for unused mineral insulating oils for transformers And switchgear
33	IEC 60529	Degrees of protection provided by enclosures (IP Code)
34	IEC 60437	Radial Interference test on high-voltage insulator
35	IEC 61936-1	Power Installation exceeding 1kV.
36	C.B.I.P Publication	Manual on Transformers

*\*In case of any conflict on any technical particular in the specification, the stricter requirement mentioned in the relevant standard shall be valid.*

### 3. CLIMATIC CONDITIONS:

1	Maximum ambient temperature	50 deg C
2	Max. Daily average ambient temp	35 deg C
3	Min Ambient Temperature	0 deg C
4	Maximum Humidity	95%
5	Average Annual Rainfall	1500mm
6	Average No. of rainy days per annum	120
7	Altitude above MSL not exceeding	1000m
8	Wind Pressure	300 Km/hr
9	Earthquakes of an intensity in horizontal direction	equivalent to seismic acceleration of 0.3g
10	Earthquakes of an intensity in vertical direction	equivalent to seismic acceleration of 0.15g (g being acceleration due to gravity)

TPCODL/TPNODL/TPSODL/TPWODL service area has heavy saline conditions along the coast and High cyclonic Intensity winds with speed upto 300 Kmph. The atmosphere is generally laden

with mild acid and dust in suspension during the dry months and is subjected to fog in cold months.

#### 4. GENERAL TECHNICAL REQUIREMENTS:

4.1 The transformer shall conform to the following specific parameters.

Sl.no	Parameters	Desired Values
1	Rated MVA (MVA)	12.5MVA (ONAN)/ 16MVA (ONAF)
2	No. of phases	3
3	Type of installation	Outdoor
4	Frequency	50 Hz (± 5% )
7	Rated voltage	
	a) High voltage winding	33 KV
	b) Low voltage winding	11 KV
8	Highest continuous system voltage	
	a) HV Winding	36 KV
	b) LV	12 KV
9	No.of Windings	Two Winding Transformer
10	Type of Cooling	ONAN/ONAF with Automatic Control
12	Method of connection	
	HV	Delta
	LV	Star
13	Vector Group	Dyn11
14	System Earthing (Neutral terminal to be brought out)	Neutral LV side to be solidly earthed
15	Percentage impedance voltage on normal tap at Base MVA <b>(Tolerance shall be as per IS 2026 Part-1, Clause 9, Table No.1)</b>	10 %
16	Transformer shall be suitable for continuous operation at a voltage of 110% on each operating tap. Transformer shall be suitable to withstand 120% of the loading on each tap.	
17	Transformer shall be capable of delivering the rated current at a voltage equal to 105% of rated voltage, without exceeding the temperature rise specified.	
18	Over Voltage operating capability and duration	112.5 % of rated voltage ( continuous )
19	Maximum Flux Density	1.6 Tesla
20	Basic Insulation levels for windings(Neutral should not be shaded) :-	
	a) 1.2 / 50 microsecond wave shape Impulse withstand (KVP)	33KV : 170 11KV: 95
	b) Power frequency voltage withstand (KV rms)	33KV : 70 11KV: 28
21	Type of winding insulation	Uniform

22	Withstand time for three phase short circuit at LV Bushings	3 Seconds
23	Permissible Temperature Rise over ambient temperature of 50 deg C	
	a) Of top oil measured by thermometer.	45 Deg C
	b) Of winding measured by resistance.	55 Deg C
24	Minimum clearances in air (mm) :-	
	HV	Phase to Phase: 400 Phase to ground: 320
	LV	Phase to Phase: 280 Phase to ground: 160
25	Core Material	CRGO Silicon Steel, M3 or better
26	Class of Insulation	A/A
27	Terminals	
	a) HV winding	36 KV oil filled communicating type porcelain bushings (Anti-fog type)
	b) LV winding	17.5 KV porcelain type of bushing (Antifog type )
28	Insulation levels for windings :-	
	a) 1.2 / 50 microsecond wave shape Impulse withstand (KVP)	33KV : 170 11KV: 95
	b) Power frequency voltage withstand (KV rms)	33KV : 70 11KV: 28
	c) creepage distance (min)	33KV : 1116 mm 11KV: 370 mm
29	Material of HV & LV Conductor	Electrolytic copper
30	Maximum current density for HV and LV winding for rated current	2.4 A / mm <sup>2</sup>
31	Polarisation index i.e ratio of megger values at 600 sec. to 60 sec for HV to earth, L.V to earth and HV to LV .	Shall be greater than or equal to 1.5, but less than or equal to 5
32	Core Assembly	Boltless Type
33	WTI & OTI	1 nos each
34	Losses	The losses shall not exceed the value given below
	a) No load loss(fixed losses) KW	9.7 KW

	b) Load losses at 75°C KW (at 12.5 MVA)	58KW
35	Wheels	The transformer shall be provided with four flanged bi-directional rollers suitable for rail gauges in both the axis for movement of the transformer in either direction.
36	Over fluxing capability	Transformers shall be designed for continuous over fluxing withstands capability due to +10% to -10% voltage variation on HV side and frequency variation of ±3%. Combined variation of voltage and frequency shall be within ±10%.
37	Auxiliary Supply	
	a) AC	415 Volts 3 phase 4 wire, ungrounded (Provision to connect neutral to be made in the terminal block). Two 415 V sources shall be made available by TPCODL/TPNODL/TPSODL/TPWODL
	b) DC	48V
38	No Load Current	No Load Current shall be 0.5% of full load current. Tolerance for No-Load Current shall be +30% of the declared value.
39	Core Grounding	The core and frame grounding connection shall be brought out through a suitable bushing for provision of external grounding. The bidder shall submit the drawing clearly showing the details of core grounding.
40	On Load Tap changer (OLTC) on HV Side	
	a) Type	On Load (Flanged type)
	b) Range	+ 4.686% to -20.606 % in steps of 1.56%
	c) Number of Steps	16 (17 Position)
	d) Principal Tap Position	5th
	e) Manual / Automatic	Yes (Both)
	f) Remote / Local	Yes (Both)
	g) IS	8468-2006
	h) All contacts should be SCADA compatible and suitable for connection to TMU	Yes
	i) Separate Conservator and OSR, PRV & MOG	Yes
	j) Potential free contacts for SCADA shall be Provided	Yes

	k) 415 V Auto change over facilities for OLTC Motor shall be Provided	Yes
	l) Flow of Power	Bidirectional
	m) Surge Relay	Yes
	n) Whether separate tap winding provided for OLTC	Yes
	o) RTCC	No
	p) SCADA and TMU compatibility	Yes

WTI CT for LV Side:	CTR: 840/1	Class:0.5	Burden: 30 VA	ISF<10
WTI CT for HV Side:	CTR: 280/1	Class:0.5	Burden: 30 VA	ISF<10

WTI HV and LV Side to be Wired according in Marshalling Panel.

HV and LV Neutral CT (Bushing CT) shall be in supplier's scope (CTR shall be decided in detailed Engineering)

Accuracy Class:PS ,  
Knee Point Voltage>500V,  
Imag at Vk/s <100mA,  
ISF <=5,  
Rct<6 Ohm.

#### 4.2 PERFORMANCE

- I. The transformer shall be capable of being operated, without danger, on any tap at the rated MVA with voltage variation of  $\pm 10\%$  corresponding to the voltage of the tap.
- II. Transformer shall be capable of operating under natural cooled condition up to specified load.
- III. The transformer shall be designed with particular attention to the suppression of maximum harmonic voltage, especially the third and fifth harmonics so as to minimize interference with communication circuit.
- IV. The transformer shall be able to withstand thermal and mechanical stresses caused by symmetrical or asymmetrical fault on any winding.
- V. The transformer and all its accessories including CTs etc. shall be designed to withstand thermal and mechanical effects of any external short circuits to earth and short circuits at the terminals of any winding for a period of 3 sec without any damage/injury.
- VI. Loading of the transformer shall be as per IS: 6600, IS: 2026 part-7, IEC 60076-7
- VII. Transformer shall be compatible for Operation along with Tap Changer Control panel or Transformer Monitoring Unit (TMU). Supply of TMU is not in scope of Bidder.

#### 5. GENERAL CONSTRUCTION:

##### 5.1 GENERAL:

- I. All transformers shall be provided with detachable, flanged, bi-directional wheels for movement and mounting on rail gauge. TPCODL/TPNODL/TPSODL/TPWODL shall provide rail tracks grouted in

concrete foundation. Bidder shall provide means for locking the wheels in positions parallel to and at right angles to the longitudinal axis of the tank.

- II. Transformer shall be two winding type, with cold rolled grain oriented, silicon-steel laminations having excellent magnetic properties, insulated and clamped to minimize vibration and noise. Laminations shall be insulated from each other with material having high inter-lamination insulation resistance and rust inhibiting property All covers and seals shall be oil and airtight and shall not be affected by mineral or synthetic oil action.
- III. All fasteners of M10 and below size should be of stainless steel. All fasteners of M12 and above size should be hot dip galvanized. To achieve a good quality corrosion free painting, bidder should provide epoxy plus polyurethane paint with minimum paint thickness of 120 microns.
- IV. The framework, clamping arrangement and general structure of the cores of each transformer shall be of robust construction, **having proper support structure** and shall be capable of withstanding any shock to which they may be subjected during transport, installation and service. **Detailed calculation for selection of bolts shall be submitted.** The framework and the core bolts shall be efficiently insulated from the core so as to reduce the eddy-currents to a minimum.
- V. The limbs and the yokes of the core shall have similar sections to minimize heating and noise arising from transverse flux. The joints in the laminated magnetic circuit shall be interleaved. Necessary cooling ducts shall be provided for heat dissipation from the core so that the anticipated maximum hot spot temperature in the core shall not be injurious to any material used in the core assembly.
- VI. The core clamping frame shall be provided with lifting eyes having ample strength to lift the complete core and winding assembly. The core assembly of oil immersed transformers shall be electrically connected to the transformer tank for effective core earthing.
- VII. The neutral terminal shall be brought out through neutral bushing from the tank and the same shall be brought up to the skid level, duly insulated by means of suitably rated epoxy insulators. The neutral conductor lead shall be of copper conductor designed to carry the maximum Earth Fault Current with solidly earthed neutral. The bidder shall justify the voltage/current rating of the neutral bushing chosen during detailed engineering. The voltage rating of the neutral bushing shall be chosen considering the probable voltage rise for neutral floating conditions. The current rating shall be chosen considering solidly earthed neutral. The neutral shall be formed at the bottom of the winding and brought to LVN bushing through a separate path.
- VIII. Top sampling valve shall be internally/externally piped and brought out of the tank sideways at skid level.
- IX. Transformer with all accessories shall be of free-standing type. Transformer accessories shall be designed in such a way that no supporting posts/structures are necessary other than the rail.
- X. The sets of radiator banks shall be connected to the main tank through a header pipe welded to the tank. Design wherein individual radiator is connected to main tank is not acceptable. Individual radiator tubes shall be connected to main tank thru butterfly valves at both ends of radiator tubes. Arrangement shall be made for suitable gap between main tank and radiator tubes.
- XI. Transformer conservator shall have Silica gel breather.
- XII. The oil level shall be higher than HV bushing terminal.
- XIII. The part of the HV bushing terminal to which overhead conductor is connected should not be involved either in the oil sealing arrangement or air release arrangement. This is to be specifically confirmed by the bidder at the time of offer.
- XIV. Two separate parts shall perform the two functions of receiving the jumper and oil sealing.
- XV. Air seals are not acceptable at HV bushing terminals.
- XVI. The oil shall be supplied in non-returnable drums. The quantity shall be of 10% excess over the requirement of transformer at 30°C.
- XVII. Magnetic oil level indicator shall comprise with 2 nos. mercury contact/switch (for High / Low oil level alarm).
- XVIII. Breather shall be used for main tank and Silica gel/ Silica gel beads breather with clear sight glass & oil sealing arrangement shall be used for OLTC purpose.

- XIX. The transformer shall be suitable for operation at full rated power on all tap positions without exceeding the applicable temperature rise. The transformer shall be designed to suppress harmonic content, especially the third and fifth, so as to eliminate distortion in the waveform and consequent additional insulation stress, noise on communication system and undesirable circulating currents between the neutrals at different transformer stations.
- XX. The design of each transformer shall be such that the risk of accidental short-circuits due to birds or vermin are obviated.
- XXI. All outdoor apparatus, including bushing insulators and fittings shall be so designed that they do not collect water at any point.
- XXII. All electrical connections and contacts shall be of ample cross sections for carrying the rated current without excessive heating. **All such contacts shall be tinned copper to avoid bi-metallic affect.**
- XXIII. Each transformer shall be designed for minimum no-load and load losses within the economic limit and as per the Indian Standards.
- XXIV. Ground terminals shall also be provided on marshalling box, OLTC local control panel and cable end box to ensure effective earthing.
- XXV. For continuity of earth connection, all gasket joints shall be provided with minimum two numbers tinned copper strip jumpers of adequate size.
- XXVI. Rain Guard shall be provided for LV compartment, Bucholz Relay, OSR, PRV, SPR, and Marshalling Box so that rain water can enter to the junction box of these relays/ cubicles. Wiring shall be bottom entry.
- XXVII. At the time of erection and commissioning, authorized person of the bidder shall be present at the site till completion of the work.
- XXVIII. Cable trays of appropriate size to be provided at necessary locations.

**5.2 CORE:**

- I. The core shall be of high grade cold rolled, non-ageing, grain oriented, annealed silicon steel lamination (CRGO), having low loss & good grain properties, coated with hot oil proof insulation, bolted together to the frames firmly to prevent vibration or noise.
- II. The grade of core shall be M3 or better. The core shall be stress relived by annealing under inert atmosphere if required, especially suitable for transformer.
- III. All core clamping bolts (If any) shall be effectively insulated. Only one grade and one thickness of core shall be accepted and no mixing of different grades shall be allowed.
- IV. The complete design of the core must ensure permanency of the core losses with continuous working of the transformers.
- V. The value of the maximum flux density allowed in the design & grade of laminations used shall be clearly stated in the offer.
- VI. The successful bidder is required to submit the following documents with regard to the procurement of core material:
  - a) Invoice of supplier
  - b) Mill's test certificate
  - c) Packing list
  - d) Bill of landing
  - e) Bill of entry certificate by custom
  - f) Description of material, electrical analysis, physical inspection certificate for surface defects, thickness and width of the material
  - g) Subjecting to at least 10% of the transformer to routine tests and no load and load loss measurement
- VII. TPCODL/TPNODL/TPSODL/TPWODL shall impose heavy penalty or black list bidders using seconds/ defective CRGO sheets or load losses found to be more than stipulated limit.
- VIII. After being sheared the laminations shall be treated to remove all burrs. Both sides of steel laminations shall be so constructed that eddy currents will be minimum.
- IX. The core frame shall be provided with lugs suitable for lifting the complete core and coil assembly of the transformer.

- X. The core and the coil shall be so fixed in the tank that shifting will not occur when the transformer is moved or during a short circuit.
- XI. All steel sections used for supporting the core shall be thoroughly sand blasted after cutting, drilling and welding. Each core lamination shall be insulated with a material that will not deteriorate due to pressure and hot oil.
- XII. The supporting frame work of the core shall be so designed as to avoid presence of pockets which would prevent complete emptying of tank through drain valve or cause trapping of air during oil filling. Adequate lifting lugs shall be provided to enable the core and windings to be lifted.
- XIII. Core Grounding:
  - a) The grounding lead from the core shall be brought out of the tank through a 11kV class bushing and grounded externally.
  - b) A protective cover shall be provided for the bushing.
  - c) The core grounding rod (stem) through the bushing shall be solid rod (stem).
  - d) The design of core grounding arrangement shall be such that the grounding links shall not come out of core during installation as well service conditions.
  - e) The supplier shall submit a drawing clearly showing the details of core grounding.
  - f) The core / frame grounding's both connections shall be brought out through a suitable bushing for provision of external grounding.

### 5.3 WINDINGS:

- I. The windings shall be so designed that all coil assemblies of identical voltage ratings shall be interchangeable, and field repairs to the windings can be made readily, without special equipment.
- II. The coils shall be supported between adjacent sections by insulating spacers, and the barriers bracings and other insulation used in the assembly of the windings shall be arranged to ensure a free circulation of the oil and to reduce hot spots in the windings.
- III. Coils should be transposed to minimize magnetic forces and extra supports shall provide for inter-disc connection.
- IV. All materials used in the insulation and assembly of the winding shall be new, insoluble, non-catalytic and chemically inactive in the hot transformer oil and shall not soften or otherwise be adversely affected under the operating conditions.
- V. The current density of coil shall not exceed 2.4 Amps/ sq mm at min tap of respective PTR's higher rating.
- VI. All threaded connections shall be provided with locking facilities. All leads from the winding to the terminal board and bushings shall be rigidly supported to prevent injury from vibration. Guide tubes shall be used where practicable.
- VII. The winding shall be brought out through bushing and provided with suitable terminal connectors, the details of which will be forwarded later.
- VIII. The windings shall be clamped securely in place so that they will not be displaced or deformed during short circuits. The assembled core and windings shall be vacuum-dried and suitably impregnated before removal from the treating tank. The copper conductors used in the coil structure shall be best suited to the requirements and all permanent current carrying joints in the windings and the leads shall be brazed.
- IX. Sharp bends should be avoided in the windings as far as possible, where unavoidable such bends should be reinforced with extra insulation tapes.
  - X. The tolerance for the winding resistance measurement for different phases but at same taps shall be limited to 1%.
  - XI. The change in impedance values between the winding (HV/LV) shall not exceed  $\pm 10\%$  of nominal impedance value as specified at all taps on HV/LV side.
  - XII. The windings shall be brought out through bushing. The windings shall be designed to withstand the specified thermal and dynamic short-circuit stresses.
  - XIII. The end turns of the high voltage windings shall have reinforced insulation to take care of the voltage surges likely to occur during switching or any other abnormal condition.



- XIV. Winding shall be suitable for connection of reactors or capacitors which would be subjected to frequent switching. All the windings shall be capable of withstanding stresses that may be caused by such switching.
- XV. Primary and secondary windings shall be constructed from high- conductivity (copper conductors), Double Paper Covered (DPC) copper conductor.
- XVI. The insulation between core and bolts and core and clamps shall withstand 2.5 kV for one minute.
- XVII. Proper bonding of inter layer insulation with the conductor shall be ensured. Test for bonding strength shall be conducted as per standards.
- XVIII. All turns of windings shall be adequately supported (by which material) to prevent movement. The core/coil assembly shall be securely held in position to avoid any movement under short circuit conditions.
- XIX. The joints in the winding shall be avoided but if it is necessary then, these shall be properly brazed and the resistance of the joints shall be less than that of parent conductor. Crimping is not allowed at any joints.

**5.4 INSULATING PAPER AND INSULATING PRESS BOARD :**

- I. The bidder shall submit characteristics along with make for all the type of insulation papers and Pressboards to be used with the offer.
- II. Inter layer insulation both for HV and LV windings shall be DPC and compressed pressboard of reputed make (subject to approval of TPCODL/TPNODL/TPSODL/TPWODL).
- III. For Winding insulation, only Double Paper Covered insulation is acceptable with laying in opposite direction to each other and each paper must have overlapping more than 25% of its width.
- IV. Kraft paper and Pressboard should be made of pure Cellulose from soft wood pulp manufactured from sulphate process. No additive, adhesive or coloring matter shall be present.
- V. Kraft paper and Pressboard should be of class A (105°C) insulation material.
- VI. All spacers, axial wedges / runners used in windings shall be made of pre-compressed solid pressboard.
- VII. All axial wedges/runners shall be properly milled to dovetail shape so that they pass through the designed spacers freely.
- VIII. Insulation shearing, milling and punching operations shall be carried out in such a way, that there should not be any burr, sharp edges and dimensional variations.
- IX. Kraft paper self-adhesive tape to be used for bonding of insulating paper layer, spanner and paperboards that are immersed in the oil filled transformer.

Below required values could be verified if required at any stage of the inspection and it should fulfill the requirement as per below table

<b>Characteristics</b>	<b>Kraft Paper</b>	<b>Pressboard (all Sizes)</b>
1. Dimension	As specified by bidder with $\pm 5\%$ tolerance.	As specified by bidder with tolerance as per IS1576.

2. Apparent Density	>0.80 g/cm <sup>3</sup>	as per IS1576 w.r.t Thickness
3. pH of Aqueous extract	6-8%	6-8%
4. Electrical strength		
i) in air	7KV/mm	12KV/mm
ii) In Oil	-----	35KV/mm
5. Ash content	Maximum 1%	Maximum 0.7
6. Moisture content	Maximum 8%	Maximum 8%
7. Oil absorption	-----	Minimum 9%

Bidder has to submit the test certificates as per IS-9335, IS-1576 for all type of insulating materials covering above stated parameters along with below parameters during stage inspection:

1. Substance (Grammage) (g/m<sup>3</sup>)
2. Compressibility
3. Tensile strength
4. Conductivity of water extract
5. Shrinkage in air
6. Flexibility
7. Cohesion between plies<sup>1</sup>.
8. Elongation
9. Air permeability
10. Tear index
11. Heat stability

### 5.5 TRANSFORMER TANK :

- I. The transformer tank and cover shall be fabricated from good commercial grade low carbon steel suitable for welding and shall be of adequate thickness.
- II. The tank shall be welded construction & top cover shall be flanged type..All seams shall be welded and where practicable they shall be double welded.
- III. The main tank body of the transformer, excluding tap changing compartments and radiators, shall be capable of withstanding pressure of 760mm of Hg.
- IV. The tank material shall be as per IS: 2026 or equivalent with ultrasonic testing done for elimination of defects in rolled plates.
- V. The welding shall be as per prior approved WPS (Welding Procedure Specs) by trained and tested welders. Calculations and documents should be submitted bidders.
- VI. The welding plan shall be shown in general i.e. Category-wise or for each type of weld in the mechanical fabrication drawing, which shall be submitted to TPCODL/TPNODL/TPSODL/TPWODL
- VII. All fittings like elbows, bends etc. shall be seamless as per applicable American or Indian Standards.
- VIII. No resistance welding of fasteners shall be done anywhere on the transformer.
- IX. To ensure oil tightness, recessed neoprene or equivalent gaskets shall be used.
- X. Manholes with welded flange and bolted covers shall be provided on the tank.
- XI. The manhole shall be of sufficient size to afford easy access to the lower ends of all the bushings, OLTC terminals etc. to permit replacement of auxiliaries without removing tank covers.
- XII. Suitable guides shall be provided for positioning the various parts during assembly or dismantling.

- XIII. Adequate space shall be provided between the cores and windings and the bottom of the tank for collection of any sediment.
- XIV. All joints including bolted as well as flanged, shall have machined matching surfaces/inner edges with smooth finish, to ensure leak proof joints.
- XV. Lifting eyes or lugs shall be provided on all parts of the transformer requiring independent handling during assembly or dismantling. In addition, the transformer tank shall be provided with lifting lugs and bosses properly secured to the sides of the tank, for lifting the transformer either by crane or by jacks.
- XVI. The design of the tank, the lifting lugs and bosses shall be such that the complete transformer assembly filled with oil can be lifted with the use of these lugs without any damage or distortions.
- XVII. The tank shall be provided with two nos. of suitable copper alloy lugs for the purpose of grounding.
- XVIII. The grounding pads should be mirror finished. Two grounding pads, located on opposite sides of the tank shall be provided with two tapped holes for connecting it with station ground mat. Necessary hardware like M10 GS bolts and spring washers shall also be provided for connections. All outer nuts & bolts should be stainless steel type.
- XIX. Each tank shall be equipped with the following valves with standard flange connection for external piping,
  - a) One drain valve located on the low voltage side of the transformer and placed to completely drain the tank. At the option of the TPCODL/TPNODL/TPSODL/TPWODL's a large valve may be furnished with an eccentric reducer. This valve shall be equipped with a small sampling cock.
  - b) One filter valve located at the top of the tank on the high-voltage side. The opening of this valve shall be baffled to prevent aeration of the oil.
  - c) One filter valve, located slightly above the bottom of the tank.
  - d) One relief valve to operate at a pressure below the test pressure for the tank.
  - e) Other two nos. valves shall also be provided, as required for proper functioning of the transformer.
  - f) A suitable locking arrangement shall be provided for locking these valves in close/open position.
- XX. All valves should be provided with clear open/close position indications. Wherever rising spindle type valves are provided the valves should be clockwise rotating for closing operations. Any valve opening should not create hindrance to other operation.
- XXI. For the auxiliary lead wiring from individual instrument to marshalling box, the cables shall be provided in the conduits.
- XXII. All the transformers shall be provided with a ladder having 'anti-climbing' device.
- XXIII. Transformer tank shall be of welded sheet steel construction and provided with gaskets steel cover plates.
- XXIV. Base shall be suitably reinforced to prevent any distortion during lifting. Base channels shall be provided with skids and pulling eyes to facilitate handling.
- XXV. All seams shall be electrically double welded for absolute oil tightness.
- XXVI. Suitable arrangement shall be made for mounting HV and LV lightning arrestors of the transformer.
- XXVII. Guards shall be provided for drain, bottom sampling and filter valves to prevent oil pilferage.
- XXVIII. Minimum Thickness for the transformer shall be as follows:
  - a) Tank Side wall :10mm
  - b) Tank Top Cover :12mm
  - c) Tank Bottom Plate :12mm
  - d) Conservator: 6mm

## 5.6 PAINTING

- I. Before painting, surface preparation shall be done by sand blasting and procedure for sand blasting has to be submitted by the Vendor along with the bid. The surface preparation for all external surface prior to painting or coating shall be witnessed by customer or shall be treated as customer hold points. After sand blasting at all edges Belzona E metal to be applied.
- II. Before shipment all steelwork not under oil shall be painted with a primary coat of anti-corrosive paint of durable nature and two coats of battleship grey paint (Shade 631 of IS: 5). Paint shall be

epoxy type. The interior surfaces shall be painted as per bidder's standard practice. All the paint including primer shall be applied after testing such as air test, hydraulic test etc. Bidder shall submit their procedure for painting for TPCODL/TPNODL/TPSODL/TPWODL's approval, along with the offer.

- III. Painting of Marshalling box: Two coats of red oxide primer & two coats of synthetic enameled paint after chemical treatment.
- IV. Metal parts not accessible for painting shall be made of corrosion resistant material.
- V. Paint shall be as per Indian Standard/International Standard for quality, surface preparation, application method, thickness check and any other test.
- VI. Additional paint shall be supplied along with the transformer for applying touch up paint at site during installation. The shade of the paint used shall be shade 631 as per IS: 5.

**5.7 SURFACE PREPARATION AND PAINTING**

- I. The paint shall be applied by airless spray.
- II. Steel surfaces shall be prepared by proper cleaning method (IS-9954) to grade Sq.2.5 of ISO 8501-1 or chemical cleaning including phosphating of the appropriate quality (IS 3618).
- III. Heat resistant (Hot oil proof) paint shall be used for the inside surface and whereas for external surface one coat of thermosetting powder paint or one coat of epoxy primer (zinc chromate) followed by two coats of polyurethane (P.U.) base paint. as per table given below:

S.No.	Paint type (should be UV restraint, non-fading)	Area to be painted	No of coats	Total dry film thickness (min); micron
1	<b>Thermosetting powder paint</b>	Inside Outside	01 01	30 60
2	<b>Liquid Paint</b>			
a.	Epoxy (primer)	Outside	1	45
b.	P.U. Paint (finish paint)	Outside	2	35 (each)
c.	Hot oil resistant paint	Inside	1	35

The two coats shall be of oil and weather-resistant nature with final coat as flossy and non-fading paint of shade 631 as per IS 5 or RAL 7032.

- IV. The dry film thickness shall not exceed the specified minimum dry film thickness by more than 25%.
- V. Any damaged part shall be cleaned to bare metal with an area extending 25 mm around its boundary. A priming coat shall be immediately applied followed by full paint finish equal to that originally applied and extending 50 mm around the perimeter of the original damage. The repainted surface shall present a smooth surface which shall be obtained by carefully chamfering the paint edges before and after priming.
- VI. Painting shall not affect by weather changes & performance against pilling out or fading etc. to be guaranteed for 5 Years.

**5.8 BUSHINGS:**

- I. Bushings provided by the bidder shall be as per IS2099-1986. The bushings shall have high factors of safety against leakage to ground and shall be so located as to provide adequate electrical clearance between bushings and grounded parts. Bushings of identical voltage rating shall be interchangeable. All bushings shall be equipped with suitable terminals of approved type and size and all external current carrying contact surfaces shall be plated, adequately. The insulation class of the high voltage neutral bushing shall be properly co-ordinate with the insulation class of the neutral of the high voltage winding.

- II. All main winding leads shall be brought out through outdoor type bushings as specified which shall be so located that the full flashover strength will be utilized and the adequate phase clearance shall be realized.
- III. Each bushing shall be so coordinated with the transformer insulation that all flash-over will occur outside the tank.
- IV. All porcelain used in bushings shall be of the wet process, homogeneous and free from cavities or other flaws. The insulation (porcelain) shall be without any joint. The glazing shall be uniform in colour and free from blisters, burns and other defects. Stresses due to expansion and contraction in any part of the bushing shall not lead to deterioration.
- V. In case of oil communicating type bushing (33kV & 11kV), venting screw of the hollow stud, shall be provided with Teflon gaskets, to avoid oil leakage problem through the same. Angle of inclination to vertical for any bushing shall not exceed 30 deg. All bushings shall have puncture strength greater than the dry flash-over value.
- VI. Main terminals shall be solder less terminals, and shall be of the type and size specified in the drawings. The spacing between the bushings must be adequate to prevent flashover between phases under all conditions of operation.
- VII. The Bidder shall give the guaranteed withstand voltages for the above and also furnish a calibration curve with different settings of the co-ordination gap, to the TPCODL/TPNODL/TPSODL/TPWODL to decide the actual gap setting. Bidder's recommendations are also invited in this respect.
- VIII. The following routine tests shall be carried out on all bushings in the presence of TPCODL/TPNODL/TPSODL/TPWODL's representative, in addition to any other specified in the IS:
  - a) Visual examination
  - b) One minute dry withstand test
  - c) Oil tightness test

- IX. The bushings shall have a link type isolating facility for tap for maintenance tests viz. power factor measurement etc. (Terminal shall be provided for the measurement of power factor and tan delta).
- X. Bushing shall be as per the approved make only. All Type test report should be submitted along with bid.

**XI. Termination Arrangement on 11KV and 33KV Side :**

**Option 1: (33KV Indoor AIS/GIS and 11KV indoor AIS )**

- a. For 33 KV side cable termination, Palm Connector & Extended Busbar of suitable size (60mm X 10mm) for termination of 1 runs of 3C x 400 sqmm. Proper supporting arrangement for extended bus bar and cables shall be provided.  
For 11 KV side cable termination, Palm Connector & Extended Busbar of suitable size (60mm X 10mm) for termination of 2 runs of 1C x 630 sqmm. . Proper supporting arrangement for extended bus bar and cables shall be provided.
- b. Copper bus bar for connecting transformer bushings to cables with support insulators and insulation sleeve
- c. Frame for cable mounting with HDPE cleats.
- d. Detailed size of all the item shall be submitted during detailed engineering for approval.
- e. Suitable Bimetallic Connector to be supplied wherever applicable

**Option 2 : (33KV Outdoor Switchyard and 11KV indoor AIS )**

- a. On 33KV side, suitable provision to connect Zebra/Panther/Dog/Coyote Conductor.

- b. For 11 KV side cable termination, Palm Connector & Extended Busbar of suitable size (60mm X 10mm) for termination of 2 runs of 1C x 630 sqmm. . Proper supporting arrangement for extended bus bar and cables shall be provided
- c. Frame for cable mounting with HDPE cleats.
- d. Detailed size of all the item shall be submitted during detailed engineering for approval.
- e. Suitable Bimetallic Connector to be supplied wherever applicable

## 5.9 RADIATORS

- I. The radiators shall be epoxy painted the entire surface including edges should be cleaned property before painting to avoid peeling of paint at the edges.
- II. Radiators shall be epoxy painted.
- III. Bidder shall submit procedure for surface preparation and painting of radiators along with the bid.
- IV. The color shade for the radiator shall be shade 631 as per IS: 5.
- V. Tank mounted radiators shall be of the detachable type with bolted and gasketted flanged connections. Proper continuous earthing (may be through Transformer body) should be ensured.
- VI. The following accessories shall be provided for radiator:
  - a. Shut off valves and blanking plates on transformer tank at each point of
  - b. Top and bottom shut off valves and blanking plates on each radiator.
  - c. Lifting Lugs
  - d. Top Oil filling Plugs
  - e. Air release plug on top
  - f. Oil Drain Plug at Bottom.
  - g. Top Oil Filling Pump.

All radiators shall be tested for.

- a. Vacuum test for one hour
- b. Hydraulic pressure test using transformer oil for one and half hour (as per ASME)
- c. Air test can be done in place of hydraulic pressure test provided.
- d. Water tank will be made available for submerging the radiators into water for leak detection.
- e. All the tests shall be done in black condition (i.e. before applying any paint).
- VII. The transformer design shall be such that the radiators and conservator can be mounted on either side of the tank connection

## 5.10 INTERNAL & EXTERNAL EARTHING

- I. Provision of complete earthing of transformer and associates should be ensure by bidders. Earthing of Main tank, OLTC Conservator, Radiator, NIDS and other shall be ensured through 50X6mm GI flat with double hole provision wherever applicable with minimum 80-100mm length.
- II. Provision of continuity of earthing shall also ensure for gasket arrangement, doors and all other extended/open able arrangements with flexible copper wire of adequate size.
- III. Equipotential strips need to be provided on flange joint ( above Butterfly Valve) of radiators, flange joint of conservator tank, two places diagonally at top cover flange joint, flange joint of OLTC

## 5.11 OIL:

- I. Oil for first filling, together with 10% extra shall be supplied with each transformer. The oil shall comply in all respects with the provisions of IS 335 & IEC No.60296 latest amendment. Particular attention shall be paid to deliver the oil free from moisture having uniform quality throughout in non-returnable steel drums.

- II. The oil shall be of EHV grade and shall have the following main characteristics or equivalent (the requirements indicated are determined in accordance with the test methods as per IS: 335). The oil in the transformer shall be filled up to 'Transport filled level' before dispatch of the transformer.
- III. The maker of the oil shall be as per approved list and should comply below mentioned technical requirements:

Sl.no.	Characteristics	Requirement as per IS 335	Method of Test
1	Appearance	The oil shall be clear and transparent and free from suspended matter or sediment temperature.	A sample of Oil shall be examined in 100mm thick layer at 27deg C
2	Density at 29.5° C (max)	0.89 g/cm3	IS 1448 (P:16):1990
3	Kinematic Viscosity @ 27° C. (Max.)	270C	IS 1448 (P:25):1976
4	Interfacial tension Min.	0.04 N/m	IS:6104:1971
5	Flash Point (Closed CUP)	140° C	IS 1448 [P:21]:1992
6	Pour Point (max)	-6° C	IS 1448 [P:10]:1970
7	Neutralization Value (total acidity) max.	0.03 mg/KOH/g	IS 1448 [P:2]:1967
8	Corrosive sulphur (In terms of classification of copper strip)	Non Corrosive	IS 1448 (Part-I)/Annex B of IS:335
9	Electric Strength (Breakdown voltage)	The sampling shall be done in accordance with the procedure laid down in IS 6855: 1973.	IS 6792 : 1992
	i) New untreated oil	30 kV (rms)	
	If the above value is not attained, the oil shall be filtered		
	ii) After Filtration Min	70 kV (r.ms.)	
10	Dielectric Dissipation Factor (tan-delta) at 90°C, max.	0.002	IS:6262-1971
11	Specific resistance (resistivity) ohm/cm/min		IS:6103-1971
	a)At 90° C, Min	35 X 10 <sup>12</sup> ohm-cm	
	b)At 27° C, Min	1500 X 10 <sup>12</sup> ohm-cm	
12	Water content, max. per million	30 (avg. 20 ppm)	Karl Fischer Method
13	Oxidation Stability		
	(i) Neutralization value after oxidation Max.	0.40 mg. KOH/g	Appendix C of IS:335

	(ii) Total sludge, after oxidation, max.	0.1 percent by weight	
14	Tan delta at 90° C after ageing test (max)	0.2	IS 6262:1971
15	Saponification Value	Max. 1.0 mg. KOH/g	Appendix E IS-335
16	Presence of oxidation inhibitor	The oil shall contain anti-oxidant additives.	IS 13631 : 1992

**Ester Oil (If applicable):**

In case of Natural Ester oil or Synthetic Ester Oil below are the requirements to be fulfilled: All transformers shall be filled to the required level with new, unused, clean, Natural or Synthetic Ester oil as per TPCODL/TPNODL/TPSODL/TPWODL approval. The use of recycled ester oil is not acceptable. Ester shall be filtered and tested for break down Voltage (BDV) and moisture content before filling. Ester shall be filled under vacuum. The Dielectric strength and water content shall meet the requirement given in TPCODL/TPNODL/TPSODL/TPWODL Specification ENG-GEN-4004. Ester oil shall be procured from approved vendor of TPCODL/TPNODL/TPSODL/TPWODL only.

Bidder has to provide the oil data in below table:

SNo.	Description	Unit	As furnished by bidder
1	Type of oil		
2	Oil Qty. for first filling	Ltr.	
3	Grade of Oil		
4	Maker's name		
5	BDV at the time of first filling	kV	

**5.12 GASKET**

- I. All bolted connection to the tank shall be fitted with suitable oil-tight gaskets which shall give satisfactory service under the operating conditions. Gaskets shall be of NRBC.
- II. Special attention shall be given to the methods of making the oil-tight joints between the tank and the cover as also between the cover and the bushings and all other outlets to ensure that the joints can be remade satisfactorily and with ease, with the help of semi-skilled labor.
- III. Where compressible gaskets are used, steps shall be provided to prevent over compression.
- IV. All the bolts provided shall be of hot dip galvanized.
- V. All bolts shall be provided with one spring washer and two numbers of flat washers and with locking bolts.
- VI. All gasket joints shall be provided with equalizing links to extend earth connections.
- VII. All Gasket should be fixed such a way that there should not be any damage during operation.
- VIII. Sheet Type Gasket of suitable Width to be used in Flanged Joint.  
O-Ring Type Gaskets not to be used on Flanged joints. (Radiators/Valves etc)

**5.13 OIL PRESERVING EQUIPMENT**



- I. Oil preserving equipment shall be conservator (expansion tank) type. The conservator shall have two filter valves, one at the bottom at one end, the other at the top, opposite end, in addition to the valve specified in the Accessories for the main tank. The conservator or expansion tank shall also have a shutoff valve and a small drain valve and sampling cock, the latter so arranged as not to interfere with oil lines. The oil level gauges (prismatic and magnetic) shall be mounted on the conservator or expansion tank. The top of the conservator shall have contact with atmosphere through two silica gel / Envirogel breathers to facilitate replacement of breather without having to keep Buchholz relay inoperative. The breathers shall have clear transparent, UV stabilized /retardant Polycarbonate with min. 3 mm thickness.
- II. Conservator oil preservation bag (atmosial bag) shall be provided with a design such that it can be installed at site with ease without any special tools and tackles. The price for COPS bag shall be clearly mentioned in the price schedule at the specified place. With COPS type conservator shall supply air or nitrogen filing arrangement with all accessories needed at the time of commission and pressure gauge arrangement shall be provided for monitoring COPS bag pressure.
- III. Proper valve arrangement (Two top valve & one bottom valve on conservator) is to be provided for proper oil filling.
- IV. Prismatic oil level indicators with red colour float shall be provided on main tank and OLTC tank Conservator. Dual contacts are required for both MOGs (Main Tank & OLTC conservator).
- V. Separate conservator tank shall be provided for OLTC.

**5.14 OLTC CONSERVATOR TANK**

- I. Tank with air release valve on top.
- II. Prismatic Oil level indicator with red color float.
- III. Magnetic Oil Level Indicator (MOG), round in shape having a diameter of 100 mm.
- IV. Bend assembly with flange - This includes two pipes, one connecting tank with OSR and another connecting OSR with OLTC along with two shut off valves. The diameter of this pipe shall be suitably sized for tanks, The complete assembly formed after attaching both the pipes to OSR and connecting with the tank should be at an angle of 5 degrees with respect to the horizontal. Also, the pipe should be off set from the tank at an angle of 32 degrees in the horizontal plane.
- V. Silica gel/Silica gel beads breather along with the explosion vent assembly
- VI. Mounting structure with eight nut bolts (S/S) for attachment
- VII. Tank shall be fabricated from good commercial grade low carbon steel.
- VIII. All joints, bolted or flanged, shall have machined matching surfaces/inner edges with smooth finish, to ensure leak proof joints.
- IX. All joints, bolted or flanged, shall have machined matching surfaces/inner edges with smooth finish, to ensure leak proof joints.
- X. The inside surface of the tank shall be painted with one coat of hot oil resistant varnish with two coats of red oxide zinc chromate primer conforming to IS:2074 followed by two coats of fully glossy finishing paint conforming to IS:2932 and yellow in color.
- XI. The outside surface shall be painted with two coats of red oxide zinc chromate primer conforming to IS: 2074 followed by two coats of fully glossy finishing paint conforming to IS: 2932 of shade 631 of IS 5.
- XII. Two Lifting lugs should be provided.

S.No	Description	12.5/16 MVA
1	Diameter	To be furnished by the bidder
2	Length of tank	To be furnished by the bidder

3	Thickness of sheet	To be furnished by the bidder
4	Weight	To be furnished by the bidder
5	Air release valve on top	Required
6	Prismatic oil level indicator with red color float	Required
7	MOG	Required
8	Bend assembly with two shut off valves	Required
9	Silica gel/Envirogel breather with explosion vent assembly	Required
10	Mounting structure	Required
11	Eight nut bolts (S/S) with mounting structure	Required
12	Inside surface finishing	The transformer shall withstand the short circuit at its terminals for the specified fault levels for minimum duration of 3 seconds.
13	Outside surface finishing	As the Transformers will be installed in areas prone to earthquakes, they shall be designed to withstand seismic forces equivalent to 0.3 g acceleration. Necessary devices for clamping the wheels to the rails shall also be provided along with any other suitable anti earthquake clamping arrangement.
14	Color of tank's external paint	631 acc. to IS 5
15	Lifting hooks	Required

### 5.15 ON LOAD TAP CHANGER

- I. OLTC shall have the entire feature to meet the requirement. The equipment shall conform to the latest applicable Indian standard / IEC standard. Equipment complying with any other authoritative standards such as British, VDE etc. shall also be considered if offered.
- II. The OLTC gear shall be designed to complete successfully tap changes for the maximum current to which transformer can be loaded i.e. 120% of the rated current. Devices shall be incorporated to prevent tap change when the through current is in excess of the safe current that the tap changer can handle. The OLTC gear shall withstand through fault currents without injury.
- III. When a tap change has been commenced it shall be completed independently of the operation of the control relays and switches. Necessary safeguards shall be provided to allow for failure of auxiliary power supply or any other contingency which may result in the tap changer movement not being completed once it is commenced.

- IV. OLTC shall be a separate compartment & should be external to transformer tank. Oil in compartments which contain the making and breaking contacts of the OLTC shall not mix with oil in other compartments of the OLTC or with transformer oil. Gases released from these compartments shall be conveyed by a pipe to a separate oil conservator or to a segregated compartment within the main transformer conservator. A OSR with shut off valves and MOG shall be installed between OLTC and conservator tank. The OLTC conservator shall be provided with prismatic oil level gauges with red color float. The length and alignment of the MOG and OSR pipe shall be such that, the transformer does not trip by the vibration of the pipe.
- V. Oil in compartments of OLTC which do not contain the make and break contacts, shall be maintained under conservator head through valve pipe connections. Any gas leaving these compartments shall pass through the OSR relay before entering the conservator. The cable entry of OSR should be from bottom end instead from side
- VI. Oil filled compartments shall be provided with filling plug, drain valve with plug, air release vent, oil sampling device, inspection opening with gasket and bolted cover with lifting handles.
- VII. The OLTC motor shall be provided with 415 V auto changeover facilities. Tap position indication along with the various alarms of tap changer shall be indicated in the marshaling box.
- VIII. Separate OLTC tank should be provided at a height lower than that of the main conservator tank so that the same is easily accessible for maintenance.
- IX. OLTC driving mechanism and its associated control equipment shall be mounted in an outdoor, weather proof cabinet, which shall include:
- a) Driving motor (415 V - 3 phase, 50 Hz, AC squirrel cage)
  - b) Motor starting contactor with thermal overload relays, isolating switch and HRC fuses.
  - c) Duplicate sources of power supply with automatic changeover from the running source to the standby source and vice versa.
  - d) End Limit Switch shall be provided to prevent operation beyond extreme taps & Contacts shall be provided for operation through SCADA.
  - e) Limit switch to cut off electrical operation on insertion of manual handle (Contacts shall be provided for operation through SCADA).
  - f) Local/Remote selector switches shall be provided with status indication.
  - g) Control switch: Raise/off/lower (spring return to normal type). (Contacts shall be provided for operation through SCADA).
  - h) Remote/local selector switch (maintained contact type). (Contacts shall be provided for operation through SCADA).
  - i) Mechanical tap position indicator showing rated tap voltage against each position and resettable maximum and minimum indicators.
  - j) Limit switches to prevent motor over travel in either direction & final mechanical stops.
  - k) Brake or clutches to permit only one tap change at a time on manual operation.
  - l) Emergency manual operating device (hand crank or hand wheel).
  - m) Electrically interlocked reversing contactors (preferably also mechanically interlocked).
  - n) 240V, 50 HZ, AC space heaters with switch and MCB.
  - o) Interior lighting fixture with lamp door switch and MCB.
  - p) Gasketed and hinged door with locking arrangement.
  - q) Terminal blocks, internal wiring, earthing terminals and cable glands for power and control cables.

- r) Necessary relays, contactors, current transformers etc.
- s) Thermal device or other means shall be provided to protect the motor and control circuit. All relays, switches, fuses etc. shall be mounted in local OLTC control cabinet and shall be clearly marked for the propose of identification.
- t) A five digit counter shall be fitted to the tap changing equipment to indicate the number of operation completed.
- u) The equipment shall be suitable for supervisory control and indication with make before break multi-way switch, having one potential free contact for each tap position. This switch shall be provided in addition to anyother switch/switches which may be required for remote tap position indication.'
- v) Operation from the local or remote control switch shall cause one tap movement only until the control switch is returned to the off position between successive operations.
- w) OLTC shall be provided with PRV.
- x) Suitable manholes covers should be provided on the sidewalls to give access to the selector switches of the OLTC. There should be ample access for opening /Reconnecting tap-leads to the OLTC from all sides.
- y) Suitable valves shall be provided to take sample of oil from the OLTC chamber during operation of the transformer.
- X. The following electrical control features shall be provided:
  - a) Positive completion of load current transfer, once a tap change has been initiated, without stopping on anyintermediate position, even in case of failure of external power supply.
  - b) Only one tap change from each tap change impulse even if the control switches or push button is maintained in the operated position.
  - c) Cut-off of electrical control when manual control is resorted to. It shall not be possible to operate theelectric drive when the manual operating gear is in the use.
  - d) Cut-off of a counter impulse for a reverse tap change until the mechanism comes to rest and resets thecircuits for a fresh operation.
  - e) Cut-off of electrical control when it tends to operate the tap beyond its extreme position. Mechanical limit s witches shall be provided for this purpose to achieve suitable interlocking.

**XI. Automatic / Parallel Operation with OLTC**

OLTC shall be able to do automatic / parallel operations through Transformer Monitoring Unit (TMU).

**XII. ALARMS:**

The following alarms shall be provided with the additional contact arrangement for connection to SCADA.

- a) End Limit Switch
- b) Manual Operation Insertion
- c) A.C. supply failure
- d) Drive motor autotripped
- e) Tap Stuck up change delayed
- f) OSR trip
- g) MOG Alarms
- h) PRV Trip

- i) TC in Progress.
  - j) Any other protective feature, if considered essential by the Bidder.
- XIII. Tap Changer Control panel or Transformer Monitoring Unit (TMU): This equipment is not required to be supplied by the bidder of the transformer.
- XIV. Auxiliary Power Supply of OLTC, and Power Circuit :
- a) Two auxiliary power supplies, 415 volt, three phase four wire shall be provided by the Purchaser for OLTC and power circuit.
  - b) All loads shall be fed by one of the two feeders through an electrically interlocked automatic transferswitch housed in the marshalling box for on load tap changer control .
  - c) Design features of the transfer switch shall include the following:
    - 1. Provision for the selection of one of the feeder as normal source and other as standby.
    - 2. Upon failure of the normal source, the load shall be automatically transferred after an adjustable timedelay to standby sources.
    - 3. Indication to be provided at marshalling box for failure of normal source and for transfer to standbysource and also for failure to transfer.
    - 4. Automatic re-transfer to normal source without any intentional time delay following re-energization ofthe normal source.
    - 5. Both the transfer and the re-transfers shall be dead transfers and AC feeders shall not be paralleledat any time.
- XV. **Manual Control:**  
The cranking device for manual operation of the OLTC gear shall be removable and suitable for operationby a man standing at ground level.  
The mechanism shall be complete with the following :
- a. Mechanical tap position indicator which shall be clearly visible from near the transformer.
  - b. A mechanical operation counter.
  - c. Mechanical stops to prevent over-cranking of the mechanism beyond the extreme tap positions.
  - d. The manual control considered as back up to the motor operated load tap changer control shall be interlocked with the motor to block motor start-up during manual operation. The manual operating mechanism shall be able to show the direction of operation for raising the HV terminal voltage and vice- versa.

**5.16 OIL SURGE RELAY**

**Oil Surge Relay** should be according to the following general technical parameters as mentioned in below table.

S. No.	Description	Unit	Requirements
1	Type of relay		Magnetic reed switch type OSR suitable for 25 mm nominal pipe bore with 1 set of potential free contact to be used for 24 to 48V
2	No. of Switching systems		1

3	Suitable for		OLTC
4	Nominal Pipe Bore	mm	25
5	Type of Flange		Square
6	Diameter of flange	mm	78 square
7	Diameter of bolt circle	mm	72
8	Number of the bolts		4
9	Size of the bolts		M10
10	Flange Thickness	mm	6 mm
11	Surge Test (TRIP )	cm/s	70 to 130
12	Velocity Test	cm/s	70 to 130
13	Relay operating range: OilTemperature		10°C to 100°C
14	Relay operating range: OilViscosity		66 to 75 centistokes at 10°C, 2 to 3.5 centistokes at 100°C
15	Element Test		With oil, at 1.75Kg/cm <sup>2</sup> for 15 minutes,
16	High Voltage Test		Shall be able to withstand 2000 V at 50 Hz for 1 minute
17	Insulation Resistance Test		Shall be Greater than 10 Mega ohms with 500 V megger

### 5.17 PRESSURE RELEASE VALVE

- I. Spring-loaded Pressure Relief Device (PRV) with mechanical flag indicator shall be provided on the main tank top of the transformer.
- II. Oil splashguard along with draining arrangement (with wire net on both side) up to ground level to be provided for prevention of oil splashing.
- III. Arrangement for air-release through a gate valve should be provided at the base of the PRV.
- IV. The PRV shall not be located in the vicinity of the Marshalling Box or OLTC Box for safety of operating personnel.
- V. A pair of potential free contacts shall be provided to trip the transformer on action of the pressure relief device.
- VI. It shall have the limit switch with 2NO and 2NC contacts, flag, switch operated rod etc.
- VII. PRV shall be tested for all the applicable test such as Leakage Test, Switch operation, break down test.

SNo	DESCRIPTION	UNIT	REQUIREMENT
1	Operating pressure		0.56 Kg/sq cm
2	Port opening diameter		150 mm
3	Operating time		Instantaneous

4	Contact rating		3A at 48 V DC magnetic blowout micro switch
5	Operating temperature		0 to 100 degree celcius
6	Valve resetting		Automatic
7	Switch		Limit switch DPDT
8	Accuracy class		+ - 1 %
9	Switch resetting		Manual
10	Number of switch		1 limit switch
11	Mechanical protection degree		IP67
12	Suitable for transformer rating	MV A	As per tender
13	Cable Entry		1" conduit
14	Packing		Supplier shall ensure that the equipment covered by this specification shall be prepared for rail/road transport (local equipment) and be packed in such a manner so as to protect the equipment from damage in transit.
15	Marking		The unit shall be appropriately marked as TPCODL/TPNODL/TPSODL/TPWODL and with the name of the vendor, Manufacturer type/ serial no. and year of manufacturing at suitable location.
16	Warranty		2 years from the date of purchase of Transformer. In case any defects are found, the vendor shall replace the product free of cost.
17	Test Reports		Test certificates to be provided : 1) Protection Class. 2) Cold & Dry Test 3) Vibration Test 4) Salt spray Test 5) Micro switch rating Test
18	Acceptance test		Following tests shall be carried out: 1)Physical Test- Dimensions 2)Switch operation test 3)Valve operation test 4)Leakage Test 5)Insulation Test

### 5.18 BUCHOLZ RELAY

**One double float gas detector relay (Buchholz relay)** with alarm and tripping contacts to detect accumulation of gas and sudden changes of oil pressure complete with shut off valves between Relay and Conservator Tank flange-couplings to permit easy removal without lowering oil level in the main tank, a bleed valve for gas venting and test valve. The installation shall be weather proof to avoid any water seepage inside the relay. The cable entry should be from bottom end of Buchholz relay instead from side. **Marking of Magnetic reed type switches shall be available on Buchholz Relay.**

Buchholz Relays should be according to the following general technical parameters as mentioned in below table.

S.No	Description	Unit	Requirements
1	Type of relay		Magnetic reed switch type Buchholz relays suitable for nominal pipe bore of 80 mm with 2 sets of potential free contacts suitable for 48V.
2	No. of Switching systems		2
3	Suitable for Transformer Rating	MVA	As per tender
4	Nominal Pipe Bore	mm	80
5	Type of Flange		Round
6	Diameter of flange	mm	185
7	Diameter of bolt circle	mm	145
8	Number of the bolts		4
9	Size of the bolts		M16
10	Flange Thickness	mm	16
11	Surge Test (TRIP )	cm/s	90 to 160
12	Gas Volume (ALARM)	cc	200 to 300
13	Velocity Test	cm/s	90 to 160
14	Relay operating range: Oil Temperature		10°C to 100°C
15	Relay operating range: Oil Viscosity		65 to 75 centistokes at 10°C, 2 to 3.5 centistokes at 100°C
16	Element Test		With oil, at 1.75Kg/cm <sup>2</sup> for 15 minutes,
17	High Voltage Test		Shall be able to withstand 2000 V at 50 Hz for 1 minute
18	Insulation Resistance Test		Shall be Greater than 10 Mega ohms with 500 V megger
19	Porosity Test		With oil, at 1.5 kg/cm <sup>2</sup> for 4 hours - There shall not be any leakage or mechanical damage
20	Mechanical Strength Test		With oil at 8 kg/cm <sup>2</sup> for 1 minute



21	Resistance of the Switch	Not to exceed 0.1 ohm across the electrodes of magnetic switch
22	Cable entry in terminal box	From bottom side

### 5.19 OTI

A dial-type indicating thermometer of robust pattern mounted on the side of the transformer at a convenient height to read the temperature in the hottest part of the oil and fitted with alarm and trip contacts and contacts for switching in and switching out the cooling system at predetermined temperatures.

### 5.20 WTI

In one winding of each phase as described below:

- I. It shall be indicating type, responsive to the combination of top oil temperature and winding current, calibrated to follow the hottest spot temperature of the transformer winding.
- II. The winding temperature detector shall operate a remote alarm in the event the hottest spot temperature approaches a dangerous level and in the case of ONAN (Oil Natural and Air Natural) Thus WTI shall have 4 independent NO contacts for alarm and trip and spare.

**Note:**

- I. **Equipment for remote winding and oil temperature Indicators** including these to be installed in the TPCODL/TPNODL/TPSODL/TPWODL control room shall be provided. Pocket with heater coil and CT for RTD for winding hot spots shall be provided.
- II. **For purpose of remote recording and data acquisition system**, Top oil temperature detector along with suitable transducer and other necessary devices to provide two sets of 4-20 mA signals with PT-100 type of sensors.
- III. Tap changer indicator of OLTC along with suitable transducer and other necessary devices to provide two sets of 4-20 mA signals along with one set of 1-16K resistance output shall be provided.
- IV. All digital outputs for remote annunciation/control/DAS shall be provided with two changeover (NO) contacts for alarm condition and two changeover (NO) contacts for trip condition. The OTI & WTI shall be provided with micro switches, instead of mercury switches for alarm and trip purpose. All the interconnected wiring between TJB, Marshalling box and OLTC etc. shall be done by the bidder and schematics drawings of the same shall be supplied.

### 5.21 VALVE

- I. Valves shall be of forged carbon steel upto 50mm size and of gun metal or of cast iron bodies with gunmetal fittings for sizes above 50mm. They shall be of full way type with screwed ends and shall be opened by turning counter clockwise when facing the hand wheel. There shall be no oil leakage when the valves are in closed position.
- II. Each valve shall be provided with an indicator to show the open and closed positions and shall be provided with facility for padlocking in either open or closed position. All screwed valves shall be furnished with pipe plugs for protection. Padlocks with duplicate keys shall be supplied along with the valves.
- III. All valves except screwed valves shall be provided with flanges having machined faced drilled to suit the applicable requirements, Oil tight blanking plates shall be provided for each connection for use when any radiator is detached and for all valves opening to atmosphere. If any special radiator valve tools are required the OEM shall supply the same.
- IV. Each transformer shall be provided with following valves on the tank:

- a) Drain valve so located as to completely drain the tank & to be provided with locking arrangement.
- b) Two filter valves on diagonally opposite corners of 50mm size & to be provided with locking arrangement.
- c) Oil sampling valves not less than 8mm at top and bottom of main tank & to be provided with locking arrangement.
- d) One 15mm air release plug.
- e) Valves between radiators and tank.
- f) Drain and filter valves shall be suitable for applying vacuum as specified in the specifications.

## 5.22 MOG:

One magnetic-type oil-level gauge each in Main Tank and OLTC Tank with low and high level alarm contacts for main tank MOG and low level alarm for OLTC tank MOG and a dial showing minimum, maximum and normal oil levels. The gauge shall be readable from the transformer base level. It should have cable disconnecting facility at top of MOG, to facilitate testing of MOG. Along with MOG, prismatic type oil level indicator (glass window) shall also be provided on conservator.

SNo	DESCRIPTION	UNIT	REQUIREMENTS
1	Mounting Pad Diameter	Mm	150
2	Electric Switch		Two no's Micro Switches / M switch
3	Contact Rating		5 Amps 240V AC, 0.25 Amp 48V
4	Switch Operation		Normally open, closes when oil drops to near empty condition. recovers automatically on rising level
5	Mounting of indicator		Vertical
6	Dial Marking		Maximum, Minimum, 1/4, 1/2 & 3/4
7	Movement of float arm		In the plane perpendicular to seating surface
8	Conservator Dia	Mm	900 mm
9	Air cell in conservator		Yes
10	Switches for		Low Oil level Alarm, High oil level Alarm
11	Color		Black marking with white background.
12	Readable from transformer base level		Yes
13	Cable disconnecting facility at top of MOG to facilitate testing of MOG		Yes
14	Mechanical Protection degree		IP55
15	Suitable for transformer rating	MVA	As per tender requirement
16	Packing		Supplier shall ensure that the equipment covered by this specification shall be prepared for rail/road transport (suitable equipment) and be packed in a manner so as to protect the equipment from damage in transit.



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17	Marking	The unit shall be appropriately marked with "TPCODL/TPNODL/TPSODL/TPWODL" and with the name of the Manufacturer type / serial no. and manufacturing at suitable location.
18	Warranty	2 years from the date of purchase of Transformer. In case any defect is found, the vendor shall replace the product free of cost.

**5.23 Marshalling Box**

- I. Marshalling Box suitable for distribution of 3 phase 4 wire, 415V power to various equipment shall be provided. Separate ground mounted marshalling box shall be provided for radiator banks, WTI, OTI, transducers, at least two (2) sets of 4-20mA converter cum indicator etc. and similarly tank mounted marshalling box shall be provided for HV/LV CT cable terminals. Two point earthing provision should be provided with 50X6mm GI flat with pad type connector, length should be of min. 80 mm. The marshalling box should include indication circuit with 48V DC supply. All cables and conduits between the transformer and control cabinet shall be included in the scope of supply by bidder. All the wiring shall have provision for connection to SCADA.
- II. Two sets of independent, potential free contacts shall be provided for various alarms/trips as detailed below. The auxiliary voltage for alarm/ trip circuit shall be 48V DC for 33/11kV Transformer).

DC system is required for

- a. Buchholz alarm
- b. OTI alarm
- c. WTI alarm (HV/LV based on WTI CT available)
- d. MOG (main) alarm
- e. MOG (OLTC) alarm
- f. Buchholz trip
- g. OTI trip
- h. WTI trip (HV/LV based on WTI CT available)
- i. OSR trip
- j. SPR trip
- k. PRV trip
- l. AC supply fail
- m. Motor Auto Trip

Two sets of spare potential free contacts shall be provided for all alarms for remote annunciation through TPCODL/TPNODL/TPSODL/TPWODL SCADA panels suitable Transducers shall be provided for 4-20mA signals for tap position indication to the TPCODL/TPNODL/TPSODL/TPWODL SCADA panel. The variation in output signals shall be linear for the complete tapping range.

In addition to above, following potential free contacts/signals shall be provided in the marshalling box, for its interfacing with TMU (Transformer Monitoring Unit) or other approved make by TPCODL/TPNODL/TPSODL/TPWODL.

SNo	Item	Provision
1	Supply of ON lamp 3 nos. R,Y,B	To be provided

2	Secondary of Control Transformer from the OLTC	Terminals shall be provided in Marshalling box
3	Tap Position Indicator	4-20 MA Signal in Marshalling box
4	Over Current Relay contact	Potential Free Contact in Marshalling box
5	Local remote Switch in OLTC	Potential Free Contact in Marshalling box
6	Raise Lower Switch	Potential Free Contact in Marshalling box
7	Hand interlocking Switch	Potential Free Contact in Marshalling box
8	Tap Change in progress	Potential Free Contact in Marshalling box
9	Odd even Switch	Potential Free Contact in Marshalling box
10	Maximum position reached	Potential Free Contact in Marshalling box
11	Minimum position reached	Potential Free Contact in Marshalling box
12	OTI	4-20mA Signal in Marshalling box
13	Annunciation - Oil level low & High (Main) - Oil level low (OLTC) - Winding Temp. High (HV+ LV) - Oil Temp High - B' relay Alarm - Winding temp trip (HV+LV) - Oil temp trip - B' relay trip - PRV trip for main & OLTC both - OSR trip - SPR trip	Potential Free Contact in Marshalling box
14	Auto manual selector switch	Potential Free Contact in Marshalling box
15	Supply ON lamp 3 nos. (R,Y,B)	To be provided
16	Secondary of Control Transformer from the OLTC	TBs shall be provided

- III. The Enclosure shall be weather proof, sheet steel construction, not less than 3 mm thick. Degree of protection shall be IP55 minimum with Canopy. It shall be provided with two hinged doors one at front and one at back with locking knobs facilities. The doors shall open through 1800. Doors shall have glass window for viewing of OTI & WTI from outside when door is closed. Doors and

glass windows shall have proper gaskets for vermin proof and dust tight arrangement. Proper extended rain shed shall be provided.

- IV. Accessories: All accessories shall be mounted properly in suitable channel inside the box. The MCBs shall be mounted on a DIN channel by a MS plate with cutout for MCBs knobs. This shall be covered by a hinged door on the front. Power cable wiring of MCBs to individual contactors shall be done through good quality copper cable of suitable rating with ferrule marking and suitable lugs at both ends. 2.5sqmm stranded copper cable with ring type lugs shall be used for control cabling purpose. All instrument and wiring shall be completely accessible.

SNo	Item	Make	Rating	Quantity
1	Main Incomer MCB 3 Pole	Siemens/ABB/L&T	63 A	02 Nos.
2	3 Pole MCB	Siemens/ABB/L&T	6 A	12 Nos.
3	3 Pole MCB	Siemens/ABB/L&T	10A	10 Nos.
4	3 Pole MCB	Siemens/ABB/L&T	16 A	10 Nos.
5	Connecter/Terminals	Wago or Phoenix, (Suitable for ting type lugs)	Suitable for 2.5 sq.mm. control cable	To accommodate all the wiring as mentioned below. Additional 10% terminals shall be provided as spare
6	Contactors, starter and relays	Siemens, L&T, English Electric		

- V. Following Tests shall be carried out on the Marshalling Box:
- Functional tests / 2kV withstand.
  - Dimensional checks.
  - Make and operation of contactors, relays.
  - Factory test report attached for bought out items.
  - Test for Enclosure Protection.

#### 5.24 Nitrogen Injection Drain & Stir System

- Fire prevention and extinguishing system shall work on the oil drain, nitrogen injection and stir method. The system shall operate during internal fault in transformer or external fire on transformer, which includes fire due to bursting of transformer bushing and Fire in OLTC tank.
- Fire detector provided on the transformer shall take minimum time for detection of fire and initiate the fire protection system on receipt of other required signals.
- System shall operate on station's DC auxiliary supply (48 VDC). The system shall be capable of working in Auto/Remote Electrical/Local manual modes.
- Provision shall be available to keep the system "ISOLATED" / "OUT OF SERVICE" which

is necessary for preventing any mal-operation during transformer maintenance.

- V. The protection system shall be compatible of being hooked on to the SCADA or fire alarm system. Suitable spare contacts shall be made available for operation of fire system. System using PLC shall be only considered.
- VI. Fire protection system shall operate in Auto mode under two logic:
  - a) In Transformer Explosion prevention Logic it shall operate on receipt of minimum three positive feedback signals, namely differential relay, pressure relief valve or rapid pressure rise relay or Buchholz relay and electrical isolation of transformer through master trip relay or HV& LV circuit breaker in series to avoid any mal-operation of system .
  - b) In Transformer Fire Prevention logic, Fire protection system shall operate in Auto mode on receipt of minimum three positive feedback signals, namely fire detector, pressure relief valve or rapid pressure rise relay or Buchholz relay / OSR (in case of fire in OLTC and electrical isolation of transformer through master trip relay or HV & LV circuit breaker in series to avoid any mal-operation of system.
  - c) Provision shall be made in system so that any of the above two logic can be disabled by operator from local panel only.
  - d) Supply and installation of Rapid Pressure Rise Relay shall be in the scope of the bidder.
- VII. Fire protection system shall operate in Remote electrical mode on receipt of signal for electrical isolation of transformer and by operating switch provided in a box which shall be accessible only after breaking the glass cover on control panel.
- VIII. The Local manual operating system shall be used only in case if the system fails in Auto mode/Remote electrical mode/ power failure. System if kept in manual mode must be clearly visible by a different alarm / LED.
- IX. The system shall start operation in auto or remote electrical or local manual, initially draining a pre- determined quantity of oil from the tank top through outlet valve to reduce the tank pressure and simultaneously closing Isolation valve in the conservator line and then inject nitrogen gas with appropriate flow rate at high pressure from lower side of the tank through inletvalves to create stirring action and reduce the temperature of top oil surface below flash point to extinguish the fire.
- X. Isolation valve in the conservator line shall operate mechanically on transformer oil flow rate with electrical signal for monitoring on control panel. However in case of bursting of transformer bushing conservator oil should be isolated from main transformer tank without any additional signal to operate isolation valve.
- XI. Provision shall be available so that in case of accidental leakage of Nitrogen, the same should not affect the operation of Transformer
- XII. The system shall have built in facility for monitoring or display of the following.
  - a. Open /Close status of valves.
  - b. Healthiness of all sensors.
  - c. Operation of PRV
  - d. Healthiness of control cable
  - e. Healthiness of control supply
- XIII. Provision shall be available for annunciation (along with audible alarm) and a mimic panel of the following.
  - a. Detection of fire due to external causes

- b. Low nitrogen pressure.
  - c. System initiated
  - d. Tank pressure beyond the set limit
  - e. Operating signal cable faulty.
  - f. Operation of conservator isolation valve (PNRV)
  - g. Supply Failure
- XIV. However, bidder shall confirm whether it is advisable to initiate the system even when transformer is not electrically isolated due to stuck breaker problem etc.
- XV. The system shall have built-in-on-line testing facility, which will be operable without affecting the functioning of the transformer.
- XVI. All valves used in system shall be stainless steel ball / butterfly type and of Legris make or equivalent as per the purchaser's approval. Limit switches shall be provided wherever required.
- XVII. The connecting cables shall be fire retardant low smoke (FRLS) armored cable. Cables passing along the top of the transformer shall be the fire survival (FS) type.
- XVIII. The Pipe Line used for the system shall be of Class 'C' type.
- XIX. All the hardware used in the system shall be stainless steel.
- XX. Limit switches used in the panel shall be of Schmersal make or equivalent as per the purchaser's approval.
- XXI. Control cable gland used in system shall be of Lapp, Germany make or equivalent as per the purchaser's approval.
- XXII. Fire extinguishing cubicle shall be of 3mm thick CRCA sheet with PU painting and IP 55 enclosure protection class and shall accommodate nitrogen gas cylinder of adequate capacity and associated accessories like regulator, high pressure tubing etc.
- XXIII. The remote control panel, to be mounted inside the control room shall accommodate the necessary control units, operating switches push buttons etc. and also alarm annunciation unit.
- XXIV. The bidder shall, furnish the complete details including bill of materials of the fire prevention and extinguishing system offered. The list of all accessories including FRLS, fire survival cable, pipes, valves, sensors, control cubicle, nitrogen gas cylinder etc. shall be listed out and furnished in the offer.
- XXV. The bidder shall ensure that fire prevention and extinguishing system offered is full proof and reliable. Installation, testing and commissioning of the fire protection system shall also be in the successful bidder's scope.
- XXVI. Bidder shall ensure that fire prevention and extinguishing system shall not affect the normal operation of power transformer.
- XXVII. Fire protection scheme to the power transformer should have authentic certification regarding performance similar to one issued by LAPEM (MEXICO)/TAC/RDSO /any other approved standard laboratory.
- XXVIII. Similar units offered by bidder shall be in successful operation for a minimum period of two years.
- XXIX. The bidder shall also furnish performance certificate for similar systems in proof of the satisfactory operation.
- XXX. NIDS is to be supplied with transformer unless specified elsewhere in the Bidding document.
- XXXI. Drawing shall be prepared as per the layout and OGA of the transformer to avoid any major fabrication at site. Complete drawing and GTP should be submitted for approval.
- XXXII. Bidder shall also ensure overall product & installation quality.

- XXXIII. In all conditions transformer shall have provision for future implementations of NIDS.
- XXXIV. In any condition OEM (PTR) guarantee shall remain the same as mention in clause no. 11 of this specification.

## 5.25 CENTRE OF GRAVITY & CENTRE LINE MARKING

### CENTRE OF GRAVITY

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

### CENTRAL LINE MARKING

Central line of the transformer, tank, etc. shall be marked properly with indication to avoid any confusion during installation of the transformer

## 5.26 ANTI RUSTING CORROSION TREATMENT

- I. The bidder shall ensure that all fabrication i.e. transformer tank, radiators, marshalling boxes and other accessories are treated for highest quality performance for the entire life of the transformer. The Bidder shall submit plan for extra measures he is taking for prevention of corrosion, along with the offer.
- II. Finishes on transformer and appurtenant parts, edges (exposed to atmosphere)
- III. NO GAS CUT EDGE OR SURFACE shall be acceptable unless smoothly ground to plane surface without irregular projections and corners (which cannot be blasted to the required roughness).
- IV. For all radiators (If Specifically Mentioned), the following painting procedure shall be followed. The metal spray (99.95% assay zinc) to a thickness about 100 microns with surface roughening and two coats of paints with proper supervision and quality checks. Bidder shall indicate separate price for metal spray of radiators.
- V. In this corrosion prevention measure it is imperative that the job is fully monitored for optimizing the proper conduct of the procedure as given in the various national standards. The coating shall be as per BS: 2569 (latest revision). The coating requirement shall be to BS: 5493 Gr. SC10Z.
- VI. The Bidder shall submit a Quality Plan, giving the parameters and checking methods, (major, critical, minor).
- VII. The paint shade used shall be shade 631 as per IS: 5.

The following shall be the check points for the metal spray of Radiators:-

- a) Metal Spray
- b) Surface preparation
- c) Chemical analysis of actual material used for spray (batch wise identification)
- d) Coating Process (the first trial job will be witnessed to see if the written procedure is followed)
- e) Coating thickness test, adhesion test as per BS.
- f) Repair area classification major or minor and accordingly the repair from blasting onwards otherwise.
- VIII. Bidder may quote for galvanized radiators instead of metal spray radiators as an alternative

## 5.27 MAKE OF MAJOR COMPONENTS & RAW MATERIALS

The BA shall procure the following constituent items from the designated vendors as follows:



	RAW MATERIAL/EQUIPMENT	MAKE
a)	Copper	M/S Sterlite, M/S Hindustan Copper, M/S Hindalco.
b)	Core	M/S AK Steels, POSCO, Kawasaki/ JFE, Nippon Steel.
c)	Insulation paper and Pressboards	ITC paper, ABB, Raman Boards- Mysore, Senapathy Whiteley – Bangalore
d)	Transformer Oil ( Mineral oil)	Savita, Apar, Gandhar
e)	Gaskets & Corks	Nu Cork, Anchor Corks
f)	Steel For Tank	M/s, TATA Steel, M/s SAIL, M/s. JSW Steel, M/s. IISCO, M/s. RINL/Vizag Steel, M/s. Jindal Steel,
g)	Dehydrating Breather	Yogya, Anushree, Electrical engineers
h)	Bucholz, PRD, SPR, OTI , WTI, and other devices	Reputed make to be approved by TPCODL/TPNODL/TPSODL/TPWODL during detailed engineering.

Also, Bidder has to provide all test certificates from original manufacturers & relevant sourcing documents. BA shall also have shot blasting facility.

## 5.28 Cooling Arrangement

1. The transformer shall be provided with ONAF cooling system, which shall be designed to give 80% output at ONAN and 100% at ONAF. The cooling system shall comprise of two Nos. (2) 50% capacity radiator banks, to the sides of the tank.

Motor and fan should be of reputed make (To be approved by TPCODL/TPNODL/TPSODL/TPWODL during Detailed Engineering)

2. The radiators shall have one (1) spare fan for each bank with the automatic switching scheme. In case of separately mounted radiator banks, it shall be possible to completely isolate each bank for maintenance and both the banks shall be interchangeable with each other. Bidder shall provide adequate number of fans of rating each for cooling of the radiator.

3. Cooling fans shall not be directly mounted on radiator bank which may cause undue vibration. These shall be located vertically at the sides radiators but on separate support structure so as to

prevent ingress of rain water. Each fan shall be suitably protected by galvanized wire guard to prevent accidental contact with the blades, the mesh being not greater than 25mm. The exhaust air flow from cooling fan shall not be directed towards the main tank in any case.

4. Cooling fan must be provided with metal net cover arrangement so that direct contact of birds and rodents can be avoided with fan blades.

5. An oil flow indicator shall be provided for the confirmation of the oil pump operating in a normal state. An indication shall be provided in the flow indicator to indicate reverse flow of oil/loss of oil flow.

6. Radiator's fans motors shall be suitable for operation from 415 volts, three phase 50 Hz power supply and shall conform to IS: 325. Each cooling fan shall be 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 IP55 as per IS: 4691.

7. 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.

8. Terminal covers and greasing cups of fan motors shall be accessible without removing the guard. The air blower shall be removable without dismantling supporting framework. The cooler and its accessories should be hot dip galvanized or corrosion resistant paint should be applied to it.

9. Radiators shall be designed to withstand the vacuum and pressure conditions specified for the tank. Coolers shall be so designed as to accessible for cleaning and painting, to prevent accumulation of water on the outer surface, to completely drain oil into the tank and to ensure against formation of gas pockets when the tank is being filled.

10. Radiators shall be connected to the tank by machined steel flanges welded to the cooler units and to the tank and provided with gaskets. Each cooler unit connection shall be provided on the tank and an indication for shut off valve which can be fastened in either open or closed position shall be provided. A separate oil tight blank flange shall be provided for each connection for use when the cooler unit is detached. Each cooler unit shall have a lifting eye.

11. Automatic operation control of fans shall be provided (with temperature change) from contacts of winding temperature indicator. The Bidder 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.

12. Suitable manual control facility for cooler fans shall be provided. The changeover to standby fans in case of failure of service fans shall be automatic. 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 manually.

General Technical Requirements for Cooling Fan:			
S No	DESCRIPTION	UNITS	Requirement
1	Sweep	mm	450 mm
2	RPM		1400

3	Rated Current	A	0.75A
4	Rated Voltage	v	415
5	Phase		3 phase
6	Power rating	watt	370 watt
7	Bird guard		To be provided
8	Colour		BS Grey similar to transformer
9	Rubber vibration damper		To be provided
10	Motor frames		Shall not get damaged during operation
General Technical Requirements for Blower:			
1	Rated voltage	v	415
2	Power supply		3 phase 50 Hz AC Supply
3	Sweep	Mm/in	900 (36)
4	Speed	RPM	960
5	Motor HP		2
6	Bird guard		To be provided
7	Colour		BS Grey (similar to transformer)
8	Suitable starter for motor		To be provided
9	Rubber vibration dam.....r		To be provided
10	Motor stand		Shall not get damaged during operation
11	Appropriate stand		To be provided
16	Packing		Supplier shall ensure that tile equipment covered by the specification shall be prepared for rail/road transport (local equipment) and be packed in such a manner so as to protect the equipment from damage in transit.
17	Marking		The unit shall be appropriately marked as "PROPERTY OF TPCODL/TPNODL/TPSODL/TPWODL" and with the name of the vendor, Manufacturer type-Serial no. and year of manufacturing at suitable location. Following details shall be included in the name plate
18	Warranty		2 years from the date of purchase of Transformer. In case any defects are found, the vendor shall replace the product free of cost.
19	Test Reports		Test certificates to be provided : a) High voltage. b) Insulation resistance. d) Electrical input. e) Fan speed. f) Power factor. i) Starting. j) Air delivery. k) Temperature rise. l) IP Test

20	Acceptance test	Following tests shall be carried out : a) High voltage. b) Insulation resistance. d) Electrical input. e) Fan speed.
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## 6. NAME PLATE AND MARKING RATING PLATE

- I. A stainless steel rating plate, of at least 1 mm thickness, shall be fitted to each transformer in a visible position and shall carry all the information as specified in the standards components.
- II. Sign writing shall also be provided as per the format attached with this specification.
- III. The letters on the rating plate shall be engraved black on the white/silver back ground.
- IV. Fixing screws for outdoor use shall be of stainless steel or any other corrosion resistant metals.
- V. The Name plate shall be embossed with “PO No. with date” & “TPCODL/TPNODL/TPSODL/TPWODL”.
- VI. Danger notice shall have red lettering on a white background or they may be pictorial as approved by the TPCODL/TPNODL/TPSODL/TPWODL
- VII. The name plate shall contain following information:
  - a. Type of transformer (Two Winding Transformer)
  - b. Relevant standard.
  - c. Manufacturer’s Name
  - d. Manufacturer’s Serial No.
  - e. Year of Manufacture (MM/YYYY)
  - f. No. of phases
  - g. Rated kVA
  - h. Rated frequency
  - i. Rated Voltage
  - j. Rated current
  - k. Connection symbol
  - l. Percentage impedance voltage at rated current.
  - m. Type of cooling (ONAN/ONAF).
  - n. Total Mass
  - o. Mass and Volume of insulating Oil.
  - p. Connection diagram showing the internal connections.
  - q. Temperature rise
  - r. Insulation levels of the windings, including neutral end of windings with non-uniform insulation.
  - s. Transportation weight
  - t. Untanking weight.
  - u. Core and windings weight
  - v. Table giving the tapping voltage, tapping current and tapping power for each tapping.
  - w. Values of short circuit impedance on the extreme tapings and on the principal tapping and indication of the winding to which the impedance is related.
  - x. A table of all guaranteed particulars.
  - y. Quantity of oil required for normal filling.
  - z. HV and LV phase to phase clearances.
  - aa. Vector diagram
  - bb. Indication of the winding which is fitted with tapping.

- cc. Table giving the tapping voltage, the tapping current and the tapping power of each winding, for each tap.
- dd. Value of short circuit impedance on the extreme tapping and on the principal tapping and indication of the winding to which the impedance is related.
- ee. Information of the ability of the transformer to operate at a voltage exceeding 110% of the tapping voltage or for the principal tapping and 110% of the rated voltage.
- ff. Tan delta value of insulating oil and kraft paper of transformer.

**VALVE SCHEDULE PLATE**

The name plate shall contain information of all the valves, their locations, quantities and schematic for the valves

**OLTC PLATE**

The name plate shall contain following information:

- I. Type
- II. S.No.
- III. Year of Manufacturing (MM/YYYY)
- IV. Motor
  - a. Operating Voltage
  - b. Normal Working Current
  - c. Max. rated Though current
- V. Phase
- VI. Frequency (Hz)
- VII. Steps (Numbers)
- VIII. Step Voltage
- IX. Weight / Volume
  - a. Tap Changer Without Oil (Kg)
  - b. Oil (Kg)
  - c. Total
- X. Control Voltage (V)
- XI. Transition Resistance (Ohms)

**MARSHALLING BOX & OLTC BOX:**

- I. Manufacture’s Name
- II. Manufacture’s Serial No.
- III. Year of Manufacturing (MM/YYYY)
- IV. Purchase Order No.

The following shall be clearly mentioned / Engraved on the Plate: “TPCODL/TPNODL/TPSODL/TPWODL”. Engraved drawing of control circuit, CT / PT circuit and TB shall be available on Marshalling Box and OLTC Box.

**OIL FILLING INSTRUCTION PLATE FOR CONSERVATOR**

The name plate shall contain

- I. Step wise process for filling oil in conservator
- II. Table of fittings with functions
- III. Conservator diagram with oil filling process
- IV. Precautions in detail

## 7. TESTS:

All routine, acceptance & type tests shall be carried out in accordance with the IS 2026 relevant standards, & TPCODL/TPNODL/TPSODL/TPWODL approved QAP. All routine & acceptance tests shall be witnessed by the TPCODL/TPNODL/TPSODL/TPWODL/his authorized representative. All the components and fittings shall also be type tested as per the relevant standards.

Following tests shall be necessarily conducted on the Power Transformers in addition to others specified in IS/IEC standards. Test for the OLTC shall be done as per the IS 8468

### 7.1 ROUTINE TESTS

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

- 1) Measurement of Winding Resistance.
- 2) Measurement of voltage ratio, polarity and vector group check.
- 3) Measurement of short impedance and load loss at 50% and 100% load.
- 4) Measurement of no load losses and magnetizing current at rated frequency and 90%, 100% and 112.5% of rated voltage
- 5) Measurement of insulation resistance.
- 6) Dielectric Test.
- 7) Test on On-Load Tap Changer.
- 8) Measurement of Zero-sequence impedance on three phase transformer.
- 9) All CTs and resistance of image coil for winding temperature indicator shall be checked for ratio test, polarity and knee point voltage test.
- 10) Determination of Capacitances and dissipation factor winding-to-earth and between windings.
- 11) Magnetic balance test.
- 12) Measurement of Magnetizing current at low voltage.
- 13) Vacuum withstand test on tanks and radiators.
- 14) The total Losses shall comprise of the No Load Losses, Load Losses ( $I^2R$  loss + stray loss) and Auxiliary Losses at rated output duly converted at 75 °C average winding temperature and shall also be indicated in the test report. Load losses shall be that corresponding to rated load on HV, LV windings.
- 15) Physical Verification of complete Transformer with all assembly including test rollers, radiators etc.
- 16) Voltage Regulation at rated load and at unit, 0.9, 0.8 lagging power factor.
- 17) Measurement of Acoustic Noise Level.
- 18) Measurement of the power taken by the fans
- 19) Functional tests on auxiliary equipment:-
  - a. Test on OTI and WTI
  - b. High Voltage test on insulation test for Auxiliary Wiring
  - c. High Voltage test on insulation test for Auxiliary Wiring
- 20) Test on Oil filled in Transformer:-
  - a. Dielectric strength of oil
  - b. Water content

- c. Dielectric dissipation factor (tan delta at 90° celcius)
- d. Resistivity.
  - 21) Induced over voltage withstand test.
  - 22) Separate Source voltage withstand test.
- 23) Oil Pressure test on completely assembled transformer at 0.35kg/sq.cm for 8 hrs.
- 24) BDV and moisture content of oil in transformer

## 7.2 TYPE TESTS

The type tests to be carried out by the Bidder shall include but not limited to the following:

- 1) Measurement of winding resistance.
- 2) Measurement of voltage ratio and check of voltage vector relationship.
- 3) Measurement of impedance voltage / short-circuit impedance (Principal tapping) and load loss.
- 4) Measurement of no load loss and current.
- 5) Measurement of insulation resistance.
- 6) Dielectric Test.
- 7) Temperature rise for determining the maximum temperature rise after continuous full load run. The ambient temperature and time should be stated in the test certificate.
- 8) Tests on on-load tap-changer.
- 9) Short Circuit withstand test.
- 10) Test to verify IP55 of Marshalling and cable boxes(if applicable)
- 11) Lightning Impulse voltage test with chopped wave.

**Note: The bidder shall submit the test report from CPRI or ERDA for the tests mentioned above.**

Following type tests shall be carried out on one transformer of each rating, at the works of the bidder, in presence of TPCODL/TPNODL/TPSODL/TPWODL representative.

- a. Temperature rise test including DGA (DGA shall be done before & after the heat run test)
- b. Impulse Test (Including chopped wave on all the three limbs of HV & LV)

## TYPE TESTS, ROUTINE TEST & ACCEPTANCE TEST OF MOG & OSR

All routine, acceptance & type tests shall be carried out in accordance with the relevant IS/IEC. All routine & acceptance tests shall be witnessed by the TPCODL/TPNODL/TPSODL/TPWODL/his authorized representative. All the components shall also be type tested as per the relevant standards. Following tests shall be necessarily conducted on the Joint and Termination Kits in addition to others specified in IS/IEC standards

### Type Test

- a) Porosity test
- b) High voltage and insulation resistance test
- c) Elements test
- d) Gas Volume test
- e) Loss of oil and surge test
- f) Mechanical strength test
- g) Velocity calibration test

### Routine Tests

- a) Porosity test
- b) High voltage and insulation resistance test
- c) Elements test
- d) Gas Volume test
- e) Loss of oil and surge test

**Acceptance Tests**

- a) Visual Inspection
- b) Porosity test
- b) High voltage and insulation resistance test
- c) Elements test
- d) Gas Volume test
- e) Loss of oil and surge test
- f) Mechanical strength test
- g) Velocity calibration test

**TYPE TEST ON NITROGEN INJECTION DRAIN AND STIR SYSTEM (NIDS)**

The NIDS shall be subjected to the operational test at manufacturing works of Nitrogen Injection Fire Prevention and extinguishing system in presence of TPCODL/TPNODL/TPSODL/TPWODL's representative. The manufacture's test certificates of various accessories of NIDS shall be furnished at the time of Inspection to the inspecting officer. Complete GTP & Drawing including mounting, support structure, earthing provision should be submitted for approval. NIDS valve opening should not create any hindrance to other parts operation

**SPECIAL TEST**

The following tests shall be carried out by mutual agreement between the TPCODL/TPNODL/TPSODL/TPWODL and the bidder. All Tests shall be done as per the relevant standard. Test certificates shall be submitted for bought out items. High voltage withstand test shall be performed on auxiliary equipment and wiring after complete assembly.

- a. Measurement of the harmonics of the No-Load Current
- b. Determination of transient voltage transformer characteristics
- c. Measurement of insulation resistance to earth of the windings, and / or measurement of Dissipation factor ( $\tan \delta$ ) of the insulation system capacitances. (These are reference values for comparison with later measurement in the field. No limitation for the values are given here.)
- d. Lightning impulse test on Neutral terminals
- e. Long duration induced AC voltage test (ACLD) transformer winding  $72.5 < U_m \leq 170kV$
- f. Magnetic circuit (isolation) test
- g. SFRA Test.

**7.3 ACCEPTANCE TEST :**

- 1) At least 10% transformer of the offered lot (minimum of one) shall be subjected to all the tests mentioned under the section 'ROUTINE Test' in presence of



TPCODL/TPNODL/TPSODL/TPWODL representative at the place of manufacture before dispatch without any extra charges. The testing shall be carried out in accordance with IS: 2026.

- 2) Oil Leakage test for acceptance shall be conducted at pressure of 0.35kg/sq.cm for one hour as per IS2026.
- 3) Temperature Rise Test (on one unit of first lot against every Rate contract / PO for each rating, for further lots against the same RC, TPCODL/TPNODL/TPSODL/TPWODL reserves the right to perform Temperature rise if required) [As per IS 2026 (Part 2) Clause no.4]
- 4) The painted surface shall pass the Cross Adhesion Test (IS1180 part 1 clause no. 21.4.d).
- 5) At stage inspection -Checking of weight, dimensions, fitting and accessories, tank sheet thickness, oil quantity, material finish and workmanship, physical verification of core coil assembly and measurement of flux density on one unit of each rating of the offered lot with reference to the GTP and contract drawings.
- 6) At Final inspection, the incoming raw material and its movement/consumption record in the related jobs of TPCODL/TPNODL/TPSODL/TPWODL will be verified by inspecting officer. In case of any deviation or non-availability of such records, the offered lot may get rejected.

#### 8. TYPE TEST CERTIFICATES:

The Bidder shall furnish the type test certificates of the Two Winding Power Transformer for the tests as mentioned above as per the corresponding standards. All the tests shall be conducted at CPRI / ERDA/Government Labs as per the relevant standards. Type tests should have been conducted in during the period not exceeding 5 years from the date of opening the bid. In the event of any discrepancy in the test reports, i.e. any test report not acceptable or any/all type tests (including additional type tests, if any) not carried out, same shall be carried out without any cost implication to the TPCODL/TPNODL/TPSODL/TPWODL

#### 9. PRE-DISPATCH INSPECTION:

1. Equipment shall be subject to inspection by a duly authorized representative of the TPCODL/TPNODL/TPSODL/TPWODL. Inspection may be made at any stage of manufacture at the option of the TPCODL/TPNODL/TPSODL/TPWODL and the equipment if found unsatisfactory as to workmanship or material, the same is liable to rejection.
2. Bidder shall grant free access to the places of manufacture to TPCODL/TPNODL/TPSODL/TPWODL's representatives at all times when the work is in progress.
3. Inspection by the TPCODL/TPNODL/TPSODL/TPWODL or its authorized representatives shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specifications.
4. Material shall be dispatched after specific MDCC (Material Dispatch Clearance Certificate) is issued by TPCODL/TPNODL/TPSODL/TPWODL.

Following documents shall be sent along with material:

- a. Test reports
- b. MDCC issued by TPCODL/TPNODL/TPSODL/TPWODL
- c. Invoice in duplicate
- d. Packing list
- e. Drawings & catalogue

- f. Guarantee / Warrantee card
- g. Delivery Challan
- h. Other Documents (as applicable)

5. In respect of raw material such as core stampings, winding conductors, insulating paper and oil, bidder shall use materials manufactured/supplied by standard manufacturers and furnish the manufacturers' test certificate as well as the proof of purchase from these manufacturers (excise gate pass) for information of the TPCODL/TPNODL/TPSODL/TPWODL. The bidder shall furnish following documents along with their offer in respect of the raw materials:

- a. Invoice of supplier
- b. Mill's certificate
- c. Packing List
- d. Bill of Landing
- e. Bill of entry certificate by custom

6. After the main raw-material i.e. core and coil material and tanks are arranged and transformers are taken for production on the shop floor, to ensure the quality of transformers, the inspection shall be carried out by the TPCODL/TPNODL/TPSODL/TPWODL's representative at following stages:

**a. Stage Inspection I** – Bidder has to facilitate for stage inspection of Tank, HV and LV windings and Core of the offered transformers. Bidder has to facilitate for stage inspection of Tank, HV and LV windings in one inspection call without any extra charges. Multiple inspections calls for stage inspection-I will not be considered and the delay will be accountable at bidder end. At this stage checking of weights, dimensions, tank sheet thickness, Pressure and vacuum test and quality of material, finish & workmanship as per GTP/QA Plan and approved drawings. During stage inspection TPCODL/TPNODL/TPSODL/TPWODL reserves the rights to dismantle the assembled core to ensure that the CRGO laminations used are of good quality. DP test on welding of TANK to be conducted at factory to ensure good quality of tank welding.

**b. Stage inspection II** – Bidder has to facilitate for stage inspection -II for Core coil assembly of the offered transformers in without any extra charges. The testing shall be carried out in accordance with IS: 2026 and as per GTP/QA plan/Drawing.

Note: For Stage inspection, Annexure –I will be referred.

**c. Final Inspection** - Bidder has to facilitate for final inspection once the offered transformer is ready for dispatch. Inspection will be done as per w.r.t tests mentioned in Clause 7.2 and inspection test plan format in Annexure-II.

7. To ascertain the quality of the transformer oil, the original manufacturer's tests report shall be submitted at the time of inspection. Arrangements shall also be made for testing of transformer oil, after taking out the sample from the manufactured transformers and tested in the presence of TPCODL/TPNODL/TPSODL/TPWODL's representative.

8. The Bidder shall intimate the TPCODL/TPNODL/TPSODL/TPWODL in advance for inspection, so that an officer for carrying out inspection could be deputed, as far as possible within 07days (Within Delhi)/ 12Days (outside Delhi) from the date of intimation.

9. Further, about the readiness of the transformers, for final inspection for carrying out tests as per relevant IS/IECs shall be sent by the Bidder along with routine test certificates. The inspection shall normally be arranged by the TPCODL/TPNODL/TPSODL/TPWODL at the earliest after receipt of offer for pre-delivery inspection.

10. In case of any defect/ defective workmanship observed at any stage by the TPCODL/TPNODL/TPSODL/TPWODL's Inspecting officer, the same shall be pointed out

to the Bidder in writing for taking remedial measures. Further processing shall only be done after clearance from the inspecting officer / TPCODL/TPNODL/TPSODL/TPWODL.

11. All tests and inspection shall be carried out at the place of manufacture unless otherwise specifically agreed upon by the manufacturer and TPCODL/TPNODL/TPSODL/TPWODL at the time of purchase/tender.

12. The manufacturer shall offer the inspector representing the TPCODL/TPNODL/TPSODL/TPWODL all reasonable facilities, without charges, to satisfy him that the material is being supplied in accordance with this specification. This will include Stage Inspection during manufacturing stage as well as during Acceptance Tests.

13. The bidder shall provide all services to establish and maintain quality of workmanship in his works and to ensure the mechanical / electrical performance of components, compliance with drawings, identification and acceptability of all materials, parts and equipment as per latest quality standards of ISO 9000.

14. The TPCODL/TPNODL/TPSODL/TPWODL has the right to have the test carried out at his own by an independent agency wherever there is a dispute regarding the quality supplied. TPCODL/TPNODL/TPSODL/TPWODL has right to test 1% of the supply selected either from the stores or field to check the quality of the product. In case of any deviation TPCODL/TPNODL/TPSODL/TPWODL have every right to reject the entire lot or penalize the bidder, which may lead to blacklisting, among other things.

## **10. INSPECTION AFTER RECEIPT AT SITE/STORE:**

### **Inspection at site:**

After erection at site, the transformers shall be subjected to the following tests and the bidder shall guarantee results of test certificates under service conditions.

- a. Measurement of winding resistance
- b. Measurement of voltage ratio and check of voltage vector relationship
- c. Measurement of magnetizing current.
- d. Magnetic balance test on three phase transformer
- e. Magnetic circuit (isolation) test
- f. Measurement of short circuit Impedance at low voltage
- g. Insulation resistance measurement
- h. Dielectric Test on oil.
- i. Determination of Capacitances and dissipation factor winding-to-earth and between windings.
- j. Bushing Capacitance and  $\tan \delta$
- k. Test on other Auxiliaries
- l. No-Load and Excitation current

This is for bidder's information that tests at site may be in bidder's scope based on mutual agreement between bidder and TPCODL/TPNODL/TPSODL/TPWODL's. However, in any case bidder shall be required to send their engineer to confirm that the erection & commissioning is done in a satisfactory manner.

TPCODL/TPNODL/TPSODL/TPWODL holds the discretion to obligate the bidder to carry out certain additional tests (e.g. SFRA, HV tan delta etc.) on transformer, for cross-checking and confirming the quality of incoming equipment owing to damages/deterioration that might have been caused during transportation/handling etc.

### **Inspection at Store:**

- a) The material received at TPCODL/TPNODL/TPSODL/TPWODL store shall be inspected for acceptance and shall be liable for rejection, if found different from the reports of the pre-dispatch inspection and one copy of the report shall be sent to Project Engineering department.
- b) In case the transformers proposed for supply against the order are not exactly as per the tested design, the Bidder shall be required to carry out the short circuit test and impulse voltage withstand test at its own cost in the presence of the representative of the TPCODL/TPNODL/TPSODL/TPWODL. The supply shall be accepted only after such test is done successfully, as it confirms on successful withstand of short circuit and healthiness of the active parts thereafter on un-tanking after a short circuit test. Apart from dynamic ability test, the transformers shall also be required to withstand thermal ability test or thermal withstand ability will have to be established by way of calculations.
- c) The TPCODL/TPNODL/TPSODL/TPWODL reserves the right to conduct all tests on Transformer after arrival at site / stores and the manufacturer shall guarantee test certificate figures under actual service conditions.
- d) The TPCODL/TPNODL/TPSODL/TPWODL reserves the right to conduct short circuit test and impulse voltage withstand test in accordance to IS, afresh on each ordered rating at TPCODL/TPNODL/TPSODL/TPWODL cost, even if the transformer of the same rating and similar design are already tested. This test shall be carried out on a transformer to be selected by the TPCODL/TPNODL/TPSODL/TPWODL either at the manufacturer's works when they are offered in a lot for supply or randomly from the supplies already made to TPCODL/TPNODL/TPSODL/TPWODL stores. The findings and conclusions of these tests shall be binding on the bidder.
- e) Test at TPCODL/TPNODL/TPSODL/TPWODL store/Site: after receipt of transformers at TPCODL/TPNODL/TPSODL/TPWODL stores/Site, following minimum tests will be carried out.
  1. Total weight of the transformer. (It should be as per the offer, subjected to tolerance as per approved drawings & GTPs)
  2. Oil level in the transformer
  3. Verifications of all the fittings
  4. Physical verification of all the transformers for any damages, oil leakage, quality of painting etc.
- f) Test at site: The TPCODL/TPNODL/TPSODL/TPWODL reserves the right to conduct all tests on Transformer after arrival at site/stores and the manufacturer shall guarantee test certificate figures under actual service conditions.

## 11. GUARANTEE:

- I. Bidder shall stand guarantee towards design, materials, workmanship & quality of process/manufacturing of items under the contract for due and intended performance of the same, as an integrated product delivered under this contract.
- II. In the event any defect is found by the TPCODL/TPNODL/TPSODL/TPWODL up to a period of 48 months from the date of commissioning or 60 months from the date of last supplies made under the contract, whichever is earlier.
- III. Bidder shall be liable to undertake to replace/rectify such defects at his own costs, within mutually agreed timeframe, and to the entire satisfaction of the TPCODL/TPNODL/TPSODL/TPWODL, failing which the TPCODL/TPNODL/TPSODL/TPWODL will be at liberty to get it replaced/rectified at Bidder's risks and costs and recover all such expenses plus the

TPCODL/TPNODL/TPSODL/TPWODL's own charges (@ 20% of expenses incurred), from the Bidder or from the "Security cum Performance Deposit" as the case may be.

- IV. In case of Two Winding Power Transformer fails within the guarantee period the TPCODL/TPNODL/TPSODL/TPWODL will immediately inform the Bidder who shall take back the failed Two Winding Power Transformer within 15 days from the date of intimation at his own cost and replace / repair the transformer within forty five days of date of intimation with a roll over guarantee.
- V. The outage period i.e. period from the date of failure till unit is repaired / replaced shall not be counted for arriving at the guarantee period. Bidder shall further be responsible for 'free replacement' for another period of THREE Years from the end of the guarantee period for any 'Latent Defects' if noticed and reported by the TPCODL/TPNODL/TPSODL/TPWODL.

## **12. PACKING AND TRANSPORT:**

- I. Bidder shall ensure that all the equipment covered under this specification shall be prepared for rail/road transport in a manner so as to protect the equipment from damage in transit.
- II. The packing may be in accordance with the bidder's standard practice but he should give full particulars of packing for the approval of the TPCODL/TPNODL/TPSODL/TPWODL. Special arrangement should be made to facilitate handling and to protect the projecting connections from damage in transit.
- III. The transformer shall be shipped filled with oil upto transport oil level guage. If transformer is transported without Oil or Partially filled, the tank shall be filled with Nitrogen under pressure complete with gas cylinder reducer, connection and pressure gauges. (After testing dew point of the Nitrogen filled. Dispatch clearance will be given only after achieving satisfactory dryness i.e. dew point measurement results). These accessories will be part of purchase. However, if neutral grounding transformer and reactors are included in the scope, these can be transported with oil. (Whichever way desired by the TPCODL/TPNODL/TPSODL/TPWODL depending on the size etc.)
- IV. Provisions for monitoring of oil and gas pressure during transport and storage and a make-up Nitrogen cylinder shall be made.
- V. A shock recorder also shall be provided during transport. Data of the same shall be shared during execution.
- VI. Bushings shall be packed in proper containers for transport.
- VII. All parts shall be adequately marked to facilitate field erection.
- VIII. Boxes and crates shall be marked with the contract number and shall have a packing list enclosed showing the parts contained therein .
- IX. Unloading, dragging of transformer up to 50mtrs & keeping it on foundation at TPCODL/TPNODL/TPSODL/TPWODL site/stores will be in the scope of supplier. The bidder shall take care of this point while quoting the rates for Freight & Insurance charges.

## **13. TENDER SAMPLE:**

All offered transformer detailed documents to be submitted as per clause no.18. The sample shall be not applicable

## **14. QUALITY CONTROL:**

1. The bidder shall submit with the offer Quality assurance plan indicating the various stages of inspection, the tests and checks which will be carried out on the material of construction, components during manufacture and bought out items and fully assembled component and equipment after finishing.

2. As part of the plan, a schedule for stage and final inspection within the parameters of the delivery schedule shall be furnished.
3. The TPCODL/TPNODL/TPSODL/TPWODL's engineer or its nominated representative shall have free access to the manufacturer's/sub-supplier's works to carry out inspections.
4. The Bidder shall invariably furnish following information along with his bid, failing which the bid shall be liable for rejection. Information shall be separately given for individual type of equipment offered.
  - i. Statement giving list of important raw materials, names of sub-suppliers for the raw materials, list of standards according to which the raw materials are tested.
  - ii. List of tests normally carried out on raw materials in the presence of Bidder's representative, copies of test certificates.
  - iii. Information and copies of test certificates as in (i) above in respect of bought out accessories.
  - iv. List of manufacturing facilities available.
  - v. **Level of automation achieved and list of areas where manual processing exists.**
  - vi. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspection.
  - vii. List of testing equipment available with the bidder for final testing of equipment along with valid calibration reports shall be furnished with the bid. Manufacturer shall possess 0.1 class instruments for measurement of losses.
  - viii. Quality Assurance Plan (QAP) withholds points for TPCODL/TPNODL/TPSODL/TPWODL's inspection.
5. The successful Bidder shall within 30 days of placement of order, submit following information to the TPCODL/TPNODL/TPSODL/TPWODL.
  - a. List of raw materials as well as bought out accessories and the names of sub-Suppliers selected from those furnished along with offer.
  - b. Type test certificates of the raw materials and bought out accessories.
6. The successful Bidder shall submit the routine test certificates of bought out accessories and central excise passes for raw material at the time of routine testing.

**15. TESTING FACILITIES:**

Bidder shall have adequate in house testing facilities for carrying out all routine tests, acceptance tests and pre-dispatch inspection as per relevant International / Indian standards. The bidder shall have minimum testing facilities in house for following:

- a. Heat run test
- b. SFRA
- c. Pre dispatch inspection as per clause no. 9 above

**16. MANUFACTURING FACILITIES:**

- a. The successful bidder will have to submit the bar chart for various manufacturing activities clearly elaborating each stage, with quantity.
- b. This bar chart should be in line with the Quality assurance plan submitted with the offer.
- c. Cat-A approval is mandatory to start Mass Production.

**17. SPARES, ACCESSORIES AND TOOLS**

1. Bidder shall provide a list of recommended spares with quantity and unit prices for 5 years of operation after commissioning.

2. The TPCODL/TPNODL/TPSODL/TPWODL may order all or any of the spare parts listed at the time of contract award and the spare parts so ordered shall be supplied as part of the definite works.
3. The TPCODL/TPNODL/TPSODL/TPWODL may order additional spares at any time during the contract period at the rates stated in the Contract Document.
4. Bidder shall give an assurance that spare parts and consumable items will continue to be available through the life of the equipment which shall be 25 years minimum.
5. However, the TPCODL/TPNODL/TPSODL/TPWODL shall be given a minimum of 12 months' notice in the event that the Bidder or any sub-vendor plans to discontinue manufacture of any component used in this equipment.
6. Any spare apparatus, parts or tools shall be subject to the same specification, tests and conditions as similar material supplied under the Contract. They shall be strictly interchangeable and suitable for use in place of the corresponding parts supplied with the equipment and must be suitably marked and numbered for identification.
7. The bidder shall also provide the following mandatory spares along with the transformer.
  - a. HT Bushing (1no.)
  - b. LT Bushing (1no.)
  - c. Neutral Bushing (1 no.)
  - d. Buchholz Relay (1 no.)
  - e. Valves ( 1Set)
  - f. OTI, WTI ( 1 each)
  - g. PRV (1 no); OSR (1 no); MOG (1 no)
  - h. Transducers for OTI, WTI, PTI
  - i. Air cell (1 no.)
  - j. Fan contactor with overload relay (1 no.)
  - k. Cooling fan (1 no.)
  - l. Set of gaskets (1 no.)
  - m. Set of mandatory spares for tap changer (1 no.)
  - n. Oil – 10% extra
  - o. Radiator tube plug – 5 No
  - p. Radiator tube valves – 2 No
  - q. Radiator tube plug oil seals – 12 No
  - r. MCCB (1 no.)
  - s. MCB (1 no.)
  - t. L/R switch (1 no.)
  - u. R/L switch (1 no.)
  - v. OLTC counter (1 no.)
  - w. Space heater & thermostat (1 no.)
  - x. Bushing CT for HV (1 no.)
  - y. Bushing CT for Neutral (1 no.)
  - z. Bushing CT for LV (1 no.)

## **18. DRAWINGS AND DOCUMENTS:**

1. Following drawings and documents shall be prepared based on TPCODL/TPNODL/TPSODL/TPWODL specifications and statutory requirements and shall be submitted with the bid:
  - a. Completely filled in Technical Particulars and compliance to each clause of the specification General Technical Requirements to Additional Details.
  - b. Description of the transformer and all components including brochures.
  - c. General arrangement for Transformer.

- d. Bill of material.
  - e. Experience Certificate and list
  - f. Type test certificates.
  - g. List of makes of major components as listed above.
2. Drawings / documents to be submitted after the award of the contract are as under:

Sr. No	Description	For Approval	For Review Information	Final Submission
1	Technical Parameters	√	√	√
2	GA Drawing of Transformer	√	√	√
3	HV and LV bushing internal view with terminal connector	√	√	√
4	Internal coil arrangement with dimensions	√	√	√
5	Breather Drawing		√	√
6	Rating Plate	√	√	√
7	Cooling calculation with no. of radiators and fins mentioned specifically	√	√	√
8	Prismatic oil level gauge drawing			√
9	Installation Instruction		√	√
10	QA & QC Plan		√	√
11	Test Certificates	√	√	√
12	Shipping drawings showing dimensions and weights of each package.	√	√	√
13	Assembly drawings and weight of main component parts.	√	√	√
14	Drawings giving Weights for foundations	√	√	√
15	Tap changing and name plate diagram.	√	√	√
16	Schematic control along with logic block diagram and wiring diagram for all auxiliary equipment.		√	√
17	Schematic diagram showing the flow of oil in the cooling system as well as each limb and winding. Longitudinal and cross-sectional views showing the duct sizes, cooling pipes etc.	√	√	√



18	Large scale drawings of high and low tension windings of the transformers showing the nature and arrangement of insulation and terminal connections.	√	√	√
19	Bushing drawing and specifications.	√	√	√
20	Crane requirement for assembly and dismantling.		√	√
21	Overhead Conductor Connections.		√	√
22	Foundation drawing of transformer, radiator supports, etc.		√	√
23	Valve Schedule details	√	√	√
24	HV , LV Bushing fixing and connection Details		√	√
25	Radiator drawing and their fixing arrangement.		√	√
26	Marshalling junction box details	√	√	√
27	Thermo junction box details.	√	√	√
28	Neutral arrangement	√	√	√
29	Drawing showing conservator with air bag and oil filling instructions	√	√	√

In addition to the above, the following drawing / information for each item pertaining to marshalling box and OLTC shall also be supplied.

30	General arrangement drawing of the marshalling box	√	√	√
31	Shipping drawings showing dimensions and weight of each package	√	√	√
32	Drawing giving the weight for its foundation.	√	√	√
33	Schematic control drawing and TB schedule / wiring diagram for all elements	√	√	√
34	Valve Schedule	√	√	√
35	Test report of all bought out elements.	√	√	√
36	The tightening torque chart	√	√	√

**3. List of Calculations to be submitted:**

- All the calculations shall be step by step showing the use of formulas and other practical considerations. **Concise calculations in table or excel sheet shall not be accepted.** Also, the reference (only standard sources as IS, IEC or any such standard is acceptable) of the formulas shall be mentioned.
- Resistance Calculation ( 75 deg. C )

3. Load Losses Calculation ( at 75 deg. C )
4. No load Losses.
5. Stray Losses.
6. Weight of Copper (Bare and with Insulation also).
7. Weight of Core.
8. BH curve & Loss/Kg graph of core material offered.
9. Flux Density calculations.
10. Current Density Calculations.
11. Short Circuit withstand.
12. Temperature Rise Calculations.
13. Conservator Volume calculations
14. Cooling Calculations showing cooling with tank and radiators separately with no. of radiators and fins mentioned specifically (For both Mineral oil and Ester oil)
15. Calculation sheet for Lifting lug design and mounting lug design to be submitted by Bidder.

**4. Additional Documents to be submitted :**

- a. List of raw materials as well as bought out accessories and name of sub-suppliers selected from those furnished along with offer.
- b. Type test certificates of the raw materials and bought out accessories.
- c. The successful Bidder shall submit the routine test certificates of bought out accessories and central excise passes for raw material at the time of routine testing.

All the documents & drawings shall be in English language. After the receipt of the order, the successful bidder will be required to furnish all relevant drawings/parameters/calculation to TPCODL/TPNODL/TPSODL/TPWODL for approval.

**5. Instruction Manuals:**

Bidder shall furnish softcopies of nicely bound manuals (In English language) covering erection and maintenance instructions and all relevant information and drawings pertaining to the main equipment as well as auxiliary devices.

**19. SCHEDULE- "A" GUARANTEED TECHNICAL PARTICULARS:**

Sl. No.	Description	Unit	As furnished by Bidder
1.0	Tapings on HV winding ON Load a)Range b)Number of steps c) Principal tap		
2.0	For ON load taps, specify details of OLTC gear(incl. type & make)		
2.1	Manual/automatic control		
2.2	Remote/local control		
2.3	If remote control, whether the remote Control cubicle included in Bidder's scope of supply		
2.4	Voltage class of OLTC		

2.5	Current rating of OLTC		
2.6	a) Location of OLTC with respect to HV winding (attach sketch). b) Location of OLTC (In Tank/Outside Tank)		
2.7	Whether separate tap winding provided for OLTC		
2.8	Whether Selector and diverter chamber are separate		
2.9	Total oil in the OLTC in selector switch		
	-- In diverter switch		
3.0	Winding		
3.1	Maximum current density in winding	Amps/mm <sup>2</sup>	
3.2	Use of continuously transposed conductor (CTC) in LV winding.	Yes/No	Yes
3.3	Area of cross section of winding conductor (HV/LV).	mm <sup>2</sup> (Min)	
3.4	Description of winding insulation		
3.5	Nature of insulation	Class	
3.6	Bare weight of copper in windings without paper insulation and leads.	Kg (Minimum)	
3.7	Details of winding and winding conductor		
4.0	Tank :		
4.1	Approximate thickness		
	Sides	mm	
	Bottom	mm	
	Cover	mm	
4.2	Material of tank		
5.0	Maximum temperature-rise above an ambient of (deg.C) a)Top oil b)Windings c) Temperature Gradient between Oil and Winding	°C °C °C	
6.0	Total loss at rated voltage at principal tapping and rated frequency.	kW	
7.0	Component losses: at 90%, at 100%, and At 110% :		
7.1	Maximum Guaranteed No load loss at rated voltage on principal tapping and at rated frequency :	kW	
7.2	Calculated No load loss at rated principal tapping & rated frequency. Submit necessary calculations	kW	
7.3	Maximum guaranteed I <sup>2</sup> R loss at rated current for the principal tapping at 75°C.	kW	

7.4	Calculated I <sup>2</sup> R loss at rated current for the principal tapping at 75°C. Submit necessary calculations.	kW	
7.5	Calculated additional losses (Eddy + stray losses) at rated current for the principal tapping at 75°C. Submit necessary Calculations.	kW	
7.6	Maximum guaranteed additional losses (Eddy + stray losses) at rated current for the principal tapping at 75°C.	kW	
7.7	Maximum Guaranteed auxiliary losses	kW	
7.8	Auxiliary losses at rated current for principal tripping:	kW	
7.9	Maximum Calculated total Losses (sum of sr.no.19.2+19.4+19.5+ 19.7) submit necessary calculation.	kW	
7.10	Guaranteed Total Losses (sum of sr. no. 19.1+19.3+19.6+19.7) submit necessary calculation.	kW	
8.0	Impedance voltage at rated current for the principal tapping HV LV (Percent) Note: (The above impedance values shall be on full MVA rating of transformer i.e. For 2 winding transformer on 12.5/16MVA base )	%	
9.0	Reactance at rated current and rated frequency (On full MVA rating of transformer i.e.For 2 winding transformer on 12.5/16MVA base ) i) HV LV ii) No load current at rated voltage and rated frequency	%	
10.0	a)Partial discharge level : b)Noise level : c)Harmonic content in charging current :		
11.0	Insulation level		
11.1	Separate source power-frequency voltage withstand : i)HV winding ii)LV winding iii)LV neutral	kV rms kV rms kV rms	
11.2	Induced over voltage withstand i)HV winding ii)LV winding iii)LV neutral	kV rms kV rms kV rms	
11.3	Full wave lightning impulse withstand voltage i)HV winding ii)LV winding iii)LV neutral	kV peak kV peak kV peak	

11.4	Uniform/Graded Insulation i)HV winding ii)LV winding iii)LV neutral	kV peak kV peak kV peak	
12.0	a)External short circuit withstand capacity b)External short circuit withstand capacity i) for HV side ii) for LV side c)Duration of external short withstand capacity	MVA  kA kA In Sec.	
13.0	Efficiencies at 75 deg.C at unity power factor : a) At full load b) At 3/4 full load c) At 1/2 full load d) At 1/4 full load	% % % %	
14.0	Efficiencies at 75 deg.C at 0.8 power factor : a) At full load b) At 3/4 full load c) At 1/2 full load d) At 1/4 full load	% % % %	
15.0	a) 415 V single phase short circuit impedance b) Percentage variation between phases.		
16.0	Regulation at full load at 75 deg.C a)At unity power factor b)At 0.8 power factor lagging	% %	
17.0	Terminal arrangement: a) High voltage b) Low voltage c) Neutral (LV) d) HV terminal phase spacing e) LV terminal phase spacing f) Any other information		
18.0	Approximate masses: a) Core b) Winding c) Bare weight of copper in windings without paper insulation and leads d) Tanks, fittings and accessories. e) Oil f) Total mass	Kg Kg Kg Kg Kg Kg	
19.0	Approximate quantity of oil required for filling (main tank) OLTC Overall maximum dimensions of the transformer complete with accessories : a) Length b) Breadth c) Height	mm mm mm	

Untanking height Reference standards			
20.	<p>Details of HV Bushings line</p> <p>a) Voltage class, b) Current rating, c) 1.2/50 s impulse withstand d) Make e) Type f) Creepage distance, total g) Creepage distance, protected. h) Year of manufacture. i) Qty. of oil in oil filled bushing</p>	<p>kV A kV (rms)</p> <p>mm mm MM/YYYY Ltr.</p>	
21	<p>Details of LV Bushings line (LV line end)</p> <p>a) Voltage class, b) Current rating, c) 1.2/50 s impulse withstand d) Make e) Type f) Creepage distance, total g) Creepage distance, protected. h) Year of manufacture. i) Qty. of oil in oil filled bushing</p>	<p>kV A kV(rms)</p> <p>mm mm MM/YYYY Ltr.</p>	
22.0	<p>Details of Neutral Bushings</p> <p>a) Voltage class, b) Current rating, c) 1.2/50 s impulse withstand d) Make e) Type f) Creepage distance, total g) Creepage distance, protected. h) Year of manufacture. i) Qty. of oil in oil filled bushing</p>	<p>kV A kV (rms)</p> <p>mm mm MM/YYYY Ltr.</p>	
23.0	<p>Details of Core Grounding Bushings</p> <p>a) Voltage class, b) Current rating, c) 1.2/50 s impulse withstand d) Make e) Type f) Creepage distance, total g) Creepage distance, protected. h) Year of manufacture. i) Qty. of oil in oil filled bushing</p>	<p>kV A kV (rms)</p> <p>mm mm MM/YYYY Ltr.</p>	

24.0	<p>Details of LV Cable Connection</p> <p>a) Clearances</p> <p>i) Phase to Phase</p> <p>ii) Phase to Earth</p> <p>b) Drawing enclosed</p> <p>c) Length Of Each phase Bus Bars. The Bus bars are suitable for how many numbers of 1Cx 1000 sq mm, 11kV, XLPE cable.</p>		
25.0	<p>Designed Fault Levels:</p> <p>a) HV</p> <p>b) LV</p>	<p>MVA</p> <p>MVA</p>	
26.0	<p>Core</p> <p>a) Material &amp; Grade</p> <p>b) thickness in mm</p> <p>c) Type of core</p> <p>d) Operating flux density</p> <p>e) Maximum flux density</p> <p>f) Over fluxing capability for 10% voltage &amp; 3% frequency variation</p> <p>g) Specific No load loss for the grade of core chosen at the specified flux density.</p> <p>h) Net weight of CRGO lamination in core. (Kg minimum). ( Please submit copy of graph in support of this)</p>	<p>Yes / No</p> <p>Watts/Kg</p>	
27.0	<p>Details of CTs on HV Bushings (Line )</p> <p>a) No. of cores</p> <p>b) Ratio for each core</p> <p>c) VA burden - for each core (along with <math>I_{mag}</math> and <math>V_K</math> wherever necessary)</p> <p>d) Accuracy class of each core</p> <p>e) Year of manufacture.</p> <p>f) Short time thermal current rating</p> <p>i) Current</p> <p>ii) Rated time</p>	<p>kA</p>	
28.0	<p>Details of CTs on LV Bushings.(Line )</p> <p>a) No. of cores</p> <p>b) Ratio for each core</p> <p>c) VA burden - for each core (along with <math>I_{mag}</math> and <math>V_K</math> wherever necessary)</p> <p>d) Accuracy class of each core.</p> <p>e) Year of manufacture.</p> <p>f) Short time thermal current rating</p> <p>i) Current</p> <p>ii) Rated time</p>	<p>kA</p>	
29.0	Rail gauge (along both axis)		
30.0	Whether Neutral end surge diverter recommended by bidder		

31.0	<p>If yes details of surge diverter</p> <ol style="list-style-type: none"> <li>a) Type</li> <li>b) Make kV class kV rating</li> </ol>		
32.0	<p>Tertiary winding if any kept isolated then the bidder to state whether one terminal to be earthed or any other precautions required during service conditions</p>		
33.0	<p>On load tap changer Particulars</p> <ol style="list-style-type: none"> <li>a) Make</li> <li>b) Type, designation</li> <li>c) Suitable for auto/manual operation</li> <li>d) Rated voltage kV</li> <li>e) Basic insulation level (BIL) of OLTC (kV peak)</li> <li>f) One minute power frequency voltage withstand of OLTC</li> <li>g) Rated current (A)</li> <li>h) No. of steps</li> <li>i) Step voltage (V)</li> <li>j) Rated voltage of drive motor V</li> <li>k) Whether diverter and selector chambers are separate.</li> <li>l) Rated voltage of control circuit V</li> <li>m) Time to complete tap changing operation from any one step to next higher or lower tap.             <ol style="list-style-type: none"> <li>i) On auto operation - Sec.</li> <li>ii) On manual operation through push button - Sec.</li> </ol> </li> <li>n) List of routine tests to be carried out on tap changer</li> <li>o) Location of the taps with respect to the terminals of the tapped winding</li> <li>p) Drawing or pamphlet number of the technical and descriptive particulars of the OLTC, enclosed with the bid.</li> <li>q) Separate conservator and Buchholz relay provided for OLTC (Yes/No)</li> <li>r) RTCC (Remote Tap Changer Control Panel)             <ol style="list-style-type: none"> <li>i. List of tap changer Annunciation</li> <li>ii. Two sets of potential free contacts for SCADA provided.</li> <li>iii. Two sets of 0/20 mA output for tap position indication provided.</li> <li>iv. 415 V Auto changeover facility for OLTC motor provided.</li> </ol> </li> </ol>		



34.0	<p>Marshalling Box</p> <p>a) Derived control supply Voltage</p> <p>b) 415 V /control supply auto-changeover facility provided.</p> <p>c) Local OTI/WIT provided.</p> <p>d) Remote OTI/WIT provided.</p> <p>e) Two sets of 0/4-20 mA signals for OTI/WIT provided.</p> <p>f) List of annunciations.</p> <p>g) Two sets of potential free contacts for annunciations provided.</p>		
35.0	Whether Marshalling boxes (ground as well as tank) provided as per specifications		
36.0	<p>Surface Preparation/Painting</p> <p>1) Material used fir Adequate rust proofing done on transformer and radiator (Details of measures to be enclosed)</p> <p>2) Type of paint (epoxy/enamel)</p> <p>3) Whether galvanized radiator offered as alternative.</p>		
37.0	<p>Conservator Oil preservation system Details (Air bag)</p> <p>a) Material of separator/Air bag</p> <p>b) Details of air pressure for the separator</p> <p>i. Design pressure</p> <p>ii. Working pressure</p> <p>iii. Bursting pressure (Puncture strength)</p> <p>c) Procedure of oil filling with air bag to be enclosed.</p> <p>d) Any precautions to be taken during maintenance of transformer with air bag to be mentioned here.</p>		
38.0	General arrangement drawing of the transformer indicating details of HV/MV/LV terminals and over all dimensions enclosed		Yes/No
39.0	Neutral Bushing Calculation to be submit.		Yes

**20. SCHEDULE “B” DEVIATIONS:**

**(TO BE ENCLOSED WITH TECHNICAL BID)**

All deviations from this specification shall be set out by the Bidders, clause by Clause in this schedule. Unless specifically mentioned in this Schedule, the tender shall be deemed to confirm the purchaser's specifications:

SL. No	Clause No.	Details of deviation with justifications

We confirm that there are no deviations apart from those detailed above.

Seal of the Company:

Signature

Designation

# **STANDARD TECHNICAL SPECIFICATION COVER SHEET**

**Specification No. : ENG-EHV-1003**

**Specification Name : Technical Specification for 33/11kV 20/25 MVA Power Transformer**

<b>SATYA PRASAD NAYAK</b>	<b>SHANTAPRIYA JENA</b>	<b>JYOTIPRAKASH MOHANTY</b>	<b>Vijender Goyal</b>	<b>KHAJAN BHARDWAJ</b>	<b>POURUSH GARG</b>
Prepared by	Reviewed by	Reviewed by	Reviewed by	Approved by	Released by
TPCODL	TPNODL	TPWODL	TPSODL	TPCODL	TPCODL
07-12-2022	07-12-2022	07-12-2022	07-12-2022	07-12-2022	08-12-2022

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## 1. SCOPE:

This Specification provides for design, engineering, manufacture, assembly, stage inspection, final inspection and testing before dispatch, packing and unloading at destination Sub-station / stores by road transport, transit insurance, of 33kV/11kV, 20/25 MVA Power Transformer(s), complete with all fittings, accessories, associated equipment, spares, required for its satisfactory operation in any of the sub-stations of the Purchaser.

The Transformer shall be of outdoor type with tap changers as detailed below.

### 20 & 25 MVA - ON Load Flange Mounted type Tap Changer

Such of the parts that may have not been specifically included, but otherwise form part of the transformer as per standard trade and/or professional practice and/or are necessary for proper operation of transformer, will be deemed to be also included in this specification. The successful bidder shall not be eligible for any extra charges for such accessories etc. notwithstanding the fact that at the time of an initial offer bidder had segregated such items and quoted for them separately.

## 2. APPLICABLE STANDARDS:

The equipment ( and the materials used ) covered by this specification shall unless otherwise stated, be designed, manufactured and tested in accordance with the latest editions of the following Indian standards & other relevant standards for components, BEE & CEA guidelines with latest amendment from time to time, thereof, some of which are listed below:

Sl.No	Reference Standard	Reference Standard Name
1	IS 5	Specification for Colors for Ready Mixed Paints and Enamels
2	IS 104	Specification for ready mixed paint, brushing, zinc chrome, priming
3	IS 335	Specification for New insulating oils
4	IS 649	Methods for testing steel sheets for magnetic circuits of power Electrical apparatus.
5	IS 1576	Solid Pressboard for Electrical Purposes -Specification
6	IS 2026	Specification for Power Transformers

7	IS 2099 / IEC-61037	Specification for Bushings for Alternating Voltages Above 1000 Volt
8	IS 2362	Determination of Water content in oil by Karl in oil Fischer Method- Test Method
9	IS 2544	Specification for Porcelain post insulators for systems with nominal Voltage Greater than 1000V
10	IS 2705	Specification for Current Transformers
11	IS 3401	Specification of Silica Gel
12	IS 3637/ IEC-364	Specification for gas operated relay (Buchholz relay).
13	IS 4253: Part II	Specification for cork composition sheets - Part II: Cork and Rubber
14	IS 4257 (PART I)	Dimensions for Clamping Arrangements for Porcelain Transformer Bushings - Part I : For 12 kV to 36 kV Bushings
15	IS 5082	Specification for Wrought Aluminum and Aluminum Alloy Bars, Rods, Tubes, Selection, Plates and Sheets for Electrical purposes
16	IS 5561	Specification for Electric Power Connectors.
17	IS 6103	Specification for Method of Testing of specific resistance (Resistivity) of electrical insulating liquids
18	IS 6262	Method of test for power factor and dielectric constant of electrical Insulating liquids
19	IS 6600	Guide for Loading of Oil-immersed Transformer.
20	IS 6792/ IEC-156	Method for Determination of Electric Strength of Insulating Oil
21	IS 8468	On-load tap changers
22	IS 8603 (PART-1)	Dimensions for Porcelain Transformer Bushings for Use in Heavily Polluted Atmospheres - Part I: 12 kV, 17.5 kV, 24 kV and 36 kV Bushing
23	IS 9335	Specification for Cellulosic Papers for Electrical Purposes
24	IS 10028:	Code of Practice for Selection, Installation and Maintenance of Transformers

25	IS 12444	Specification for Continuously Cast and Rolled Electrolytic Copper Wire Rods for Electrical Conductors.
26	IS 13964	Methods of Measurement of Transformer and Reactor Sound level
27	IS 3639	Specification for fitting & accessories of Power Transformer
28	IS 1866	Code of practice for maintenance of transformer oil
29	IEC 60156	Insulating liquids - Determination of the breakdown voltage at Power frequency - Test method
30	IS 2074	Ready Mixed Paint, Air Drying, Red Oxide Zinc Chrome, Priming – Specification
31	IS 2932	Enamel, Synthetic, Exterior: (a) Undercoating (b) Finishing – Specification
32	IEC 60296	Specification for unused mineral insulating oils for transformers And switchgear
33	IEC 60529	Degrees of protection provided by enclosures (IP Code)
34	IEC 60437	Radial Interference test on high-voltage insulator
35	IEC 61936-1	Power Installation exceeding 1kV.
36	C.B.I.P Publication	Manual on Transformers
37	IEC 60641	Pressboard and presspaper for electrical purposes

*\*In case of any conflict on any technical particular in the specification, the stricter requirement mentioned in the relevant standard shall be valid.*

### 3. CLIMATIC CONDITIONS:

1	Maximum ambient temperature	50 deg C
2	Max. Daily average ambient temp	35 deg C
3	Min Ambient Temperature	0 deg C
4	Maximum Humidity	95%
5	Average Annual Rainfall	1500mm
6	Average No. of rainy days per annum	120

7	Altitude above MSL not exceeding	1000m
8	Wind Pressure	300 Km/hr
9	Earthquakes of an intensity in horizontal direction	equivalent to seismic acceleration of 0.3g
10	Earthquakes of an intensity in vertical direction	equivalent to seismic acceleration of 0.15g (g being acceleration due to gravity)

TPCODL/TPNODL/TPSODL/TPWODL service area has heavy saline conditions along the coast and High cyclonic Intensity winds with speed upto 300 Kmph. The atmosphere is generally laden with mild acid and dust in suspension during the dry months and is subjected to fog in cold months.

#### 4. GENERAL TECHNICAL REQUIREMENTS:

4.1 The transformer shall conform to the following specific parameters.

Sl.no.	Parameters	Desired Values
1	Rated MVA (MVA)	20/25 MVA
	ONAN	20 MVA
	ONAF	25 MVA
2	No. of phases	3
3	Type of installation	Outdoor
4	Frequency	50 Hz ( $\pm 5\%$ )
7	Rated voltage	
	a) High voltage winding	33 KV
	b) Low voltage winding	11 KV
8	Highest continuous system voltage	
	a) HV Winding	36 KV
	b) LV	12 KV
9	No. of Windings	Two Winding Transformer
10	Type of Cooling	ONAN
12	Method of connection	
	HV	Delta
	LV	Star
13	Vector Group	Dyn11



14	System Earthing (Neutral terminal to be brought out)	Neutral LV side to be solidly earthed
15	Percentage impedance voltage on normal tap at Base MVA <b>(Tolerance shall be as per IS 2026 Part-1, Clause 9, Table No.1)</b>	10 %
16	Transformer shall be suitable for continuous operation at a voltage of 110% on each operating tap. Transformer shall be suitable to withstand 120% of the loading on each tap.	
17	Transformer shall be capable of delivering the rated current at a voltage equal to 105% of rated voltage, without exceeding the temperature rise specified.	
18	Over Voltage operating capability and duration	112.5 % of rated voltage ( continuous )
19	Maximum Flux Density	1.6 Tesla
20	Basic Insulation levels for windings(Neutral should not be shaded) :-	
	a) 1.2 / 50 microsecond wave shape Impulse withstand (KVP)	33KV : 170 11KV: 95
	b) Power frequency voltage withstand (KV rms)	33KV : 70 11KV: 28
21	Type of winding insulation	Uniform
22	Withstand time for three phase short circuit at LV Bushings	3 Seconds
23	Permissible Temperature Rise over ambient temperature of 50 deg C	
	a) Of top oil measured by thermometer.	45 Deg C
	b) Of winding measured by resistance.	55 Deg C
24	Minimum clearances in air (mm) :-	
	HV	Phase to Phase: 400 Phase to ground: 320
	LV	Phase to Phase: 280 Phase to ground: 160
25	Core Material	CRGO Silicon Steel, M3 or better
26	Class of Insulation	A/A
27	Terminals	
	a) HV winding	36 KV oil filled communicating type porcelain bushings (Anti-fog type)
	b) LV winding	17.5 KV porcelain type of bushing (Antifog type )
28	Insulation levels for windings :-	

	a) 1.2 / 50 microsecond wave shape Impulse withstand (KVP)	33KV : 170 11KV: 95
	b) Power frequency voltage withstand (KV rms)	33KV : 70 11KV: 28
	c) creepage distance (min)	33KV : 1116 mm 11KV: 372 mm
29	Material of HV & LV Conductor	Electrolytic copper
30	Maximum current density for HV and LV winding for rated current	2.4 A / mm <sup>2</sup>
31	Polarisation index i.e ratio of megger values at 600 sec. to 60 sec for HV to earth, L.V to earth and HV to LV .	Shall be greater than or equal to 1.5, but less than or equal to 5
32	Core Assembly	Boltless Type
33	WTI & OTI	1 nos each
34	Losses	The losses shall not exceed the value given below
	a) No load loss(fixed losses) KW	12 KW
	b) Load losses at 75°C KW (at ONAN)	64 KW
	c)Maximum guaranteed Auxiliary load losses(includes fans/coolers capacity)	2 KW
	d) Maximum guaranteed Total losses (TLmax) ( a+b+c)	78 KW
35	Wheels	The transformer shall be provided with four flanged bi-directional rollers suitable for rail gauges in both the axis for movement of the transformer in either direction.
36	Over fluxing capability	Transformers shall be designed for continuous over fluxing withstands capability due to +10% to –10% voltage variation on HV side and frequency variation of ±3%. Combined variation of voltage and frequency shall be within ±10%.
37	Auxiliary Supply	



**Specification No:** [ENG-EHV-1003](#)

**Specification Name:** Technical Specification for 33/11kV 20/25 MVA Power Transformer

	a) AC	415 Volts 3 phase 4 wire, ungrounded (Provision to connect neutral to be made in the terminal block). Two 415 V sources shall be made available by TPCODL/TPNODL/TPSODL/TPWODL
	b) DC	24V/48V DC
38	No Load Current	No Load Current shall be 0.5% of full load current. Tolerance for No-Load Current shall be +30% of the declared value.
39	Core Grounding	The core and frame grounding connection shall be brought out through a suitable bushing for provision of external grounding. The bidder shall submit the drawing clearly showing the details of core grounding.
40	On Load Tap changer (OLTC) on HV Side	
	a) Type	On Load (Flanged type)
	b) Range	+ 4.686% to -20.606 % in steps of 1.56%
	c) Number of Steps	16 (17 Position)
	d) Principal Tap Position	5th
	e) Manual / Automatic	Yes (Both)
	f) Remote / Local	Yes (Both)
	g) IS	8468-2006
	h) All contacts should be SCADA compatible and suitable for connection to TMU	Yes
	i) Separate Conservator and OSR, PRV & MOG	Yes
	j) Potential free contacts for SCADA shall be Provided	Yes
	k) 415 V Auto change over facilities for OLTC Motor shall be Provided	Yes
	l) Flow of Power	Bidirectional
	m) Surge Relay	Yes
	n) Whether separate tap winding provided for OLTC	Yes
	o) RTCC	No
	p) SCADA and TMU compatibility	Yes

WTI CT for LV Side:	CTR: 1312/1	Class:0.5	Burden: 30 VA	ISF<10
WTI CT for HV Side:	CTR: 435/1	Class:0.5	Burden: 30 VA	ISF<10



Specification No: [ENG-EHV-1003](#)

Specification Name: Technical Specification for 33/11kV 20/25 MVA Power Transformer

WTI HV and LV Side to be Wired according in Marshalling Panel.

Neutral CT (Bushing CT) in supplier's scope (CTR shall be decided in detailed Engineering)  
Accuracy Class:PS ,  
Knee Point Voltage>500V,  
Imag at Vk/s <100mA,  
ISF <=5,  
Rct<6 Ohm.

## 4.2 PERFORMANCE

- I. The transformer 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.
- II. Transformer shall be capable of operating under natural cooled condition up to specified load.
- III. The transformer shall be designed with particular attention to the suppression of maximum harmonic voltage, especially the third and fifth harmonics so as to minimize interference with communication circuit.
- IV. The transformer shall be able to withstand thermal and mechanical stresses caused by symmetrical or asymmetrical fault on any winding.
- V. The transformer and all its accessories including CTs etc. shall be designed to withstand thermal and mechanical effects of any external short circuits to earth and short circuits at the terminals of any winding for a period of 3 sec without any damage/injury.
- VI. Loading of the transformer shall be as per IS: 6600, IS: 2026 part-7, IEC 60076-7
- VII. Transformer shall be compatible for Operation along with Tap Changer Control panel or Transformer Monitoring Unit (TMU). Supply of TMU is not in scope of Bidder.

## 5. GENERAL CONSTRUCTION:

### 5.1 GENERAL:

- I. All transformers shall be provided with detachable, flanged, bi-directional wheels for movement and mounting on rail gauge. TPCODL/TPNODL/TPSODL/TPWODL shall provide rail tracks grouted in concrete foundation. Bidder shall provide means for locking the wheels in positions parallel to and at right angles to the longitudinal axis of the tank.
- II. Transformer shall be two winding type, with cold rolled grain oriented, silicon-steel laminations having excellent magnetic properties, insulated and clamped to minimize vibration and noise. Laminations shall be insulated from each other with material having high inter-lamination insulation resistance and rust inhibiting property All covers and seals shall be oil and airtight and shall not be affected by mineral or synthetic oil action.
- III. All fasteners of M10 and below size should be of stainless steel. All fasteners of M12 and above size should be hot dip galvanized. To achieve a good quality corrosion free painting, bidder should provide epoxy plus polyurethane paint with minimum paint thickness of 120 microns.
- IV. The framework, clamping arrangement and general structure of the cores of each transformer shall be of robust construction, **having proper support structure** and shall be capable of

withstanding any shock to which they may be subjected during transport, installation and service. **Detailed calculation for selection of bolts shall be submitted.** The framework and the core bolts shall be efficiently insulated from the core so as to reduce the eddy-currents to a minimum.

- V. The limbs and the yokes of the core shall have similar sections to minimize heating and noise arising from transverse flux. The joints in the laminated magnetic circuit shall be interleaved. Necessary cooling ducts shall be provided for heat dissipation from the core so that the anticipated maximum hot spot temperature in the core shall not be injurious to any material used in the core assembly.
- VI. The core clamping frame shall be provided with lifting eyes having ample strength to lift the complete core and winding assembly. The core assembly of oil immersed transformers shall be electrically connected to the transformer tank for effective core earthing.
- VII. The neutral terminal shall be brought out through neutral bushing from the tank and the same shall be brought up to the skid level, duly insulated by means of suitably rated epoxy insulators. The neutral conductor lead shall be of copper conductor designed to carry the maximum Earth Fault Current with solidly earthed neutral. **The bidder shall justify the voltage/current rating of the neutral bushing chosen during detailed engineering.** The voltage rating of the neutral bushing shall be chosen considering the probable voltage rise for neutral floating conditions. The current rating shall be chosen considering solidly earthed neutral. The neutral shall be formed at the bottom of the winding and brought to LVN bushing through a separate path.
- VIII. Top sampling valve shall be internally/externally piped and brought out of the tank sideways at skid level.
- IX. Transformer with all accessories shall be of free-standing type. Transformer accessories shall be designed in such a way that no supporting posts/structures are necessary other than the rail.
- X. The sets of radiator banks shall be connected to the main tank through a header pipe welded to the tank. Design wherein individual radiator is connected to main tank is not acceptable. Individual radiator tubes shall be connected to main tank thru butterfly valves at both ends of radiator tubes. Arrangement shall be made for suitable gap between main tank and radiator tubes.
- XI. Transformer conservator shall have Silica gel breather.
- XII. The oil level shall be higher than HV bushing terminal.
- XIII. The part of the HV bushing terminal to which overhead conductor is connected should not be involved either in the oil sealing arrangement or air release arrangement. This is to be specifically confirmed by the bidder at the time of offer.
- XIV. Two separate parts shall perform the two functions of receiving the jumper and oil sealing.
- XV. Air seals are not acceptable at HV bushing terminals.
- XVI. The oil shall be supplied in non-returnable drums. The quantity shall be of 10% excess over the requirement of transformer at 30°C.
- XVII. Magnetic oil level indicator shall comprise with 2 nos. mercury contact/switch (for High / Low oil level alarm).
- XVIII. Breather shall be used for main tank and Silica gel/ Silica gel beads breather with clear sight glass & oil sealing arrangement shall be used for OLTC purpose.
- XIX. The transformer shall be suitable for operation at full rated power on all tap positions without exceeding the applicable temperature rise. The transformer shall be designed to suppress harmonic content, especially the third and fifth, so as to eliminate distortion in the waveform and consequent additional insulation stress, noise on communication system and undesirable circulating currents between the neutrals at different transformer stations.

- XX. The design of each transformer shall be such that the risk of accidental short-circuits due to birds or vermin are obviated.
- XXI. All outdoor apparatus, including bushing insulators and fittings shall be so designed that they do not collect water at any point.
- XXII. All electrical connections and contacts shall be of ample cross sections for carrying the rated current without excessive heating. All such contacts shall be tinned copper to avoid bi-metallic affect.
- XXIII. Each transformer shall be designed for minimum no-load and load losses within the economic limit and as per the Indian Standards.
- XXIV. Ground terminals shall also be provided on marshalling box, OLTC local control panel and cable end box to ensure effective earthing.
- XXV. For continuity of earth connection, all gasket joints shall be provided with minimum two numbers tinned copper strip jumpers of adequate size.
- XXVI. Rain Guard shall be provided for LV compartment, Buchholz Relay, OSR, PRV, SPR, and Marshalling Box so that rain water can enter to the junction box of these relays/ cubicles. Wiring shall be bottom entry.
- XXVII. At the time of erection and commissioning, authorized person of the bidder shall be present at the site till completion of the work.
- XXVIII. Cable trays of appropriate size to be provided at necessary locations.

**5.2 CORE:**

- I. The core shall be of high grade cold rolled, non-ageing, grain oriented, annealed silicon steel lamination (CRGO), having low loss & good grain properties, coated with hot oil proof insulation, bolted together to the frames firmly to prevent vibration or noise.
- II. The grade of core shall be M3 or better. The core shall be stress relived by annealing under inert atmosphere if required, especially suitable for transformer.
- III. All core clamping bolts (If any) shall be effectively insulated. Only one grade and one thickness of core shall be accepted and no mixing of different grades shall be allowed.
- IV. The complete design of the core must ensure permanency of the core losses with continuous working of the transformers.
- V. The value of the maximum flux density allowed in the design & grade of laminations used shall be clearly stated in the offer.
- VI. The successful bidder is required to submit the following documents with regard to the procurement of core material:
  - a) Invoice of supplier
  - b) Mill's test certificate
  - c) Packing list
  - d) Bill of landing
  - e) Bill of entry certificate by custom
  - f) Description of material, electrical analysis, physical inspection certificate for surface defects, thickness and width of the material
  - g) Subjecting to at least 10% of the transformer to routine tests and no load and load loss measurement
- VII. TPCODL/TPNODL/TPSODL/TPWODL shall impose heavy penalty or black list bidders using seconds/ defective CRGO sheets or load losses found to be more than stipulated limit.
- VIII. After being sheared the laminations shall be treated to remove all burrs. Both sides of steel laminations shall be so constructed that eddy currents will be minimum.
- IX. The core frame shall be provided with lugs suitable for lifting the complete core and coil assembly of the transformer.

- X. The core and the coil shall be so fixed in the tank that shifting will not occur when the transformer is moved or during a short circuit.
- XI. All steel sections used for supporting the core shall be thoroughly sand blasted after cutting, drilling and welding. Each core lamination shall be insulated with a material that will not deteriorate due to pressure and hot oil.
- XII. The supporting frame work of the core shall be so designed as to avoid presence of pockets which would prevent complete emptying of tank through drain valve or cause trapping of air during oil filling. Adequate lifting lugs shall be provided to enable the core and windings to be lifted.
- XIII. Core Grounding:
  - a) The grounding lead from the core shall be brought out of the tank through a 11kV class bushing and grounded externally.
  - b) A protective cover shall be provided for the bushing.
  - c) The core grounding rod (stem) through the bushing shall be solid rod (stem).
  - d) The design of core grounding arrangement shall be such that the grounding links shall not come out of core during installation as well service conditions.
  - e) The supplier shall submit a drawing clearly showing the details of core grounding.
  - f) The core / frame grounding's both connections shall be brought out through a suitable bushing for provision of external grounding.

### 5.3 WINDINGS:

- I. The windings shall be so designed that all coil assemblies of identical voltage ratings shall be interchangeable, and field repairs to the windings can be made readily, without special equipment.
- II. The coils shall be supported between adjacent sections by insulating spacers, and the barriers bracings and other insulation used in the assembly of the windings shall be arranged to ensure a free circulation of the oil and to reduce hot spots in the windings.
- III. Coils should be transposed to minimize magnetic forces and extra supports shall provide for inter-disc connection.
- IV. All materials used in the insulation and assembly of the winding shall be new, insoluble, non-catalytic and chemically inactive in the hot transformer oil and shall not soften or otherwise be adversely affected under the operating conditions.
- V. The current density of coil shall not exceed 2.4 Amps/ sq mm at min tap of respective PTR's higher rating.
- VI. All threaded connections shall be provided with locking facilities. All leads from the winding to the terminal board and bushings shall be rigidly supported to prevent injury from vibration. Guide tubes shall be used where practicable.
- VII. The winding shall be brought out through bushing and provided with suitable terminal connectors, the details of which will be forwarded later.
- VIII. The windings shall be clamped securely in place so that they will not be displaced or deformed during short circuits. The assembled core and windings shall be vacuum-dried and suitably impregnated before removal from the treating tank. The copper conductors used in the coil structure shall be best suited to the requirements and all permanent current carrying joints in the windings and the leads shall be brazed.
- IX. Sharp bends should be avoided in the windings as far as possible, where unavoidable such bends should be reinforced with extra insulation tapes.
- X. The tolerance for the winding resistance measurement for different phases but at same taps shall be limited to 1%.
- XI. The change in impedance values between the winding (HV/LV) shall not exceed  $\pm 10\%$  of nominal impedance value as specified at all taps on HV/LV side.

- XII. The windings shall be brought out through bushing. The windings shall be designed to withstand the specified thermal and dynamic short-circuit stresses.
- XIII. The end turns of the high voltage windings shall have reinforced insulation to take care of the voltage surges likely to occur during switching or any other abnormal condition.
- XIV. Winding shall be suitable for connection of reactors or capacitors which would be subjected to frequent switching. All the windings shall be capable of withstanding stresses that may be caused by such switching.
- XV. Primary and secondary windings shall be constructed from high- conductivity (copper conductors), Double Paper Covered (DPC) copper conductor.
- XVI. The insulation between core and bolts and core and clamps shall withstand 2.5 kV for one minute.
- XVII. Proper bonding of inter layer insulation with the conductor shall be ensured. Test for bonding strength shall be conducted as per standards.
- XVIII. All turns of windings shall be adequately supported (by which material) to prevent movement. The core/coil assembly shall be securely held in position to avoid any movement under short circuit conditions.
- XIX. The joints in the winding shall be avoided but if it is necessary then, these shall be properly brazed and the resistance of the joints shall be less than that of parent conductor. Crimping is not allowed at any joints.

**5.4 INSULATING PAPER AND INSULATING PRESS BOARD :**

- I. The bidder shall submit characteristics along with make for all the type of insulation papers and Pressboards to be used with the offer.
- II. For Winding insulation, only Double Paper Covered insulation is acceptable with laying in opposite direction to each other and each paper must have overlapping more than 25% of its width.
- III. Kraft paper and Pressboard should be made of pure Cellulose from soft wood pulp manufactured from sulphate process. No additive, adhesive or coloring matter shall be present.
- IV. Kraft paper and Pressboard should be of class A (105°C) insulation material.
- V. All spacers, axial wedges / runners used in windings shall be made of pre-compressed solid pressboard.
- VI. All axial wedges/runners shall be properly milled to dovetail shape so that they pass through the designed spacers freely.
- VII. Insulation shearing, milling and punching operations shall be carried out in such a way, that there should not be any burr, sharp edges and dimensional variations.
- VIII. Kraft paper self-adhesive tape to be used for bonding of insulating paper layer, spanner and paperboards that are immersed in the oil filled transformer.

Below required values could be verified if required at any stage of the inspection and it should fulfill the requirement as per below table

Characteristics	Kraft Paper	Pressboard (all Sizes)
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1. Dimension	As specified by bidder with $\pm 5\%$ tolerance.	As specified by bidder with tolerance as per IS1576.
2. Apparent Density	$>0.80 \text{ g/cm}^3$	as per IS1576 w.r.t Thickness
3. pH of Aqueous extract	6-8%	6-8%
4. Electrical strength		
i) in air	7KV/mm	12KV/mm
ii) In Oil	-----	35KV/mm
5. Ash content	Maximum 1%	Maximum 0.7
6. Moisture content	Maximum 8%	Maximum 8%
7. Oil absorption	-----	Minimum 9%

Bidder has to submit the test certificates as per IS-9335, IS-1576 for all type of insulating materials covering above stated parameters along with below parameters during stage inspection:

1. Substance (Grammage) (g/m<sup>3</sup>)
2. Compressibility
3. Tensile strength
4. Conductivity of water extract
5. Shrinkage in air
6. Flexibility
7. Cohesion between plies<sup>1</sup>.
8. Elongation
9. Air permeability
10. Tear index
11. Heat stability

#### 5.5 TRANSFORMER TANK :

- I. The transformer tank and cover shall be fabricated from good commercial grade low carbon steel suitable for welding and shall be of adequate thickness.
- II. The tank shall be welded construction & top cover shall be flanged type. All seams shall be welded and where practicable they shall be double welded.
- III. The main tank body of the transformer, excluding tap changing compartments and radiators, shall be capable of withstanding pressure of 760mm of Hg.
- IV. The tank material shall be as per IS: 2026 or equivalent with ultrasonic testing done for elimination of defects in rolled plates.
- V. The welding shall be as per prior approved WPS (Welding Procedure Specs) by trained and tested welders. Calculations and documents should be submitted bidders.
- VI. The welding plan shall be shown in general i.e. Category-wise or for each type of weld in the mechanical fabrication drawing, which shall be submitted to TPCODL/TPNODL/TPSODL/TPWODL

- VII. All fittings like elbows, bends etc. shall be seamless as per applicable American or Indian Standards.
- VIII. No resistance welding of fasteners shall be done anywhere on the transformer.
- IX. To ensure oil tightness, recessed neoprene or equivalent gaskets shall be used.
- X. Manholes with welded flange and bolted covers shall be provided on the tank.
- XI. The manhole shall be of sufficient size to afford easy access to the lower ends of all the bushings, OLTC terminals etc. to permit replacement of auxiliaries without removing tank covers.
- XII. Suitable guides shall be provided for positioning the various parts during assembly or dismantling.
- XIII. Adequate space shall be provided between the cores and windings and the bottom of the tank for collection of any sediment.
- XIV. All joints including bolted as well as flanged, shall have machined matching surfaces/inner edges with smooth finish, to ensure leak proof joints.
- XV. Lifting eyes or lugs shall be provided on all parts of the transformer requiring independent handling during assembly or dismantling. In addition, the transformer tank shall be provided with lifting lugs and bosses properly secured to the sides of the tank, for lifting the transformer either by crane or by jacks.
- XVI. The design of the tank, the lifting lugs and bosses shall be such that the complete transformer assembly filled with oil can be lifted with the use of these lugs without any damage or distortions.
- XVII. The tank shall be provided with two nos. of suitable copper alloy lugs for the purpose of grounding.
- XVIII. The grounding pads should be mirror finished. Two grounding pads, located on opposite sides of the tank shall be provided with two tapped holes for connecting it with station ground mat. Necessary hardware like M10 GS bolts and spring washers shall also be provided for connections. All outer nuts & bolts should be stainless steel type.
- XIX. Each tank shall be equipped with the following valves with standard flange connection for external piping,
  - a) One drain valve located on the low voltage side of the transformer and placed to completely drain the tank. At the option of the TPCODL/TPNODL/TPSODL/TPWODL's a large valve may be furnished with an eccentric reducer. This valve shall be equipped with a small sampling cock.
  - b) One filter valve located at the top of the tank on the high-voltage side. The opening of this valve shall be baffled to prevent aeration of the oil.
  - c) One filter valve, located slightly above the bottom of the tank.
  - d) One relief valve to operate at a pressure below the test pressure for the tank.
  - e) Other two nos. valves shall also be provided, as required for proper functioning of the transformer.
  - f) A suitable locking arrangement shall be provided for locking these valves in close/open position.
- XX. All valves should be provided with clear open/close position indications. Wherever rising spindle type valves are provided the valves should be clockwise rotating for closing operations. Any valve opening should not create hindrance to other operation.
- XXI. For the auxiliary lead wiring from individual instrument to marshalling box, the cables shall be provided in the conduits.
- XXII. All the transformers shall be provided with a ladder having 'anti-climbing' device.
- XXIII. Transformer tank shall be of welded sheet steel construction and provided with gaskets steel cover plates.

- XXIV. Base shall be suitably reinforced to prevent any distortion during lifting. Base channels shall be provided with skids and pulling eyes to facilitate handling.
- XXV. All seams shall be electrically double welded for absolute oil tightness.
- XXVI. Suitable arrangement shall be made for mounting HV and LV lightning arrestors of the transformer.
- XXVII. Guards shall be provided for drain, bottom sampling and filter valves to prevent oil pilferage.
- XXVIII. Minimum Thickness for the transformer shall be as follows:
- Tank Side wall :10mm
  - Tank Top Cover :12mm
  - Tank Bottom Plate :12mm
  - Conservator: 6mm

### 5.6 PAINTING

- Before painting, surface preparation shall be done by sand blasting and procedure for sand blasting has to be submitted by the Vendor along with the bid. The surface preparation for all external surface prior to painting or coating shall be witnessed by customer or shall be treated as customer hold points. After sand blasting at all edges Belzona E metal to be applied.
- Before shipment all steelwork not under oil shall be painted with a primary coat of anti-corrosive paint of durable nature and two coats of battleship grey paint (Shade 631 of IS: 5). Paint shall be epoxy type. The interior surfaces shall be painted as per bidder's standard practice. All the paint including primer shall be applied after testing such as air test, hydraulic test etc. Bidder shall submit their procedure for painting for TPCODL/TPNODL/TPSODL/TPWODL's approval, along with the offer.
- Painting of Marshalling box: Two coats of red oxide primer & two coats of synthetic enameled paint after chemical treatment.
- Metal parts not accessible for painting shall be made of corrosion resistant material.
- Paint shall be as per Indian Standard/International Standard for quality, surface preparation, application method, thickness check and any other test.
- Additional paint shall be supplied along with the transformer for applying touch up paint at site during installation. The shade of the paint used shall be shade 631 as per IS: 5.

### 5.7 SURFACE PREPARATION AND PAINTING

- The paint shall be applied by airless spray.
- Steel surfaces shall be prepared by proper cleaning method (IS-9954) to grade Sq.2.5 of ISO 8501-1 or chemical cleaning including phosphating of the appropriate quality (IS 3618).
- Heat resistant (Hot oil proof) paint shall be used for the inside surface and whereas for external surface one coat of thermosetting powder paint or one coat of epoxy primer (zinc chromate) followed by two coats of polyurethane (P.U.) base paint. as per table given below:

S.No.	Paint type (should be UV restraint, non-fading)	Area to be painted	No of coats	Total dry film thickness (min); micron
1	<b>Thermosetting powder paint</b>	Inside	01	30
		Outside	01	60
2	<b>Liquid Paint</b>			
a.	Epoxy (primer)	Outside	1	45
b.	P.U. Paint (finish paint)	Outside	2	35 (each)
c.	Hot oil resistant paint	Inside	1	35

The two coats shall be of oil and weather-resistant nature with final coat as glossy and non-fading paint of shade 631 as per IS 5 or RAL 7032.

- IV. The dry film thickness shall not exceed the specified minimum dry film thickness by more than 25%.
- V. Any damaged part shall be cleaned to bare metal with an area extending 25 mm around its boundary. A priming coat shall be immediately applied followed by full paint finish equal to that originally applied and extending 50 mm around the perimeter of the original damage. The repainted surface shall present a smooth surface which shall be obtained by carefully chamfering the paint edges before and after priming.
- VI. Painting shall not be affected by weather changes & performance against pilling out or fading etc. to be guaranteed for 5 Years.

### 5.8 BUSHINGS:

- I. Bushings provided by the bidder shall be as per IS2099-1986. The bushings shall have high factors of safety against leakage to ground and shall be so located as to provide adequate electrical clearance between bushings and grounded parts. Bushings of identical voltage rating shall be interchangeable. All bushings shall be equipped with suitable terminals of approved type and size and all external current carrying contact surfaces shall be plated, adequately. The insulation class of the high voltage neutral bushing shall be properly co-ordinate with the insulation class of the neutral of the high voltage winding.
- II. All main winding leads shall be brought out through outdoor type bushings as specified which shall be so located that the full flashover strength will be utilized and the adequate phase clearance shall be realized.
- III. Each bushing shall be so coordinated with the transformer insulation that all flash-over will occur outside the tank.
- IV. All porcelain used in bushings shall be of the wet process, homogeneous and free from cavities or other flaws. The insulation (porcelain) shall be without any joint. The glazing shall be uniform in colour and free from blisters, burns and other defects. Stresses due to expansion and contraction in any part of the bushing shall not lead to deterioration.
- V. In case of oil communicating type bushing (33kV & 11kV), venting screw of the hollow stud, shall be provided with Teflon gaskets, to avoid oil leakage problem through the same. Angle of inclination to vertical for any bushing shall not exceed 30 deg. All bushings shall have puncture strength greater than the dry flash-over value.
- VI. Main terminals shall be solder less terminals, and shall be of the type and size specified in the drawings. The spacing between the bushings must be adequate to prevent flashover between phases under all conditions of operation.
- VII. The Bidder shall give the guaranteed withstand voltages for the above and also furnish a calibration curve with different settings of the co-ordination gap, to the TPCODL/TPNODL/TPSODL/TPWODL to decide the actual gap setting. Bidder's recommendations are also invited in this respect.
- VIII. The following routine tests shall be carried out on all bushings in the presence of TPCODL/TPNODL/TPSODL/TPWODL's representative, in addition to any other specified in the IS:
  - a) Visual examination
  - b) One minute dry withstand test
  - c) Oil tightness test

- IX. The bushings shall have a link type isolating facility for tap for maintenance tests viz. power factor measurement etc. (Terminal shall be provided for the measurement of power factor and tan delta).
- X. Bushing shall be as per the approved make only. All Type test report should be submitted along with bid.
- XI. Termination Arrangement on 11KV and 33KV Side :

**Option 1: (33KV Indoor AIS/GIS and 11KV indoor AIS )**

- a. For 33 KV side cable termination, Palm Connector & Extended copper Busbar of suitable size (60mm X 10mm) for termination of 1C X 630 sqmm cable. Proper supporting arrangement for extended bus bar and cables shall be provided.  
For 11 KV side cable termination, Palm Connector & Extended Copper Busbar of suitable size (75mm X 12mm) for termination of 3 runs of 1C x 630 sqmm. . Proper supporting arrangement for extended bus bar and cables shall be provided.
- b. Copper bus bar for connecting transformer bushings to cables with support insulators and insulation sleeve
- c. Frame for cable mounting with HDPE cleats.
- d. Detailed size of all the item shall be submitted during detailed engineering for approval.
- e. Suitable Bimetallic Connector to be supplied wherever applicable

**Option 2 : (33KV Outdoor Switchyard and 11KV indoor AIS )**

- a. On 33KV side, suitable provision to connect Zebra/Panther/Dog/Coyote Conductor.
- b. For 11 KV side cable termination, Palm Connector & Extended Busbar of suitable size (75mm X 12mm) for termination of 3 runs of 1C x 630 sqmm . Proper supporting arrangement for extended bus bar and cables shall be provided
- c. Frame for cable mounting with HDPE cleats.
- d. Detailed size of all the item shall be submitted during detailed engineering for approval.
- e. Suitable Bimetallic Connector to be supplied wherever applicable

**5.9 RADIATORS**

- I. The radiators shall be epoxy painted the entire surface including edges should be cleaned property before painting to avoid peeling of paint at the edges.
- II. Radiators shall be metal spray painted.
- III. Bidder shall submit procedure for surface preparation and painting of radiators along with the bid.
- IV. The color shade for the radiator shall be shade 631 as per IS: 5.
- V. Tank mounted radiators shall be of the detachable type with bolted and gasketed flanged connections. Proper continuous earthing (may be through Transformer body) should be ensured.
- VI. The following accessories shall be provided for radiator:
- a. Shut off valves and blanking plates on transformer tank at each point of
- b. Top and bottom shut off valves and blanking plates on each radiator.
- c. Lifting Lugs

- d. Top Oil filling Plugs
- e. Air release plug on top
- f. Oil Drain Plug at Bottom.
- g. Top Oil Filling Pump.

All radiators shall be tested for.

- a. Vacuum test for one hour
  - b. Hydraulic pressure test using transformer oil for one and half hour (as per ASME)
  - c. Air test can be done in place of hydraulic pressure test provided.
  - d. Water tank will be made available for submerging the radiators into water for leak detection.
  - e. All the tests shall be done in black condition (i.e. before applying any paint).
- VII. The transformer design shall be such that the radiators and conservator can be mounted on either side of the tank connection

#### 5.10 INTERNAL EARTHING

- I. Provision of complete earthing of transformer and associates should be ensure by bidders. Earthing of Main tank, OLTC Conservator, Radiator, NIDS and other shall be ensured through 50X6mm GI flat with double hole provision wherever applicable with minimum 80-100mm length.
- II. Provision of continuity of earthing shall also ensure for gasket arrangement, doors and all other extended/open able arrangements with flexible copper wire of adequate size.
- III. Equipotential strips need to be provided on flange joint ( above Butterfly Valve) of radiators, flange joint of conservator tank, two places diagonally at top cover flange joint, flange joint of OLTC

#### 5.11 OIL:

- I. Oil for first filling, together with 10% extra shall be supplied with each transformer. The oil shall comply in all respects with the provisions of IS 335 & IEC No.60296 latest amendment. Particular attention shall be paid to deliver the oil free from moisture having uniform quality throughout in non-returnable steel drums.
- II. The oil shall be of EHV grade and shall have the following main characteristics or equivalent (the requirements indicated are determined in accordance with the test methods as per IS: 335). The oil in the transformer shall be filled up to 'Transport filled level' before dispatch of the transformer.
- III. The maker of the oil shall be as per approved list and should comply below mentioned technical requirements:

Sl. no.	Characteristics	Requirement as per IS 335	Method of Test
1	Appearance	The oil shall be clear and transparent and free from suspended matter or sediment temperature.	A sample of Oil shall be examined in 100mm thick layer at 27deg C
2	Density at 29.5° C (max)	0.89 g/cm3	IS 1448 (P:16):1990

3	Kinematic Viscosity @ 27° C. (Max.)	270C	IS 1448 (P:25):1976
4	Interfacial tension Min.	0.04 N/m	IS:6104:1971
5	Flash Point (Closed CUP)	140° C	IS 1448 [P:21]:1992
6	Pour Point (max)	-6° C	IS 1448 [P:10]:1970
7	Neutralization Value (total acidity) max.	0.03 mg/KOH/g	IS 1448 [P:2]:1967
8	Corrosive sulphur (In terms of classification of copper strip)	Non Corrosive	IS 1448 (Part-I)/Annex B of IS:335
9	Electric Strength (Breakdown voltage)	The sampling shall be done in accordance with the procedure laid down in IS 6855: 1973.	IS 6792 : 1992
	i) New untreated oil	30 kV (rms)	
	If the above value is not attained, the oil shall be filtered		
	ii) After Filtration Min	70 kV (r.m.s.)	
10	Dielectric Dissipation Factor (tan-delta) at 90°C, max.	0.002	IS:6262-1971
11	Specific resistance (resistivity) ohm/cm/min		IS:6103-1971
	a)At 90° C, Min	35 X 10 <sup>12</sup> ohm-cm	
	b)At 27° C, Min	1500 X 10 <sup>12</sup> ohm-cm	
12	Water content, max. per million	30 (avg. 20 ppm)	Karl Fischer Method
13	Oxidation Stability		
	(i) Neutralization value after oxidation Max.	0.40 mg. KOH/g	Appendix C of IS:335
	(ii) Total sludge, after oxidation, max.	0.1 percent by weight	
14	Tan delta at 90° C after ageing test (max)	0.2	IS 6262:1971
15	Saponification Value	Max. 1.0 mg. KOH/g	Appendix E IS-335



Specification No: [ENG-EHV-1003](#)

Specification Name: Technical Specification for 33/11kV 20/25 MVA Power Transformer

16	Presence of oxidation inhibitor	The oil shall contain anti-oxidant additives.	IS 13631 : 1992
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**Ester Oil :**

In case of Natural Ester oil or Synthetic Ester Oil below are the requirements to be fulfilled: All transformers shall be filled to the required level with new, unused, clean, Natural or Synthetic Ester oil as per TPCODL/TPNODL/TPSODL/TPWODL approval. The use of recycled ester oil is not acceptable. Ester shall be filtered and tested for break down Voltage (BDV) and moisture content before filling. Ester shall be filled under vacuum. The Dielectric strength and water content shall meet the requirement given in TPCODL/TPNODL/TPSODL/TPWODL Specification ENG-GEN-4004. Ester oil shall be procured from approved vendor of TPCODL/TPNODL/TPSODL/TPWODL only.

Bidder has to provide the oil data in below table:

SNo.	Description	Unit	As furnished by bidder
1	Type of oil		
2	Oil Qty. for first filling	Ltr.	
3	Grade of Oil		
4	Maker's name		
5	BDV at the time of first filling	kV	

**5.12 GASKET**

- I. All bolted connection to the tank shall be fitted with suitable oil-tight gaskets which shall give satisfactory service under the operating conditions. Gaskets shall be of NRBC.
- II. Special attention shall be given to the methods of making the oil-tight joints between the tank and the cover as also between the cover and the bushings and all other outlets to ensure that the joints can be remade satisfactorily and with ease, with the help of semi-skilled labor.
- III. Where compressible gaskets are used, steps shall be provided to prevent over compression.
- IV. All the bolts provided shall be of hot dip galvanized.
- V. All bolts shall be provided with one spring washer and two numbers of flat washers and with locking bolts.
- VI. All gasket joints shall be provided with equalizing links to extend earth connections.
- VII. All Gasket should be fixed such a way that there should not be any damage during operation.
- VIII. Sheet Type Gasket of suitable Width to be used in Flanged Joint.  
We recommend, O-Ring Type Gaskets not to be used on Flanged joints. (Radiators/Valves etc)

**5.13 OIL PRESERVING EQUIPMENT**

- I. Oil preserving equipment shall be conservator (expansion tank) type. The conservator shall have two filter valves, one at the bottom at one end, the other at the top, opposite end, in addition to the valve specified in the Accessories for the main tank. The conservator or expansion tank shall also have a shutoff valve and a small drain valve and sampling cock, the



latter so arranged as not to interfere with oil lines. The oil level gauges (prismatic and magnetic) shall be mounted on the conservator or expansion tank. The top of the conservator shall have contact with atmosphere through two silica gel / Envirogel breathers to facilitate replacement of breather without having to keep Buchholz relay inoperative. The breathers shall have clear transparent, UV stabilized /retardant Polycarbonate with min. 3 mm thickness.

- II. Conservator oil preservation bag (atmosial bag) shall be provided with a design such that it can be installed at site with ease without any special tools and tackles. The price for COPS bag shall be clearly mentioned in the price schedule at the specified place. With COPS type conservator shall supply air or nitrogen filling arrangement with all accessories needed at the time of commission and pressure gauge arrangement shall be provided for monitoring COPS bag pressure.
- III. Proper valve arrangement (Two top valve & one bottom valve on conservator) is to be provided for proper oil filling.
- IV. Prismatic oil level indicators with red colour float shall be provided on main tank and OLTC tank Conservator. Dual contacts are required for both MOGs (Main Tank & OLTC conservator).
- V. Separate conservator tank shall be provided for OLTC.

#### 5.14 OLTC CONSERVATOR TANK

- I. Tank with air release valve on top.
- II. Prismatic Oil level indicator with red color float.
- III. Magnetic Oil Level Indicator (MOG), round in shape having a diameter of 100 mm.
- IV. Bend assembly with flange - This includes two pipes, one connecting tank with OSR and another connecting OSR with OLTC along with two shut off valves. The diameter of this pipe shall be suitably sized for tanks, The complete assembly formed after attaching both the pipes to OSR and connecting with the tank should be at an angle of 5 degrees with respect to the horizontal. Also, the pipe should be off set from the tank at an angle of 32 degrees in the horizontal plane.
- V. Silica gel/Silica gel beads breather along with the explosion vent assembly
- VI. Mounting structure with eight nut bolts (S/S) for attachment
- VII. Tank shall be fabricated from good commercial grade low carbon steel.
- VIII. All joints, bolted or flanged, shall have machined matching surfaces/inner edges with smooth finish, to ensure leak proof joints.
- IX. All joints, bolted or flanged, shall have machined matching surfaces/inner edges with smooth finish, to ensure leak proof joints.
- X. The inside surface of the tank shall be painted with one coat of hot oil resistant varnish with two coats of red oxide zinc chromate primer conforming to IS:2074 followed by two coats of fully glossy finishing paint conforming to IS:2932 and yellow in color.
- XI. The outside surface shall be painted with two coats of red oxide zinc chromate primer conforming to IS: 2074 followed by two coats of fully glossy finishing paint conforming to IS: 2932 of shade 631 of IS 5.
- XII. Two Lifting lugs should be provided.

S.No	Description	20 MVA
1	Diameter	To be furnished by the bidder

2	Length of tank	To be furnished by the bidder
3	Thickness of sheet	To be furnished by the bidder
4	Weight	To be furnished by the bidder
5	Air release valve on top	Required
6	Prismatic oil level indicator with red color float	Required
7	MOG	Required
8	Bend assembly with two shut off valves	Required
9	Silica gel/Envirogel breather with explosion vent assembly	Required
10	Mounting structure	Required
11	Eight nut bolts (S/S) with mounting structure	Required
12	Inside surface finishing	The transformer shall withstand the short circuit at its terminals for the specified fault levels for minimum duration of 3 seconds.
13	Outside surface finishing	As the Transformers will be installed in areas prone to earthquakes, they shall be designed to withstand seismic forces equivalent to 0.3 g acceleration. Necessary devices for clamping the wheels to the rails shall also be provided along with any other suitable anti earthquake clamping arrangement.
14	Color of tank's external paint	631 acc. to IS 5
15	Lifting hooks	Required

### 5.15 ON LOAD TAP CHANGER

- I. OLTC shall have the entire feature to meet the requirement. The equipment shall conform to the latest applicable Indian standard / IEC standard. Equipment complying with any other authoritative standards such as British, VDE etc. shall also be considered if offered.
- II. The OLTC gear shall be designed to complete successfully tap changes for the maximum current to which transformer can be loaded i.e. 120% of the rated current. Devices shall be incorporated to prevent tap change when the through current is in excess of the safe current that the tap changer can handle. The OLTC gear shall withstand through fault currents without

injury.

- III. When a tap change has been commenced it shall be completed independently of the operation of the control relays and switches. Necessary safeguards shall be provided to allow for failure of auxiliary power supply or any other contingency which may result in the tap changer movement not being completed once it is commenced.
- IV. OLTC shall be a separate compartment & should be external to transformer tank. Oil in compartments which contain the making and breaking contacts of the OLTC shall not mix with oil in other compartments of the OLTC or with transformer oil. Gases released from these compartments shall be conveyed by a pipe to a separate oil conservator or to a segregated compartment within the main transformer conservator. A OSR with shut off valves and MOG shall be installed between OLTC and conservator tank. The OLTC conservator shall be provided with prismatic oil level gauges with red color float. The length and alignment of the MOG and OSR pipe shall be such that, the transformer does not trip by the vibration of the pipe.
- V. Oil in compartments of OLTC which do not contain the make and break contacts, shall be maintained under conservator head through valve pipe connections. Any gas leaving these compartments shall pass through the OSR relay before entering the conservator. The cable entry of OSR should be from bottom end instead from side
- VI. Oil filled compartments shall be provided with filling plug, drain valve with plug, air release vent, oil sampling device, inspection opening with gasket and bolted cover with lifting handles.
- VII. The OLTC motor shall be provided with 415 V auto changeover facilities. Tap position indication along with the various alarms of tap changer shall be indicated in the marshaling box.
- VIII. Separate OLTC tank should be provided at a height lower than that of the main conservator tank so that the same is easily accessible for maintenance.
- IX. OLTC driving mechanism and its associated control equipment shall be mounted in an outdoor, weather proof cabinet, which shall include:
  - a) Driving motor (415 V - 3 phase, 50 Hz, AC squirrel cage)
  - b) Motor starting contactor with thermal overload relays, isolating switch and HRC fuses.
  - c) Duplicate sources of power supply with automatic changeover from the running source to the standby source and vice versa.
  - d) End Limit Switch shall be provided to prevent operation beyond extreme taps & Contacts shall be provided for operation through SCADA.
  - e) Limit switch to cut off electrical operation on insertion of manual handle (Contacts shall be provided for operation through SCADA).
  - f) Local/Remote selector switches shall be provided with status indication.
  - g) Control switch: Raise/off/lower (spring return to normal type). (Contacts shall be provided for operation through SCADA).
  - h) Remote/local selector switch (maintained contact type). (Contacts shall be provided for operation through SCADA).
  - i) Mechanical tap position indicator showing rated tap voltage against each position and resettable maximum and minimum indicators.

- j) Limit switches to prevent motor over travel in either direction & final mechanical stops.
  - k) Brake or clutches to permit only one tap change at a time on manual operation.
  - l) Emergency manual operating device (hand crank or hand wheel).
  - m) Electrically interlocked reversing contactors (preferably also mechanically interlocked).
  - n) 240V, 50 HZ, AC space heaters with switch and MCB.
  - o) Interior lighting fixture with lamp door switch and MCB.
  - p) Gasketed and hinged door with locking arrangement.
  - q) Terminal blocks, internal wiring, earthing terminals and cable glands for power and control cables.
  - r) Necessary relays, contactors, current transformers etc.
  - s) Thermal device or other means shall be provided to protect the motor and control circuit. All relays, switches, fuses etc. shall be mounted in local OLTC control cabinet and shall be clearly marked for the propose of identification.
  - t) A five digit counter shall be fitted to the tap changing equipment to indicate the number of operation completed.
  - u) The equipment shall be suitable for supervisory control and indication with make before break multi-way switch, having one potential free contact for each tap position. This switch shall be provided in addition to anyother switch/switches which may be required for remote tap position indication.'
  - v) Operation from the local or remote control switch shall cause one tap movement only until the control switch is returned to the off position between successive operations.
  - w) OLTC shall be provided with PRV.
  - x) Suitable manholes covers should be provided on the sidewalls to give access to the selector switches of the OLTC. There should be ample access for opening /Reconnecting tap-leads to the OLTC from all sides.
  - y) Suitable valves shall be provided to take sample of oil from the OLTC chamber during operation of the transformer.
- X. The following electrical control features shall be provided:
- a) Positive completion of load current transfer, once a tap change has been initiated, without stopping on anyintermediate position, even in case of failure of external power supply.
  - b) Only one tap change from each tap change impulse even if the control switches or push button is maintained in the operated position.
  - c) Cut-off of electrical control when manual control is resorted to. It shall not be possible to operate theelectric drive when the manual operating gear is in the use.
  - d) Cut-off of a counter impulse for a reverse tap change until the mechanism comes to rest and resets thecircuits for a fresh operation.
  - e) Cut-off of electrical control when it tends to operate the tap beyond its extreme position. Mechanical limit s witches shall be provided for this purpose to achieve suitable interlocking.

**XI. Automatic / Parallel Operation with OLTC**

OLTC shall be able to do automatic / parallel operations through Transformer Monitoring Unit (TMU).

## XII. ALARMS:

The following alarms shall be provided with the additional contact arrangement for connection to SCADA.

- a) End Limit Switch
- b) Manual Operation Insertion
- c) A.C. supply failure
- d) Drive motor autotripped
- e) Tap Stuck up change delayed
- f) OSR trip
- g) MOG Alarms
- h) PRV Trip
- i) TC in Progress.
- j) Any other protective feature, if considered essential by the Bidder.

XIII. Tap Changer Control panel or Transformer Monitoring Unit (TMU): This equipment is not required to be supplied by the bidder of the transformer.

XIV. Auxiliary Power Supply of OLTC, and Power Circuit :

- a) Two auxiliary power supplies, 415 volt, three phase four wire shall be provided by the Purchaser for OLTC and power circuit.
- b) All loads shall be fed by one of the two feeders through an electrically interlocked automatic transferswitch housed in the marshalling box for on load tap changer control .
- c) Design features of the transfer switch shall include the following:
  1. Provision for the selection of one of the feeder as normal source and other as standby.
  2. Upon failure of the normal source, the load shall be automatically transferred after an adjustable timedelay to standby sources.
  3. Indication to be provided at marshalling box for failure of normal source and for transfer to standbysource and also for failure to transfer.
  4. Automatic re-transfer to normal source without any intentional time delay following re-energization ofthe normal source.
  5. Both the transfer and the re-transfers shall be dead transfers and AC feeders shall not be paralleledat any time.

## XV. Manual Control:

The cranking device for manual operation of the OLTC gear shall be removable and suitable for operationby a man standing at ground level.

The mechanism shall be complete with the following :

- a. Mechanical tap position indicator which shall be clearly visible from near the transformer.
- b. A mechanical operation counter.
- c. Mechanical stops to prevent over-cranking of the mechanism beyond the extreme tap positions.
- d. The manual control considered as back up to the motor operated load tap changer control

shall be interlocked with the motor to block motor start-up during manual operation. The manual operating mechanism shall be able to show the direction of operation for raising the HV terminal voltage and vice- versa.

### 5.16 OIL SURGE RELAY

**Oil Surge Relay** should be according to the following general technical parameters as mentioned in below table.

S. No.	Description	Unit	Requirements
1	Type of relay		Magnetic reed switch type OSR suitable for 25 mm nominal pipe bore with 1 set of potential free contact to be used for 24 to 48V
2	No. of Switching systems		1
3	Suitable for		OLTC
4	Nominal Pipe Bore	mm	25
5	Type of Flange		Square
6	Diameter of flange	mm	78 square
7	Diameter of bolt circle	mm	72
8	Number of the bolts		4
9	Size of the bolts		M10
10	Flange Thickness	mm	6 mm
11	Surge Test (TRIP )	cm/s	70 to 130
12	Velocity Test	cm/s	70 to 130
13	Relay operating range: Oil Temperature		10°C to 100°C
14	Relay operating range: Oil Viscosity		66 to 75 centistokes at 10°C, 2 to 3.5 centistokes at 100°C
15	Element Test		With oil, at 1.75Kg/cm <sup>2</sup> for 15

			minutes,
16	High Voltage Test		Shall be able to withstand 2000 V at 50 Hz for 1 minute
17	Insulation Resistance Test		Shall be Greater than 10 Mega ohms with 500V megger

### 5.17 PRESSURE RELEASE VALVE

- I. Spring-loaded Pressure Relief Device (PRV) with mechanical flag indicator shall be provided on the main tank top of the transformer.
- II. Oil splashguard along with draining arrangement (with wire net on both side) up to ground level to be provided for prevention of oil splashing.
- III. Arrangement for air-release through a gate valve should be provided at the base of the PRV.
- IV. The PRV shall not be located in the vicinity of the Marshalling Box or OLTC Box for safety of operating personnel.
- V. A pair of potential free contacts shall be provided to trip the transformer on action of the pressure relief device.
- VI. It shall have the limit switch with 2NO and 2NC contacts, flag, switch operated rod etc.
- VII. PRV shall be tested for all the applicable test such as Leakage Test, Switch operation, break down test.

SN o	DESCRIPTION	UNIT	REQUIREMENT
1	Operating pressure		0.56 Kg/sq cm
2	Port opening diameter		150 mm
3	Operating time		Instantaneous
4	Contact rating		3A at 48 V DC magnetic blowout micro switch
5	Operating temperature		0 to 100 degree celcius
6	Valve resetting		Automatic
7	Switch		Limit switch DPDT
8	Accuracy class		+ - 1 %
9	Switch resetting		Manual
10	Number of switch		1 limit switch
11	Mechanical protection degree		IP67
12	Suitable for transformer rating	MV A	As per tender
13	Cable Entry		1" conduit

14	Packing		Supplier shall ensure that the equipment covered by this specification shall be prepared for rail/road transport (local equipment) and be packed in such a manner so as to protect the equipment from damage in transit.
15	Marking		The unit shall be appropriately marked as TPCODL/TPNODL/TPSODL/TPWODL and with the name of the vendor, Manufacturer type/ serial no. and year of manufacturing at suitable location.
16	Warranty		2 years from the date of purchase of Transformer. In case any defects are found, the vendor shall replace the product free of cost.
17	Test Reports		Test certificates to be provided : 1) Protection Class. 2) Cold & Dry Test 3) Vibration Test 4) Salt spray Test 5) Micro switch rating Test
18	Acceptance test		Following tests shall be carried out: 1)Physical Test- Dimensions 2)Switch operation test 3)Valve operation test 4)Leakage Test 5)Insulation Test

### 5.18 BUCHHOLZ RELAY

**One double float gas detector relay (Buchholz relay)** with alarm and tripping contacts to detect accumulation of gas and sudden changes of oil pressure complete with shut off valves between Relay and Conservator Tank flange-couplings to permit easy removal without lowering oil level in the main tank, a bleed valve for gas venting and test valve. The installation shall be weather proof to avoid any water seepage inside the relay. The cable entry should be from bottom end of Buchholz relay instead from side. **Marking of Magnetic reed type switches shall be available on Buchholz Relay.**

Buchholz Relays should be according to the following general technical parameters as mentioned in below table.

S.No	Description	Unit	Requirements
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1	Type of relay		Magnetic reed switch type Buchholz relays suitable for nominal pipe bore of 80 mm with 2 sets of potential free contacts suitable for 48V.
2	No. of Switching systems		2
3	Suitable for Transformer Rating	MVA	As per tender
4	Nominal Pipe Bore	mm	80
5	Type of Flange		Round
6	Diameter of flange	mm	185
7	Diameter of bolt circle	mm	145
8	Number of the bolts		4
9	Size of the bolts		M16
10	Flange Thickness	mm	16
11	Surge Test (TRIP )	cm/s	90 to 160
12	Gas Volume (ALARM)	cc	200 to 300
13	Velocity Test	cm/s	90 to 160
14	Relay operating range: Oil Temperature		10°C to 100°C
15	Relay operating range: Oil Viscosity		65 to 75 centistokes at 10°C, 2 to 3.5 centistokes at 100°C
16	Element Test		With oil, at 1.75Kg/cm <sup>2</sup> for 15 minutes,
17	High Voltage Test		Shall be able to withstand 2000 V at 50 Hz for 1 minute
18	Insulation Resistance Test		Shall be Greater than 10 Mega ohms with 500 V megger
19	Porosity Test		With oil, at 1.5 kg/cm <sup>2</sup> for 4 hours - There shall not be any leakage or mechanical damage
20	Mechanical Strength Test		With oil at 8 kg/cm <sup>2</sup> for 1 minute
21	Resistance of the Switch		Not to exceed 0.1 ohm across the electrodes of magnetic switch
22	Cable entry in terminal box		From bottom side

#### 5.19 OTI

A dial-type indicating thermometer of robust pattern mounted on the side of the transformer at a convenient height to read the temperature in the hottest part of the oil and fitted with alarm and trip contacts and contacts for switching in and switching out the cooling system at predetermined temperatures.

#### 5.20 WTI

In one winding of each phase as described below:

- I. It shall be indicating type, responsive to the combination of top oil temperature and winding current, calibrated to follow the hottest spot temperature of the transformer winding.
- II. The winding temperature detector shall operate a remote alarm in the event the hottest spot temperature approaches a dangerous level and in the case of ONAN (Oil Natural and Air Natural) Thus WTI shall have 4 independent NO contacts for alarm and trip and spare.

**Note:**

- I. **Equipment for remote winding and oil temperature Indicators** including these to be installed in the TPCODL/TPNODL/TPSODL/TPWODL control room shall be provided. Pocket with heater coil and CT for RTD for winding hot spots shall be provided.
- II. **For purpose of remote recording and data acquisition system**, Top oil temperature detector along with suitable transducer and other necessary devices to provide two sets of 4-20 mA signals with PT-100 type of sensors.
- III. Tap changer indicator of OLTC along with suitable transducer and other necessary devices to provide two sets of 4-20 mA signals along with one set of 1-16K resistance output shall be provided.
- IV. All digital outputs for remote annunciation/control/DAS shall be provided with two changeover (NO) contacts for alarm condition and two changeover (NO) contacts for trip condition. The OTI & WTI shall be provided with micro switches, instead of mercury switches for alarm and trip purpose. All the interconnected wiring between TJB, Marshalling box and OLTC etc. shall be done by the bidder and schematics drawings of the same shall be supplied.

**5.21 VALVE**

- I. Valves shall be of forged carbon steel upto 50mm size and of gun metal or of cast iron bodies with gunmetal fittings for sizes above 50mm. They shall be of full way type with screwed ends and shall be opened by turning counter clockwise when facing the hand wheel. There shall be no oil leakage when the valves are in closed position.
- II. Each valve shall be provided with an indicator to show the open and closed positions and shall be provided with facility for padlocking in either open or closed position. All screwed valves shall be furnished with pipe plugs for protection. Padlocks with duplicate keys shall be supplied along with the valves.
- III. All valves except screwed valves shall be provided with flanges having machined faced drilled to suit the applicable requirements, Oil tight blanking plates shall be provided for each connection for use when any radiator is detached and for all valves opening to atmosphere. If any special radiator valve tools are required the OEM shall supply the same.
- IV. Each transformer shall be provided with following valves on the tank:
  - a) Drain valve so located as to completely drain the tank & to be provided with locking arrangement.
  - b) Two filter valves on diagonally opposite corners of 50mm size & to be provided with locking arrangement.
  - c) Oil sampling valves not less than 8mm at top and bottom of main tank & to be provided with locking arrangement.
  - d) One 15mm air release plug.
  - e) Valves between radiators and tank.
  - f) Drain and filter valves shall be suitable for applying vacuum as specified in the specifications.

## 5.22 MOG:

One magnetic-type oil-level gauge each in Main Tank and OLTC Tank with low and high level alarm contacts for main tank MOG and low level alarm for OLTC tank MOG and a dial showing minimum, maximum and normal oil levels. The gauge shall be readable from the transformer base level. It should have cable disconnecting facility at top of MOG, to facilitate testing of MOG. Along with MOG, prismatic type oil level indicator (glass window) shall also be provided on conservator.

SNo	DESCRIPTION	UNIT	REQUIREMENTS
1	Mounting Pad Diameter	Mm	150
2	Electric Switch		Two no's Micro Switches / Mercury switch
3	Contact Rating		5 Amps 240V AC, 0.25 Amp 48V DC.
4	Switch Operation		Normally open, closes when oil level drops to near empty condition. Switch recovers automatically on rising of oil level
5	Mounting of indicator		Vertical
6	Dial Marking		Maximum, Minimum, 1/4, 1/2 & 3/4
7	Movement of float arm		In the plane perpendicular to seating face
8	Conservator Dia	Mm	900 mm
9	Air cell in conservator		Yes
10	Switches for		Low Oil level Alarm, High oil level Alarm.
11	Color		Black marking with white/yellow background.
12	Readable from transformer base level		Yes
13	Cable disconnecting facility at top of MOG to facilitate testing of MOG		Yes
14	Mechanical Protection degree		IP55
15	Suitable for transformer rating	MVA	As per tender requirement
16	Packing		Supplier shall ensure that the equipment covered by this specification shall be prepared for rail/road transport (local equipment) and be packed in such a manner so as to protect the equipment from damage in transit.
17	Marking		The unit shall be appropriately marked as "TPCODL/TPNODL/TPSODL/TPWODL" and with the name of the vendor, Manufacturer type / serial no. and year of manufacturing at suitable location.



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18	Warranty	2 years from the date of purchase of Transformer. In case any defects are found, the vendor shall replace the product free of cost.
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### 5.23 Marshalling Box

- I. Marshalling Box suitable for distribution of 3 phase 4 wire, 415V power to various equipment shall be provided. Separate ground mounted marshalling box shall be provided for radiator banks, WTI, OTI, transducers, at least two (2) sets of 4-20mA converter cum indicator etc. and similarly tank mounted marshalling box shall be provided for HV/LV CT cable terminals. Two point earthing provision should be provided with 50X6mm GI flat with pad type connector, length should be of min. 80 mm. The marshalling box should include indication circuit with 48V DC supply. All cables and conduits between the transformer and control cabinet shall be included in the scope of supply by bidder. All the wiring shall have provision for connection to SCADA.
- II. Two sets of independent, potential free contacts shall be provided for various alarms/trips as detailed below. The auxiliary voltage for alarm/ trip circuit shall be 48V DC for 33/11kV Transformer).

DC system is required for

- a. Buchholz alarm
- b. OTI alarm
- c. WTI alarm (HV/LV based on WTI CT available)
- d. MOG (main) alarm
- e. MOG (OLTC) alarm
- f. Buchholz trip
- g. OTI trip
- h. WTI trip (HV/LV based on WTI CT available)
- i. OSR trip
- j. SPR trip
- k. PRV trip
- l. AC supply fail
- m. Motor Auto Trip

Two sets of spare potential free contacts shall be provided for all alarms for remote annunciation through TPCODL/TPNODL/TPSODL/TPWODL SCADA panels suitable Transducers shall be provided for 4-20mA signals for tap position indication to the TPCODL/TPNODL/TPSODL/TPWODL SCADA panel. The variation in output signals shall be linear for the complete tapping range.

In addition to above, following potential free contacts/signals shall be provided in the marshalling box, for its interfacing with TMU (Transformer Monitoring Unit) or other approved make by TPCODL/TPNODL/TPSODL/TPWODL.

SNo	Item	Provision
1	Supply of ON lamp 3 nos. R,Y,B	To be provided

2	Secondary of Control Transformer from the OLTC	Terminals shall be provided in Marshalling box
3	Tap Position Indicator	4-20 MA Signal in Marshalling box
4	Over Current Relay contact	Potential Free Contact in Marshalling box
5	Local remote Switch in OLTC	Potential Free Contact in Marshalling box
6	Raise Lower Switch	Potential Free Contact in Marshalling box
7	Hand interlocking Switch	Potential Free Contact in Marshalling box
8	Tap Change in progress	Potential Free Contact in Marshalling box
9	Odd even Switch	Potential Free Contact in Marshalling box
10	Maximum position reached	Potential Free Contact in Marshalling box
11	Minimum position reached	Potential Free Contact in Marshalling box
12	OTI	4-20mA Signal in Marshalling box
13	Annunciation - Oil level low & High (Main) - Oil level low (OLTC) - Winding Temp. High (HV+ LV) - Oil Temp High - B' relay Alarm - Winding temp trip (HV+LV) - Oil temp trip - B' relay trip - PRV trip for main & OLTC both - OSR trip - SPR trip	Potential Free Contact in Marshalling box
14	Auto manual selector switch	Potential Free Contact in Marshalling box
15	Supply ON lamp 3 nos. (R,Y,B)	To be provided
16	Secondary of Control Transformer from the OLTC	TBs shall be provided

- III. The Enclosure shall be weather proof, sheet steel construction, not less than 3 mm thick. Degree of protection shall be IP55 minimum with Canopy. It shall be provided with two hinged

doors one at front and one at back with locking knobs facilities. The doors shall open through 1800. Doors shall have glass window for viewing of OTI & WTI from outside when door is closed. Doors and glass windows shall have proper gaskets for vermin proof and dust tight arrangement. Proper extended rain shed shall be provided.

- IV. Accessories: All accessories shall be mounted properly in suitable channel inside the box. The MCBs shall be mounted on a DIN channel by a MS plate with cutout for MCBs knobs. This shall be covered by a hinged door on the front. Power cable wiring of MCBs to individual contactors shall be done through good quality copper cable of suitable rating with ferrule marking and suitable lugs at both ends. 2.5sqmm stranded copper cable with ring type lugs shall be used for control cabling purpose. All instrument and wiring shall be completely accessible.

SNo	Item	Make	Rating	Quantity
1	Main Incomer MCB 3 Pole	Siemens/ABB/L&T	63 A	02 Nos.
2	3 Pole MCB	Siemens/ABB/L&T	6 A	12 Nos.
3	3 Pole MCB	Siemens/ABB/L&T	10A	10 Nos.
4	3 Pole MCB	Siemens/ABB/L&T	16 A	10 Nos.
5	Connector/Terminals	Wago or Phoenix, (Suitable for ring type lugs)	Suitable for 2.5 sq.mm. control cable	To accommodate all the wiring as mentioned below. Additional 10% terminals shall be provided as spare
6	Contactors, starter and relays	Siemens, L&T, English Electric		

V. Following Tests shall be carried out on the Marshalling Box:

- a. Functional tests / 2kV withstand.
- b. Dimensional checks.
- c. Make and operation of contactors, relays.
- d. Factory test report attached for bought out items.
- e. Test for Enclosure Protection.

#### 5.24 Nitrogen Injection Drain & Stir System

- I. Fire prevention and extinguishing system shall work on the oil drain, nitrogen injection and stir method. The system shall operate during internal fault in transformer or external fire on transformer, which includes fire due to bursting of transformer bushing and Fire in OLTC tank.
- II. Fire detector provided on the transformer shall take minimum time for detection of fire and initiate the fire protection system on receipt of other required signals.
- III. System shall operate on station's DC auxiliary supply (48 VDC). The system shall be

capable of working in Auto/Remote Electrical/Local manual modes.

- IV. Provision shall be available to keep the system "ISOLATED" /"OUT OF SERVICE" which is necessary for preventing any mal-operation during transformer maintenance.
- V. The protection system shall be compatible of being hooked on to the SCADA or fire alarm system. Suitable spare contacts shall be made available for operation of fire system. System using PLC shall be only considered.
- VI. Fire protection system shall operate in Auto mode under two logic:
  - a) In Transformer Explosion prevention Logic it shall operate on receipt of minimum three positive feedback signals, namely differential relay, pressure relief valve or rapid pressure rise relay or Buchholz relay and electrical isolation of transformer through master trip relay or HV& LV circuit breaker in series to avoid any mal-operation of system .
  - b) In Transformer Fire Prevention logic, Fire protection system shall operate in Auto mode on receipt of minimum three positive feedback signals, namely fire detector, pressure relief valve or rapid pressure rise relay or Buchholz relay / OSR (in case of fire in OLTC and electrical isolation of transformer through master trip relay or HV & LV circuit breaker in series to avoid any mal-operation of system.
  - c) Provision shall be made in system so that any of the above two logic can be disabled by operator from local panel only.
  - d) Supply and installation of Rapid Pressure Rise Relay shall be in the scope of the bidder.
- VII. Fire protection system shall operate in Remote electrical mode on receipt of signal for electrical isolation of transformer and by operating switch provided in a box which shall be accessible only after breaking the glass cover on control panel.
- VIII. The Local manual operating system shall be used only in case if the system fails in Auto mode/Remote electrical mode/ power failure. System if kept in manual mode must be clearly visible by a different alarm / LED.
- IX. The system shall start operation in auto or remote electrical or local manual, initially draining a pre- determined quantity of oil from the tank top through outlet valve to reduce the tank pressure and simultaneously closing Isolation valve in the conservator line and then inject nitrogen gas with appropriate flow rate at high pressure from lower side of the tank through inlet valves to create stirring action and reduce the temperature of top oil surface below flash point to extinguish the fire.
- X. Isolation valve in the conservator line shall operate mechanically on transformer oil flow rate with electrical signal for monitoring on control panel. However in case of bursting of transformer bushing conservator oil should be isolated from main transformer tank without any additional signal to operate isolation valve.
- XI. Provision shall be available so that in case of accidental leakage of Nitrogen, the same should not affect the operation of Transformer
- XII. The system shall have built in facility for monitoring or display of the following.
  - a. Open /Close status of valves.

- b. Healthiness of all sensors.
  - c. Operation of PRV
  - d. Healthiness of control cable
  - e. Healthiness of control supply
- XIII. Provision shall be available for annunciation (along with audible alarm) and a mimic panel of the following.
- a. Detection of fire due to external causes
  - b. Low nitrogen pressure.
  - c. System initiated
  - d. Tank pressure beyond the set limit
  - e. Operating signal cable faulty.
  - f. Operation of conservator isolation valve (PNRV)
  - g. Supply Failure
- XIV. However, bidder shall confirm whether it is advisable to initiate the system even when transformer is not electrically isolated due to stuck breaker problem etc.
- XV. The system shall have built-in-on-line testing facility, which will be operable without affecting the functioning of the transformer.
- XVI. All valves used in system shall be stainless steel ball / butterfly type and of Legris make or equivalent as per the purchaser's approval. Limit switches shall be provided wherever required.
- XVII. The connecting cables shall be fire retardant low smoke (FRLS) armored cable. Cables passing along the top of the transformer shall be the fire survival (FS) type.
- XVIII. The Pipe Line used for the system shall be of Class 'C' type.
- XIX. All the hardware used in the system shall be stainless steel.
- XX. Limit switches used in the panel shall be of Schmersal make or equivalent as per the purchaser's approval.
- XXI. Control cable gland used in system shall be of Lapp, Germany make or equivalent as per the purchaser's approval.
- XXII. Fire extinguishing cubicle shall be of 3mm thick CRCA sheet with PU painting and IP 55 enclosure protection class and shall accommodate nitrogen gas cylinder of adequate capacity and associated accessories like regulator, high pressure tubing etc.
- XXIII. The remote control panel, to be mounted inside the control room shall accommodate the necessary control units, operating switches push buttons etc. and also alarm annunciation unit.
- XXIV. The bidder shall, furnish the complete details including bill of materials of the fire prevention and extinguishing system offered. The list of all accessories including FRLS, fire survival cable, pipes, valves, sensors, control cubicle, nitrogen gas cylinder etc. shall be listed out and furnished in the offer.
- XXV. The bidder shall ensure that fire prevention and extinguishing system offered is full proof and reliable. Installation, testing and commissioning of the fire protection system shall also be in the successful bidder's scope.
- XXVI. Bidder shall ensure that fire prevention and extinguishing system shall not affect the



normal operation of power transformer.

- XXVII. Fire protection scheme to the power transformer should have authentic certification regarding performance similar to one issued by LAPEM (MEXICO)/TAC/RDSO /any other approved standard laboratory.
- XXVIII. Similar units offered by bidder shall be in successful operation for a minimum period of two years.
- XXIX. The bidder shall also furnish performance certificate for similar systems in proof of the satisfactory operation.
- XXX. NIDS is to be supplied with transformer unless specified elsewhere in the Bidding document.
- XXXI. Drawing shall be prepared as per the layout and OGA of the transformer to avoid any major fabrication at site. Complete drawing and GTP should be submitted for approval.
- XXXII. Bidder shall also ensure overall product & installation quality.
- XXXIII. In all conditions transformer shall have provision for future implementations of NIDS.
- XXXIV. In any condition OEM (PTR) guarantee shall remain the same as mention in clause no. 11 of this specification.

## **5.25 CENTRE OF GRAVITY & CENTRE LINE MARKING**

### **CENTRE OF GRAVITY**

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

### **CENTRAL LINE MARKING**

Central line of the transformer, tank, etc. shall be marked properly with indication to avoid any confusion during installation of the transformer

## **5.26 ANTI RUSTING CORROSION TREATMENT**

- I. The bidder shall ensure that all fabrication i.e. transformer tank, radiators, marshalling boxes and other accessories are treated for highest quality performance for the entire life of the transformer. The Bidder shall submit plan for extra measures he is taking for prevention of corrosion, along with the offer.
- II. Finishes on transformer and appurtenant parts, edges (exposed to atmosphere)
- III. NO GAS CUT EDGE OR SURFACE shall be acceptable unless smoothly ground to plane surface without irregular projections and corners (which cannot be blasted to the required roughness).
- IV. For all radiators the following painting procedure shall be followed. The metal spray (99.95% assay zinc) to a thickness about 100 microns with surface roughening and two coats of paints with proper supervision and quality checks. Bidder shall indicate separate price for metal spray of radiators.
- V. In this corrosion prevention measure it is imperative that the job is fully monitored for optimizing the proper conduct of the procedure as given in the various national standards. The coating

shall be as per BS: 2569 (latest revision). The coating requirement shall be to BS: 5493 Gr. SC10Z.

- VI. The Bidder shall submit a Quality Plan, giving the parameters and checking methods, (major, critical, minor).
- VII. The paint shade used shall be shade 631 as per IS: 5.

The following shall be the check points for the metal spray of Radiators:-

- Metal Spray
- Surface preparation
- Chemical analysis of actual material used for spray (batch wise identification)
- Coating Process (the first trial job will be witnessed to see if the written procedure is followed)
- Coating thickness test, adhesion test as per BS.
- Repair area classification major or minor and accordingly the repair from blasting onwards otherwise.

VIII. Bidder may quote for galvanized radiators instead of metal spray radiators as an alternative

## 5.27 MAKE OF MAJOR COMPONENTS & RAW MATERIALS

The BA shall procure the following constituent items from the designated vendors as follows:

	RAW MATERIAL/EQUIPMENT	MAKE
a)	Copper	M/S Sterlite, M/S Hindustan Copper, M/S Hindalco.
b)	Core	M/S AK Steels, POSCO, Kawasaki/ JFE, Nippon Steel.
c)	Insulation paper and Pressboards	ITC paper, ABB, Raman Boards- Mysore, Senapathy Whiteley – Bangalore
d)	Transformer Oil ( Mineral oil)	Savita, Apar, Gandhar
e)	Gaskets & Corks	Neoprene Rubber Bonded Cork Gasket (NRBC), Anchor Corks
f)	Steel For Tank	M/s, TATA Steel, M/s SAIL, M/s. JSW Steel, M/s. IISCO, M/s. RINL/Vizag Steel, M/s. Jindal Steel,
g)	Dehydrating Breather	Yogya, Anushree, Electrical engineers
h)	Buchholz, PRD, SPR, OTI , WTI, and other devices	Reputed make to be approved by TPCODL/TPNODL/TPSODL/TPWODL during detailed engineering.

Also, Bidder has to provide all test certificates from original manufacturers & relevant sourcing documents. BA shall also have shot blasting facility.

## 5.28 Cooling Arrangement

1. The transformer shall be provided with ONAF cooling system, which shall be designed to give 80% output at ONAN and 100% at ONAF. The cooling system shall comprise of two Nos. (2) 50% capacity radiator banks, to the sides of the tank.
2. The radiators shall have one (1) spare fan for each bank with the automatic switching scheme. In case of separately mounted radiator banks, it shall be possible to completely isolate each bank for maintenance and both the banks shall be interchangeable with each other. Bidder shall provide adequate number of fans of rating each for cooling of the radiator.
3. Cooling fans shall not be directly mounted on radiator bank which may cause undue vibration. These shall be located vertically at the sides radiators but on separate support structure so as to prevent ingress of rain water. Each fan shall be suitably protected by galvanized wire guard to prevent accidental contact with the blades, the mesh being not greater than 25mm. The exhaust air flow from cooling fan shall not be directed towards the main tank in any case.
4. Cooling fan must be provided with metal net cover arrangement so that direct contact of birds and rodents can be avoided with fan blades.
5. An oil flow indicator shall be provided for the confirmation of the oil pump operating in a normal state. An indication shall be provided in the flow indicator to indicate reverse flow of oil/loss of oil flow.
6. Radiator's fans motors shall be suitable for operation from 415 volts, three phase 50 Hz power supply and shall conform to IS: 325. Each cooling fan shall be 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 IP55 as per IS: 4691.
7. 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.
8. Terminal covers and greasing cups of fan motors shall be accessible without removing the guard. The air blower shall be removable without dismantling supporting framework. The cooler and its accessories should be hot dip galvanized or corrosion resistant paint should be applied to it.
9. Radiators shall be designed to withstand the vacuum and pressure conditions specified for the tank. Coolers shall be so designed as to accessible for cleaning and painting, to prevent

accumulation of water on the outer surface, to completely drain oil into the tank and to ensure against formation of gas pockets when the tank is being filled.

10. Radiators shall be connected to the tank by machined steel flanges welded to the cooler units and to the tank and provided with gaskets. Each cooler unit connection shall be provided on the tank and an indication for shut off valve which can be fastened in either open or closed position shall be provided. A separate oil tight blank flange shall be provided for each connection for use when the cooler unit is detached. Each cooler unit shall have a lifting eye.

11. Automatic operation control of fans shall be provided (with temperature change) from contacts of winding temperature indicator. The Bidder 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.

12. Suitable manual control facility for cooler fans shall be provided. The changeover to standby fans in case of failure of service fans shall be automatic. 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 manually.

General Technical Requirements for Cooling Fan:

S No	DESCRIPTION	UNITS	Requirement
1	Sweep	mm	450 mm
2	RPM		1400
3	Rated Current	A	0.75A
4	Rated Voltage	v	415
5	Phase		3 phase
6	Power rating	watt	370 watt
7	Bird guard		To be provided
8	Colour		BS Grey similar to transformer
9	Rubber vibration damper		To be provided
10	Motor frames		Shall not get damaged during operation

General Technical Requirements for Blower:

1	Rated voltage	v	415
2	Power supply		3 phase 50 Hz AC Supply
3	Sweep	Mm/in	900 (36)
4	Speed	RPM	960
5	Motor HP		2
6	Bird guard		To be provided
7	Colour		BS Grey (similar to transformer)
8	Suitable starter for motor		To be provided
9	Rubber vibration dam.....r		To be provided
10	Motor stand		Shall not get damaged during operation
11	Appropriate stand		To be provided

16	Packing		Supplier shall ensure that tile equipment covered by th s specification shall be prepared for rail/road transport (local equipment) and be packed in such a manner so as to protect the equipment from damage in transit.
17	Marking		The unit shall be appropriately marked as "PROPERTY OF TPCODL/TPNODL/TPSODL/TPWODL" and withthe name of the vendor, Manufacturer type- I Serial no.and year of manufacturing at suitable location. Following details shall be included in the name plate
18	Warranty		2 years from the date of purchase of Transformer. In case any defects are found, the vendor shall replace the product free of cost.
19	Test Reports		Test certificates to be provided : a) High voltage. b) Insulation resistance. c) Earthing continuity. d) E ectrical input. e) Fan speed. f) Power factor. g) Leakage current. h) Cord grip. i) Starting. j) Air delivery. K) Temperature rise.
20	Acceptance test		Following tests shall be carried out: a) High voltage. b) Insulation resistance. c) Earthing continuity. d) Electrical input. e) Fan speed.

## 6. NAME PLATE AND MARKING RATING PLATE

- I. A stainless steel rating plate, of at least 1 mm thickness, shall be fitted to each transformer in a visible position and shall carry all the information as specified in the standards.
- II. Sign writing shall also be provided as per the format attached with this specification.
- III. The letters on the rating plate shall be engraved black on the white/silver back ground.
- IV. Fixing screws for outdoor use shall be of stainless steel or any other corrosion resistant metals.
- V. The Name plate shall be embossed with "PO no. with date" & "TPCODL/TPNODL/TPSODL/TPWODL".
- VI. Danger notice shall have red lettering on a white background or they may be pictorial as approved by the TPCODL/TPNODL/TPSODL/TPWODL
- VII. The name plate shall contain following information:
  - a. Type of transformer (Two Winding Transformer)

- b. Relevant standard.
- c. Manufacturer's Name
- d. Manufacturer's Serial No.
- e. Year of Manufacture (MM/YYYY)
- f. No. of phases
- g. Rated kVA
- h. Rated frequency
- i. Rated Voltage
- j. Rated current
- k. Connection symbol
- l. Percentage impedance voltage at rated current.
- m. Type of cooling (ONAN/ONAF).
- n. Total Mass
- o. Mass and Volume of insulating Oil.
- p. Connection diagram showing the internal connections.
- q. Temperature rise
- r. Insulation levels of the windings, including neutral end of windings with non-uniform insulation.
- s. Transportation weight
- t. Untanking weight.
- u. Core and windings weight
- v. Table giving the tapping voltage, tapping current and tapping power for each tapping.
- w. Values of short circuit impedance on the extreme tapings and on the principal tapping and indication of the winding to which the impedance is related.
- x. A table of all guaranteed particulars.
- y. Quantity of oil required for normal filling.
- z. HV and LV phase to phase clearances.
- aa. Vector diagram
- bb. Indication of the winding which is fitted with tapping.
- cc. Table giving the tapping voltage, the tapping current and the tapping power of each winding, for each tap.
- dd. Value of short circuit impedance on the extreme tapping and on the principal tapping and indication of the winding to which the impedance is related.
- ee. Information of the ability of the transformer to operate at a voltage exceeding 110% of the tapping voltage or for the principal tapping and 110% of the rated voltage.
- ff. Tan delta value of insulating oil and kraft paper of transformer.

#### **VALVE SCHEDULE PLATE**

The name plate shall contain information of all the valves, their locations, quantities and schematic for the valves

#### **OLTC PLATE**

The name plate shall contain following information:

- I. Type
- II. S.No.
- III. Year of Manufacturing (MM/YYYY)
- IV. Motor
  - a. Operating Voltage
  - b. Normal Working Current

- c. Max. rated Through current
- V. Phase
- VI. Frequency (Hz)
- VII. Steps (Numbers)
- VIII. Step Voltage
- IX. Weight / Volume
  - a. Tap Changer Without Oil (Kg)
  - b. Oil (Kg)
  - c. Total
- X. Control Voltage (V)
- XI. Transition Resistance (Ohms)

**MARSHALLING BOX & OLTC BOX:**

- I. Manufacture's Name
- II. Manufacture's Serial No.
- III. Year of Manufacturing (MM/YYYY)
- IV. Purchase Order No.

The following shall be clearly mentioned / Engraved on the Plate: "TPCODL/TPNODL/TPSODL/TPWODL". Engraved drawing of control circuit, CT / PT circuit and TB shall be available on Marshalling Box and OLTC Box.

**OIL FILLING INSTRUCTION PLATE FOR CONSERVATOR**

The name plate shall contain

- I. Step wise process for filling oil in conservator
- II. Table of fittings with functions
- III. Conservator diagram with oil filling process
- IV. Precautions in detail

**7. TESTS:**

All routine, acceptance & type tests shall be carried out in accordance with the IS 2026 relevant standards, & TPCODL/TPNODL/TPSODL/TPWODL approved QAP. All routine & acceptance tests shall be witnessed by the TPCODL/TPNODL/TPSODL/TPWODL/his authorized representative. All the components and fittings shall also be type tested as per the relevant standards.

Following tests shall be necessarily conducted on the Power Transformers in addition to others specified in IS/IEC standards. Test for the OLTC shall be done as per the IS 8468

**7.1 ROUTINE TESTS**

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

- 1) Measurement of Winding Resistance.

- 2) Measurement of voltage ratio, polarity and vector group check.
- 3) Measurement of short impedance and load loss at 50% and 100% load.
- 4) Measurement of no load losses and magnetizing current at rated frequency and 90%, 100% and 112.5% of rated voltage
- 5) Measurement of insulation resistance.
- 6) Dielectric Test.
- 7) Test on On-Load Tap Changer.
- 8) Measurement of Zero-sequence impedance on three phase transformer.
- 9) All CTs and resistance of image coil for winding temperature indicator shall be checked for ratio test, polarity and knee point voltage test.
- 10) Determination of Capacitances and dissipation factor winding-to-earth and between windings.
- 11) Magnetic balance test.
- 12) Measurement of Magnetizing current at low voltage.
- 13) Vacuum withstand test on tanks and radiators.
- 14) The total Losses shall comprise of the No Load Losses, Load Losses ( $I^2R$  loss + stray loss) and Auxiliary Losses at rated output duly converted at 75 °C average winding temperature and shall also be indicated in the test report. Load losses shall be that corresponding to rated load on HV, LV windings.
- 15) Physical Verification of complete Transformer with all assembly including test rollers, radiators etc.
- 16) Voltage Regulation at rated load and at unit, 0.9, 0.8 lagging power factor.
- 17) Measurement of Acoustic Noise Level.
- 18) Measurement of the power taken by the fans
- 19) Functional tests on auxiliary equipment:-
  - a. Test on OTI and WTI
  - b. High Voltage test on insulation test for Auxiliary Wiring
  - c. High Voltage test on insulation test for Auxiliary Wiring
- 20) Test on Oil filled in Transformer:-
  - a. Dielectric strength of oil
  - b. Water content
  - c. Dielectric dissipation factor (tan delta at 90° celcius)
  - d. Resistivity.
- 21) Induced over voltage withstand test.
- 22) Separate Source voltage withstand test.
- 23) Oil Pressure test on completely assembled transformer at 0.35kg/sq.cm for 8 hrs.
- 24) BDV and moisture content of oil in transformer

## 7.2 TYPE TESTS

The type tests to be carried out by the Bidder shall include but not limited to the following:

- 1) Measurement of winding resistance.
- 2) Measurement of voltage ratio and check of voltage vector relationship.
- 3) Measurement of impedance voltage / short-circuit impedance (Principal tapping) and load loss.
- 4) Measurement of no load loss and current.
- 5) Measurement of insulation resistance.
- 6) Dielectric Test.
- 7) Temperature rise for determining the maximum temperature rise after continuous full load run. The ambient temperature and time should be stated in the test certificate.
- 8) Tests on on-load tap-changer.
- 9) Short Circuit withstand test.





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- 10) Test to verify IP55 of Marshalling and cable boxes(if applicable)
- 11) Lightning Impulse voltage test with chopped wave.

**Note: The bidder shall submit the test report from CPRI or ERDA for the tests mentioned above.**

Following type tests shall be carried out on one transformer of each rating, at the works of the bidder, in presence of TPCODL/TPNODL/TPSODL/TPWODL representative.

- a. Temperature rise test including DGA (DGA shall be done before & after the heat run test)
- b. Impulse Test (Including chopped wave on all the three limbs of HV & LV)

#### **TYPE TESTS, ROUTINE TEST & ACCEPTANCE TEST OF MOG & OSR**

All routine, acceptance & type tests shall be carried out in accordance with the relevant IS/IEC. All routine & acceptance tests shall be witnessed by the TPCODL/TPNODL/TPSODL/TPWODL/his authorized representative. All the components shall also be type tested as per the relevant standards. Following tests shall be necessarily conducted on the Joint and Termination Kits in addition to others specified in IS/IEC standards

#### **Type Test**

- a) Porosity test
- b) High voltage and insulation resistance test
- c) Elements test
- d) Gas Volume test
- e) Loss of oil and surge test
- f) Mechanical strength test
- g) Velocity calibration test

#### **Routine Tests**

- a) Porosity test
- b) High voltage and insulation resistance test
- c) Elements test
- d) Gas Volume test
- e) Loss of oil and surge test

#### **Acceptance Tests**

- a) Visual Inspection
- b) Porosity test
- b) High voltage and insulation resistance test
- c) Elements test
- d) Gas Volume test
- e) Loss of oil and surge test
- f) Mechanical strength test
- g) Velocity calibration test

### **TYPE TEST ON NITROGEN INJECTION DRAIN AND STIR SYSTEM (NIDS)**

The NIDS shall be subjected to the operational test at manufacturing works of Nitrogen Injection Fire Prevention and extinguishing system in presence of TPCODL/TPNODL/TPSODL/TPWODL's representative. The manufacture's test certificates of various accessories of NIDS shall be furnished at the time of Inspection to the inspecting officer. Complete GTP & Drawing including mounting, support structure, earthing provision should be submitted for approval. NIDS valve opening should not create any hindrance to other parts operation

### **SPECIAL TEST**

The following tests shall be carried out by mutual agreement between the TPCODL/TPNODL/TPSODL/TPWODL and the bidder. All Tests shall be done as per the relevant standard. Test certificates shall be submitted for bought out items. High voltage withstand test shall be performed on auxiliary equipment and wiring after complete assembly.

- a. Measurement of the harmonics of the No-Load Current
- b. Determination of transient voltage transformer characteristics
- c. Measurement of insulation resistance to earth of the windings, and / or measurement of Dissipation factor ( $\tan \delta$ ) of the insulation system capacitances. (These are reference values for comparison with later measurement in the field. No limitation for the values are given here.)
- d. Lightning impulse test on Neutral terminals
- e. Long duration induced AC voltage test (ACLD) transformer winding  $72.5 < U_m \leq 170kV$
- f. Magnetic circuit (isolation) test
- g. SFRA Test.

### **7.3 ACCEPTANCE TEST :**

- 1) At least 10% transformer of the offered lot (minimum of one) shall be subjected to all the tests mentioned under the section 'ROUTINE Test' in presence of TPCODL/TPNODL/TPSODL/TPWODL representative at the place of manufacture before dispatch without any extra charges. The testing shall be carried out in accordance with IS: 2026.
- 2) Oil Leakage test for acceptance shall be conducted at pressure of 0.35kg/sq.cm for one hour as per IS2026.
- 3) Temperature Rise Test (on one unit of first lot against every Rate contract / PO for each rating, for further lots against the same RC, TPCODL/TPNODL/TPSODL/TPWODL reserves the right to perform Temperature rise if required) [As per IS 2026 (Part 2) Clause no.4]
- 4) The painted surface shall pass the Cross Adhesion Test (IS1180 part 1 clause no. 21.4.d).
- 5) At stage inspection -Checking of weight, dimensions, fitting and accessories, tank sheet thickness, oil quantity, material finish and workmanship, physical verification of core coil assembly and measurement of flux density on one unit of each rating of the offered lot with reference to the GTP and contract drawings.
- 6) At Final inspection, the incoming raw material and its movement/consumption record in the related jobs of TPCODL/TPNODL/TPSODL/TPWODL will be verified by inspecting officer. In case of any deviation or non-availability of such records, the offered lot may get rejected.

### **8. TYPE TEST CERTIFICATES:**



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The Bidder shall furnish the type test certificates of the Two Winding Power Transformer for the tests as mentioned above as per the corresponding standards. All the tests shall be conducted at CPRI / ERDA/Government Labs as per the relevant standards. Type tests should have been conducted in during the period not exceeding 5 years from the date of opening the bid. In the event of any discrepancy in the test reports, i.e. any test report not acceptable or any/all type tests (including additional type tests, if any) not carried out, same shall be carried out without any cost implication to the TPCODL/TPNODL/TPSODL/TPWODL

## 9. PRE-DISPATCH INSPECTION:

1. Equipment shall be subject to inspection by a duly authorized representative of the TPCODL/TPNODL/TPSODL/TPWODL. Inspection may be made at any stage of manufacture at the option of the TPCODL/TPNODL/TPSODL/TPWODL and the equipment if found unsatisfactory as to workmanship or material, the same is liable to rejection.
2. Bidder shall grant free access to the places of manufacture to TPCODL/TPNODL/TPSODL/TPWODL's representatives at all times when the work is in progress.
3. Inspection by the TPCODL/TPNODL/TPSODL/TPWODL or its authorized representatives shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specifications.
4. Material shall be dispatched after specific MDCC (Material Dispatch Clearance Certificate) is issued by TPCODL/TPNODL/TPSODL/TPWODL.

Following documents shall be sent along with material:

- a. Test reports
- b. MDCC issued by TPCODL/TPNODL/TPSODL/TPWODL
- c. Invoice in duplicate
- d. Packing list
- e. Drawings & catalogue
- f. Guarantee / Warrantee card
- g. Delivery Challan
- h. Other Documents (as applicable)

5. In respect of raw material such as core stampings, winding conductors, insulating paper and oil, bidder shall use materials manufactured/supplied by standard manufacturers and furnish the manufacturers' test certificate as well as the proof of purchase from these manufacturers (excise gate pass) for information of the TPCODL/TPNODL/TPSODL/TPWODL. The bidder shall furnish following documents along with their offer in respect of the raw materials:

- a. Invoice of supplier
- b. Mill's certificate
- c. Packing List
- d. Bill of Landing
- e. Bill of entry certificate by custom

6. After the main raw-material i.e. core and coil material and tanks are arranged and transformers are taken for production on the shop floor, to ensure the quality of transformers, the inspection shall be carried out by the TPCODL/TPNODL/TPSODL/TPWODL's representative at following stages:

**a. Stage Inspection I** – Bidder has to facilitate for stage inspection of Tank, HV and LV windings and Core of the offered transformers. Bidder has to facilitate for stage inspection of Tank, HV and LV windings in one inspection call without any extra charges. Multiple inspections calls for stage inspection-I will not be considered and the delay will be accountable at bidder end. At this stage checking of weights, dimensions, tank sheet thickness, Pressure and vacuum test and quality of material, finish & workmanship as per GTP/QA Plan and approved drawings. During stage inspection TPCODL/TPNODL/TPSODL/TPWODL reserves the rights to dismantle the assembled core to ensure that the CRGO laminations used are of good quality.

DP test on welding of tank to be conducted to ensure good quality of tank welding.

**b. Stage inspection II** – Bidder has to facilitate for stage inspection -II for Core coil assembly of the offered transformers in without any extra charges. The testing shall be carried out in accordance with IS: 2026 and as per GTP/QA plan/Drawing.

Note: For Stage inspection, Annexure –I will be referred.

**c. Final Inspection** - Bidder has to facilitate for final inspection once the offered transformer is ready for dispatch. Inspection will be done as per w.r.t tests mentioned in Clause 7.2 and inspection test plan format in Annexure-II.

7. To ascertain the quality of the transformer oil, the original manufacturer's tests report shall be submitted at the time of inspection. Arrangements shall also be made for testing of transformer oil, after taking out the sample from the manufactured transformers and tested in the presence of TPCODL/TPNODL/TPSODL/TPWODL's representative.

8. The Bidder shall intimate the TPCODL/TPNODL/TPSODL/TPWODL in advance for inspection, so that an officer for carrying out inspection could be deputed, as far as possible within 07days (Within Delhi)/ 12Days (outside Delhi) from the date of intimation.

9. Further, about the readiness of the transformers, for final inspection for carrying out tests as per relevant IS/IECs shall be sent by the Bidder along with routine test certificates. The inspection shall normally be arranged by the TPCODL/TPNODL/TPSODL/TPWODL at the earliest after receipt of offer for pre-delivery inspection.

10. In case of any defect/ defective workmanship observed at any stage by the TPCODL/TPNODL/TPSODL/TPWODL's Inspecting officer, the same shall be pointed out to the Bidder in writing for taking remedial measures. Further processing shall only be done after clearance from the inspecting officer / TPCODL/TPNODL/TPSODL/TPWODL.

11. All tests and inspection shall be carried out at the place of manufacture unless otherwise specifically agreed upon by the manufacturer and TPCODL/TPNODL/TPSODL/TPWODL at the time of purchase/tender.

12. The manufacturer shall offer the inspector representing the TPCODL/TPNODL/TPSODL/TPWODL all reasonable facilities, without charges, to satisfy him that the material is being supplied in accordance with this specification. This will include Stage Inspection during manufacturing stage as well as during Acceptance Tests.

13. The bidder shall provide all services to establish and maintain quality of workmanship in his works and to ensure the mechanical / electrical performance of components, compliance with drawings, identification and acceptability of all materials, parts and equipment as per latest quality standards of ISO 9000.

14. The TPCODL/TPNODL/TPSODL/TPWODL has the right to have the test carried out at his own by an independent agency wherever there is a dispute regarding the quality supplied. TPCODL/TPNODL/TPSODL/TPWODL has right to test 1% of the supply selected either from the stores or field to check the quality of the product. In case of any deviation TPCODL/TPNODL/TPSODL/TPWODL have every right to reject the entire lot or penalize the bidder, which may lead to blacklisting, among other things.



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## 10. INSPECTION AFTER RECEIPT AT SITE/STORE:

### Inspection at site:

After erection at site, the transformers shall be subjected to the following tests and the bidder shall guarantee results of test certificates under service conditions.

- a. Measurement of winding resistance
- b. Measurement of voltage ratio and check of voltage vector relationship
- c. Measurement of magnetizing current.
- d. Magnetic balance test on three phase transformer
- e. Magnetic circuit (isolation) test
- f. Measurement of short circuit Impedance at low voltage
- g. Insulation resistance measurement
- h. Dielectric Test on oil.
- i. Determination of Capacitances and dissipation factor winding-to-earth and between windings.
- j. Bushing Capacitance and  $\tan \delta$
- k. Test on other Auxiliaries
- l. No-Load and Excitation current

This is for bidder's information that tests at site may be in bidder's scope based on mutual agreement between bidder and TPCODL/TPNODL/TPSODL/TPWODL's. However, in any case bidder shall be required to send their engineer to confirm that the erection & commissioning is done in a satisfactory manner.

TPCODL/TPNODL/TPSODL/TPWODL holds the discretion to obligate the bidder to carry out certain additional tests (e.g. SFRA, HV tan delta etc.) on transformer, for cross-checking and confirming the quality of incoming equipment owing to damages/deterioration that might have been caused during transportation/handling etc.

### Inspection at Store:

- a) The material received at TPCODL/TPNODL/TPSODL/TPWODL store shall be inspected for acceptance and shall be liable for rejection, if found different from the reports of the pre-dispatch inspection and one copy of the report shall be sent to Project Engineering department.
- b) In case the transformers proposed for supply against the order are not exactly as per the tested design, the Bidder shall be required to carry out the short circuit test and impulse voltage withstand test at its own cost in the presence of the representative of the TPCODL/TPNODL/TPSODL/TPWODL. The supply shall be accepted only after such test is done successfully, as it confirms on successful withstand of short circuit and healthiness of the active parts thereafter on un-tanking after a short circuit test. Apart from dynamic ability test, the transformers shall also be required to withstand thermal ability test or thermal withstand ability will have to be established by way of calculations.
- c) The TPCODL/TPNODL/TPSODL/TPWODL reserves the right to conduct all tests on Transformer after arrival at site / stores and the manufacturer shall guarantee test certificate figures under actual service conditions.
- d) The TPCODL/TPNODL/TPSODL/TPWODL reserves the right to conduct short circuit test and impulse voltage withstand test in accordance to IS, afresh on each ordered rating at TPCODL/TPNODL/TPSODL/TPWODL cost, even if the transformer of the same rating and similar design are already tested. This test shall be carried out on a transformer to be selected by the TPCODL/TPNODL/TPSODL/TPWODL either at the manufacturer's works when they are

offered in a lot for supply or randomly from the supplies already made to TPCODL/TPNODL/TPSODL/TPWODL stores. The findings and conclusions of these tests shall be binding on the bidder.

- e) Test at TPCODL/TPNODL/TPSODL/TPWODL store/Site: after receipt of transformers at TPCODL/TPNODL/TPSODL/TPWODL stores/Site, following minimum tests will be carried out.
1. Total weight of the transformer. (It should be as per the offer, subjected to tolerance as per approved drawings & GTPs)
  2. Oil level in the transformer
  3. Verifications of all the fittings
  4. Physical verification of all the transformers for any damages, oil leakage, quality of painting etc.
- f) Test at site: The TPCODL/TPNODL/TPSODL/TPWODL reserves the right to conduct all tests on Transformer after arrival at site/stores and the manufacturer shall guarantee test certificate figures under actual service conditions.
- g) **Shock/impact recorder data analysis to be submitted by bidder to ascertain the concealed damage.**

## 11. GUARANTEE:

- I. Bidder shall stand guarantee towards design, materials, workmanship & quality of process/manufacturing of items under the contract for due and intended performance of the same, as an integrated product delivered under this contract.
- II. In the event any defect is found by the TPCODL/TPNODL/TPSODL/TPWODL up to a period of 48 months from the date of commissioning or 60 months from the date of last supplies made under the contract, whichever is earlier.
- III. Bidder shall be liable to undertake to replace/rectify such defects at his own costs, within mutually agreed timeframe, and to the entire satisfaction of the TPCODL/TPNODL/TPSODL/TPWODL, failing which the TPCODL/TPNODL/TPSODL/TPWODL will be at liberty to get it replaced/rectified at Bidder's risks and costs and recover all such expenses plus the TPCODL/TPNODL/TPSODL/TPWODL's own charges (@ 20% of expenses incurred), from the Bidder or from the "Security cum Performance Deposit" as the case may be.
- IV. In case of Two Winding Power Transformer fails within the guarantee period the TPCODL/TPNODL/TPSODL/TPWODL will immediately inform the Bidder who shall take back the failed Two Winding Power Transformer within 15 days from the date of intimation at his own cost and replace / repair the transformer within forty five days of date of intimation with a roll over guarantee.
- V. The outage period i.e. period from the date of failure till unit is repaired / replaced shall not be counted for arriving at the guarantee period. Bidder shall further be responsible for 'free replacement' for another period of THREE Years from the end of the guarantee period for any 'Latent Defects' if noticed and reported by the TPCODL/TPNODL/TPSODL/TPWODL.

## 12. PACKING AND TRANSPORT:

- I. Bidder shall ensure that all the equipment covered under this specification shall be prepared for rail/road transport in a manner so as to protect the equipment from damage in transit.
- II. The packing may be in accordance with the bidder's standard practice but he should give full particulars of packing for the approval of the TPCODL/TPNODL/TPSODL/TPWODL. Special



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arrangement should be made to facilitate handling and to protect the projecting connections from damage in transit.

- III. The transformer shall be shipped filled with oil upto transport oil level guage. If transformer is transported without Oil or Partially filled, the tank shall be filled with Nitrogen under pressure complete with gas cylinder reducer, connection and pressure gauges. (After testing dew point of the Nitrogen filled. Dispatch clearance will be given only after achieving satisfactory dryness i.e. dew point measurement results). These accessories will be part of purchase. However, if neutral grounding transformer and reactors are included in the scope, these can be transported with oil. (Whichever way desired by the TPCODL/TPNODL/TPSODL/TPWODL depending on the size etc.)
- IV. Provisions for monitoring of oil and gas pressure during transport and storage and a make-up Nitrogen cylinder shall be made.
- V. A shock recorder also shall be provided during transport. Data of the same shall be shared during execution.
- VI. Bushings shall be packed in proper containers for transport.
- VII. All parts shall be adequately marked to facilitate field erection.
- VIII. Boxes and crates shall be marked with the contract number and shall have a packing list enclosed showing the parts contained therein
- IX. Unloading, dragging of transformer up to 50mtrs & keeping it on foundation at TPCODL/TPNODL/TPSODL/TPWODL site/stores will be in the scope of supplier. The bidder shall take care of this point while quoting the rates for Freight & Insurance charges.

### 13. TENDER SAMPLE:

All offered transformer detailed documents to be submitted as per clause no.18. The sample shall be not applicable

### 14. QUALITY CONTROL:

1. The bidder shall submit with the offer Quality assurance plan indicating the various stages of inspection, the tests and checks which will be carried out on the material of construction, components during manufacture and bought out items and fully assembled component and equipment after finishing.
2. As part of the plan, a schedule for stage and final inspection within the parameters of the delivery schedule shall be furnished.
3. The TPCODL/TPNODL/TPSODL/TPWODL's engineer or its nominated representative shall have free access to the manufacturer's/sub-supplier's works to carry out inspections.
4. The Bidder shall invariably furnish following information along with his bid, failing which the bid shall be liable for rejection. Information shall be separately given for individual type of equipment offered.
  - i. Statement giving list of important raw materials, names of sub-suppliers for the raw materials, list of standards according to which the raw materials are tested.
  - ii. List of tests normally carried out on raw materials in the presence of Bidder's representative, copies of test certificates.
  - iii. Information and copies of test certificates as in (i) above in respect of bought out accessories.
  - iv. List of manufacturing facilities available.
  - v. **Level of automation achieved and list of areas where manual processing exists.**

- vi. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspection.
  - vii. List of testing equipment available with the bidder for final testing of equipment along with valid calibration reports shall be furnished with the bid. Manufacturer shall possess 0.1 class instruments for measurement of losses.
  - viii. Quality Assurance Plan (QAP) withholds points for TPCODL/TPNODL/TPSODL/TPWODL's inspection.
5. The successful Bidder shall within 30 days of placement of order, submit following information to the TPCODL/TPNODL/TPSODL/TPWODL.
- a. List of raw materials as well as bought out accessories and the names of sub-Suppliers selected from those furnished along with offer.
  - b. Type test certificates of the raw materials and bought out accessories.
6. The successful Bidder shall submit the routine test certificates of bought out accessories and central excise passes for raw material at the time of routine testing.

#### 15. TESTING FACILITIES:

Bidder shall have adequate in house testing facilities for carrying out all routine tests, acceptance tests and pre-dispatch inspection as per relevant International / Indian standards. The bidder shall have minimum testing facilities in house for following:

- a. Heat run test
- b. SFRA
- c. Pre dispatch inspection as per clause no. 9 above

#### 16. MANUFACTURING FACILITIES:

- a. The successful bidder will have to submit the bar chart for various manufacturing activities clearly elaborating each stage, with quantity.
- b. This bar chart should be in line with the Quality assurance plan submitted with the offer.
- c. Cat-A approval is mandatory to start manufacturing.

#### 17. SPARES, ACCESSORIES AND TOOLS

- 1. Bidder shall provide a list of recommended spares with quantity and unit prices for 5 years of operation after commissioning.
- 2. The TPCODL/TPNODL/TPSODL/TPWODL may order all or any of the spare parts listed at the time of contract award and the spare parts so ordered shall be supplied as part of the definite works.
- 3. The TPCODL/TPNODL/TPSODL/TPWODL may order additional spares at any time during the contract period at the rates stated in the Contract Document.
- 4. Bidder shall give an assurance that spare parts and consumable items will continue to be available through the life of the equipment which shall be 25 years minimum.
- 5. However, the TPCODL/TPNODL/TPSODL/TPWODL shall be given a minimum of 12 months' notice in the event that the Bidder or any sub-vendor plans to discontinue manufacture of any component used in this equipment.
- 6. Any spare apparatus, parts or tools shall be subject to the same specification, tests and conditions as similar material supplied under the Contract. They shall be strictly interchangeable and suitable for use in place of the corresponding parts supplied with the equipment and must be suitably marked and numbered for identification.
- 7. The bidder shall also provide the following mandatory spares along with the transformer.
  - a. HT Bushing (1no.)



- b. LT Bushing (1no.)
- c. Neutral Bushing (1 no.)
- d. Buchholtz Relay (1 no.)
- e. Valves ( 1Set)
- f. OTI, WTI ( 1 each)
- g. PRV (1 no); OSR (1 no); MOG (1 no)
- h. Transducers for OTI, WTI, PTI
- i. Air cell (1 no.)
- j. Fan contactor with overload relay (1 no.)
- k. Cooling fan (1 no.)
- l. Set of gaskets (1 no.)
- m. Set of mandatory spares for tap changer (1 no.)
- n. Oil – 10% extra
- o. Radiator tube plug – 5 No
- p. Radiator tube valves – 2 No
- q. Radiator tube plug oil seals – 12 No
- r. MCCB (1 no.)
- s. MCB (1 no.)
- t. L/R switch (1 no.)
- u. R/L switch (1 no.)
- v. OLTC counter (1 no.)
- w. Space heater & thermostat (1 no.)
- x. Bushing CT for HV (1 no.)
- y. Bushing CT for Neutral (1 no.)
- z. Bushing CT for LV (1 no.)

**18. DRAWINGS AND DOCUMENTS:**

1. Following drawings and documents shall be prepared based on TPCODL/TPNODL/TPSODL/TPWODL specifications and statutory requirements and shall be submitted with the bid:
  - a. Completely filled in Technical Particulars and compliance to each clause of the specification General Technical Requirements to Additional Details.
  - b. Description of the transformer and all components including brochures.
  - c. General arrangement for Transformer.
  - d. Bill of material.
  - e. Experience Certificate and list
  - f. Type test certificates.
  - g. List of makes of major components as listed above.
2. Drawings / documents to be submitted after the award of the contract are as under:

Sr. No	Description	For Approval	For Review Information	Final Submission
1	Technical Parameters	√	√	√
2	GA Drawing of Transformer	√	√	√
3	HV and LV bushing internal view with terminal connector	√	√	√
4	Internal coil arrangement with dimensions	√	√	√

5	Breather Drawing		√	√
6	Rating Plate	√	√	√
7	Cooling calculation with no. of radiators and fins mentioned specifically	√	√	√
8	Prismatic oil level gauge drawing			√
9	Installation Instruction		√	√
10	QA & QC Plan		√	√
11	Test Certificates	√	√	√
12	Shipping drawings showing dimensions and weights of each package.	√	√	√
13	Assembly drawings and weight of main component parts.	√	√	√
14	Drawings giving Weights for foundations	√	√	√
15	Tap changing and name plate diagram.	√	√	√
16	Schematic control along with logic block diagram and wiring diagram for all auxiliary equipment.		√	√
17	Schematic diagram showing the flow of oil in the cooling system as well as each limb and winding. Longitudinal and cross-sectional views showing the duct sizes, cooling pipes etc.	√	√	√
18	Large scale drawings of high and low tension windings of the transformers showing the nature and arrangement of insulation and terminal connections.	√	√	√
19	Bushing drawing and specifications.	√	√	√
20	Crane requirement for assembly and dismantling.		√	√
21	Overhead Conductor Connections.		√	√

22	Foundation drawing of transformer, radiator supports, etc.		√	√	√
23	Valve Schedule details	√	√		√
24	HV , LV Bushing fixing and connection Details		√		√
25	Radiator drawing and their fixing arrangement.		√		√
26	Marshaling junction box details	√	√		√
27	Thermo junction box details.	√	√		√
28	Neutral arrangement	√	√		√
29	Drawing showing conservator with air bag and oil filling instructions	√	√		√

In addition to the above, the following drawing / information for each item pertaining to marshalling box and OLTC shall also be supplied.

30	General arrangement drawing of the marshaling box		√	√	√
31	Shipping drawings showing dimensions and weight of each package		√	√	√
32	Drawing giving the weight for its foundation.		√	√	√
33	Schematic control drawing and TB schedule / wiring diagram for all elements		√	√	√
34	Valve Schedule		√	√	√
35	Test report of all bought out elements.		√	√	√
36	The tightening torque chart		√	√	√

**3. List of Calculations to be submitted:**

- All the calculations shall be step by step showing the use of formulas and other practical considerations. **Concise calculations in table or excel sheet shall not be accepted.** Also, the reference (only standard sources as IS, IEC or any such standard is acceptable) of the formulas shall be mentioned.
- Resistance Calculation ( 75 deg. C )
- Load Losses Calculation ( at 75 deg. C )
- No load Losses.
- Stray Losses.
- Weight of Copper (Bare and with Insulation also).
- Weight of Core.
- BH curve & Loss/Kg graph of core material offered.
- Flux Density calculations.
- Current Density Calculations.
- Short Circuit withstand.
- Temperature Rise Calculations.
- Conservator Volume calculations



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14. Cooling Calculations showing cooling with tank and radiators separately with no. of radiators and fins mentioned specifically (For both Mineral oil and Ester oil)
15. Calculation sheet for Lifting lug design and mounting lug design to be submitted by Bidder.

**4. Additional Documents to be submitted :**

- a. List of raw materials as well as bought out accessories and name of sub-suppliers selected from those furnished along with offer.
- b. Type test certificates of the raw materials and bought out accessories.
- c. The successful Bidder shall submit the routine test certificates of bought out accessories and central excise passes for raw material at the time of routine testing.

All the documents & drawings shall be in English language. After the receipt of the order, the successful bidder will be required to furnish all relevant drawings/parameters/calculation to TPCODL/TPNODL/TPSODL/TPWODL for approval.

**5. Instruction Manuals:**

Bidder shall furnish softcopies of nicely bound manuals (In English language) covering erection and maintenance instructions and all relevant information and drawings pertaining to the main equipment as well as auxiliary devices.

**19. SCHEDULE- "A" GUARANTEED TECHNICAL PARTICULARS:**

Sl. No.	Description	Unit	As furnished by Bidder
1.0	Tapings on HV winding ON Load Range a) Number of steps b) Principal tap		
2.0	For ON load taps, specify details of OLTC gear(incl. type & make)		
2.1	Manual/automatic control		
2.2	Remote/local control		
2.3	If remote control, whether the remote Control cubicle included in Bidder's scope of supply		
2.4	Voltage class of OLTC		
2.5	Current rating of OLTC		
2.6	a) Location of OLTC with respect to HV winding (attach sketch). b) Location of OLTC (In Tank/Outside Tank)		
2.7	Whether separate tap winding provided for OLTC		
2.8	Whether Selector and diverter chamber are separate		
2.9	Total oil in the OLTC in selector switch		

	-- In diverter switch		
3.0	Winding		
3.1	Maximum current density in winding	Amps/mm <sup>2</sup>	
3.2	Use of continuously transposed conductor (CTC) in LV winding.	Yes/No	Yes
3.3	Area of cross section of winding conductor (HV/LV/Reg).	mm <sup>2</sup> (Min)	
3.4	Description of winding insulation		
3.5	Nature of insulation	Class	
3.6	Bare weight of copper in windings without paper insulation and leads.	Kg (Minimum)	
3.7	Details of winding and winding conductor		
4.0	Tank :		
4.1	Approximate thickness		
	Sides	mm	
	Bottom	mm	
	Cover	mm	
4.2	Material of tank		
5.0	Maximum temperature-rise above an ambient of (deg.C) a)Top oil b)Windings c) Temperature Gradient between Oil and Winding	°C °C °C	
6.0	Total loss at rated voltage at principal tapping and rated frequency.	kW	
7.0	Component losses: at 90%, at 100%, and At 110% :		
7.1	Maximum Guaranteed No load loss at rated voltage on principal tapping and at rated frequency :	kW	
7.2	Calculated No load loss at rated principal tapping & rated frequency. Submit necessary calculations	kW	
7.3	Maximum guaranteed I <sup>2</sup> R loss at rated current for the principal tapping at 75°C.	kW	
7.4	Calculated I <sup>2</sup> R loss at rated current for the principal tapping at 75°C. Submit necessary calculations.	kW	
7.5	Calculated additional losses (Eddy + stray losses) at rated current for the principal tapping at 75°C. Submit necessary Calculations.	kW	
7.6	Maximum guaranteed additional losses (Eddy + stray losses) at rated current for the principal tapping at 75°C.	kW	

7.7	Maximum Guaranteed auxiliary losses	kW	
7.8	Auxiliary losses at rated current for principal tripping:	kW	
7.9	Maximum Calculated total Losses (sum of sr.no.19.2+19.4+19.5+ 19.7) submit necessary calculation.	kW	
7.10	Guaranteed Total Losses (sum of sr. no. 19.1+19.3+19.6+19.7) submit necessary calculation.	kW	
8.0	Impedance voltage at rated current for the principal tapping HV LV (Percent) Note: (The above impedance values shall be on full MVA rating of transformer i.e. For 2 winding transformer on 20 MVA base )	%	
9.0	Reactance at rated current and rated frequency (On full MVA rating of transformer i.e.For 2 winding transformer on 20 MVA base ) i) HV LV ii) No load current at rated voltage and rated frequency	%	
10.0	a)Partial discharge level : b)Noise level : c)Harmonic content in charging current :		
11.0	Insulation level		
11.1	Separate source power-frequency voltage withstand : i)HV winding ii)LV winding iii)LV neutral	kV rms kV rms kV rms	
11.2	Induced over voltage withstand i)HV winding ii)LV winding iii)LV neutral	kV rms kV rms kV rms	
11.3	Full wave lightning impulse withstand voltage nd i)HV winding ii)LV winding iii)LV neutral	kV peak kV peak kV peak	
11.4	Uniform/Graded Insulation i)HV winding ii)LV winding iii)LV neutral	kV peak kV peak kV peak	
12.0	a)External short circuit withstand capacity b)External short circuit withstand capacity i) for HV side ii) for LV side c)Duration of external short withstand capacity	MVA  kA kA In Sec.	

13.0	Efficiencies at 75 deg.C at unity power factor : a) At full load b) At 3/4 full load c) At 1/2 full load d) At 1/4 full load	% % % %	
14.0	Efficiencies at 75 deg.C at 0.8 power factor : a) At full load b) At 3/4 full load c) At 1/2 full load d) At 1/4 full load	% % % %	
15.0	a) 415 V single phase short circuit impedance b) Percentage variation between phases.		
16.0	Regulation at full load at 75 deg.C a)At unity power factor b)At 0.8 power factor lagging	% %	
17.0	Terminal arrangement: a) High voltage b) Low voltage c) Neutral (LV) d) HV terminal phase spacing e) LV terminal phase spacing f) Any other information		
18.0	Approximate masses: a) Core b) Winding c) Bare weight of copper in windings without paper insulation and leads d) Tanks, fittings and accessories. e) Oil f) Total mass	Kg Kg Kg Kg Kg Kg	
19.0	Approximate quantity of oil required for filling (main tank) OLTC Overall maximum dimensions of the transformer complete with accessories : a) Length b) Breadth c) Height	mm mm mm	
	Untanking height Reference standards		

20.	<p>Details of HV Bushings line</p> <p>a) Voltage class, b) Current rating, c) 1.2/50 s impulse withstand d) Make e) Type f) Creepage distance, total g) Creepage distance, protected. h) Year of manufacture. i) Qty. of oil in oil filled bushing</p>	<p>kV A kV (rms)</p> <p>mm mm MM/YYYY Ltr.</p>	
21	<p>Details of LV Bushings line (LV line end)</p> <p>a) Voltage class, b) Current rating, c) 1.2/50 s impulse withstand d) Make e) Type f) Creepage distance, total g) Creepage distance, protected. h) Year of manufacture. i) Qty. of oil in oil filled bushing</p>	<p>kV A kV(rms)</p> <p>mm mm MM/YYYY Ltr.</p>	
22.0	<p>Details of Neutral Bushings</p> <p>a) Voltage class, b) Current rating, c) 1.2/50 s impulse withstand d) Make e) Type f) Creepage distance, total g) Creepage distance, protected. h) Year of manufacture. i) Qty. of oil in oil filled bushing</p>	<p>kV A kV (rms)</p> <p>mm mm MM/YYYY Ltr.</p>	
23.0	<p>Details of Core Grounding Bushings</p> <p>a) Voltage class, b) Current rating, c) 1.2/50 s impulse withstand d) Make e) Type f) Creepage distance, total g) Creepage distance, protected. h) Year of manufacture. i) Qty. of oil in oil filled bushing</p>	<p>kV A kV (rms)</p> <p>mm mm MM/YYYY Ltr.</p>	



24.0	<p>Details of LV Cable Connection</p> <p>a) Clearances</p> <p>i) Phase to Phase</p> <p>ii) Phase to Earth</p> <p>b) Drawing enclosed</p> <p>c) Length Of Each phase Bus Bars. The Bus bars are suitable for how many numbers of 1Cx 1000 sq mm, 11kV, XLPE cable.</p>		
25.0	<p>Designed Fault Levels:</p> <p>a) HV</p> <p>b) LV</p>	<p>MVA</p> <p>MVA</p>	
26.0	<p>Core</p> <p>a) Material &amp; Grade</p> <p>b) thickness in mm</p> <p>c) Type of core</p> <p>d) Operating flux density</p> <p>e) Maximum flux density</p> <p>f) Over fluxing capability for 10% voltage &amp; 3% frequency variation</p> <p>g) Specific No load loss for the grade of core chosen at the specified flux density.</p> <p>h) Net weight of CRGO lamination in core. (Kg minimum).</p> <p>( Please submit copy of graph in support of this)</p>	<p>Yes / No</p> <p>Watts/Kg</p>	
27.0	<p>Details of CTs on HV Bushings (Line )</p> <p>a) No. of cores</p> <p>b) Ratio for each core</p> <p>c) VA burden - for each core (along with Imag and VK wherever necessary)</p> <p>d) Accuracy class of each core</p> <p>e) Year of manufacture.</p> <p>f) Short time thermal current rating</p> <p>i) Current</p> <p>ii) Rated time</p>	<p>kA</p>	
28.0	<p>Details of CTs on LV Bushings.(Line )</p> <p>a) No. of cores</p> <p>b) Ratio for each core</p> <p>c) VA burden - for each core (along with Imag and VK wherever necessary)</p> <p>d) Accuracy class of each core.</p> <p>e) Year of manufacture.</p> <p>f) Short time thermal current rating</p> <p>i) Current</p> <p>ii) Rated time</p>	<p>kA</p>	
29.0	<p>Rail gauge (along both axis)</p>		

30.0	Whether Neutral end surge diverter recommended by bidder		
31.0	If yes details of surge diverter a) Type b) Make kV class kV rating		
32.0	Tertiary winding if any kept isolated then the bidder to state whether one terminal to be earthed or any other precautions required during service conditions		
33.0	On load tap changer Particulars a) Make b) Type, designation c) Suitable for auto/manual operation d) Rated voltage kV e) Basic insulation level (BIL) of OLTC (kV peak) f) One minute power frequency voltage withstand of OLTC g) Rated current (A) h) No. of steps i) Step voltage (V) j) Rated voltage of drive motor V k) Whether diverter and selector chambers are separate. l) Rated voltage of control circuit V m) Time to complete tap changing operation from any one step to next higher or lower tap. i) On auto operation - Sec. ii) On manual operation through push button - Sec. n) List of routine tests to be carried out on tap changer o) Location of the taps with respect to the terminals of the tapped winding p) Drawing or pamphlet number of the technical and descriptive particulars of the OLTC, enclosed with the bid. q) Separate conservator and Buchholz relay provided for OLTC (Yes/No) r) RTCC (Remote Tap Changer Control Panel) i. List of tap changer Annunciation ii. Two sets of potential free contacts for SCADA provided. iii. Two sets of 0/20 mA output for tap position indication provided. iv. 415 V Auto changeover facility for OLTC motor provided.		

34.0	<p>Marshalling Box</p> <p>a) Derived control supply Voltage</p> <p>b) 415 V /control supply auto-changeover facility provided.</p> <p>c) Local OTI/WIT provided.</p> <p>d) Remote OTI/WIT provided.</p> <p>e) Two sets of 0/4-20 mA signals for OTI/WIT provided.</p> <p>f) List of annunciations.</p> <p>g) Two sets of potential free contacts for annunciations provided.</p>		
35.0	Whether Marshalling boxes (ground as well as tank) provided as per specifications		
36.0	<p>Surface Preparation/Painting</p> <p>1) Material used fir Adequate rust proofing done on transformer and radiator (Details of measures to be enclosed)</p> <p>2) Type of paint (epoxy/enamel)</p> <p>3) Whether galvanized radiator offered as alternative.</p>		
37.0	<p>Conservator Oil preservation system Details (Air bag)</p> <p>a) Material of separator/Air bag</p> <p>b) Details of air pressure for the separator</p> <p>i. Design pressure</p> <p>ii. Working pressure</p> <p>iii. Bursting pressure (Puncture strength)</p> <p>c) Procedure of oil filling with air bag to be enclosed.</p> <p>d) Any precautions to be taken during maintenance of transformer with air bag to be mentioned here.</p>		
38.0	General arrangement drawing of the transformer indicating details of HV/MV/LV terminals and over all dimensions enclosed		Yes/No
39.0	Neutral Bushing Calculation to be submit.		Yes

**20. SCHEDULE “B” DEVIATIONS:**

**(TO BE ENCLOSED WITH TECHNICAL BID)**

All deviations from this specification shall be set out by the Bidders, clause by Clause in this schedule. Unless specifically mentioned in this Schedule, the tender shall be deemed to confirm the purchaser's

**TPCODL**  
**TPWODL**

**TPNODL**  
**TPSODL**

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specifications:

<b>SL. No</b>	<b>Clause No.</b>	<b>Details of deviation with justifications</b>

We confirm that there are no deviations apart from those detailed above.

Seal of the Company:

Signature

Designation

# **STANDARD TECHNICAL SPECIFICATION COVER SHEET**

**Specification No. : ENG-EHV-1004**

**Specification Name : Technical Specification for 33/0.4kV 100kVA to 2000kVA  
Distribution Transformer (Cu)**

<b>SATYA PRASAD NAYAK</b>	<b>SHANTAPRIYA JENA</b>	<b>JYOTIPRAKASH MOHANTY</b>	<b>Vijender Goyal</b>	<b>KHAJAN BHARDWAJ</b>	<b>POURUSH GARG</b>
Prepared by	Reviewed by	Reviewed by	Reviewed by	Approved by	Released by
TPCODL	TPNODL	TPWODL	TPSODL	TPCODL	TPCODL
06-12-2022	06-12-2022	06-12-2022	06-12-2022	06-12-2022	07-12-2022

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TPWODL*



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20. SCHEDULE "B" DEVIATIONS



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Specification Name: Technical Specification for 33/0.4kV 100kVA to 2000kVA Distribution Transformer (Cu)

## 1. SCOPE:

- I. This Specification covers the technical requirements of design, manufacture, testing at manufacturer's works, packing forwarding, supply and unloading at site/store and performance of Oil immersed, non-sealed, naturally cooled, three Phase 33/0.433 kV, 50Hz, outdoor conventional type, copper winding, Distribution Transformer of 100kVA to 2MVA ratings.
- II. The transformer shall be complete with all components and accessories, which are necessary or usual for their efficient performance and trouble free operation under the various operating and atmospheric conditions specified in clause no. 3
- III. Such of the parts that may have not been specifically included, but otherwise form part of the transformer as per standard trade and/or professional practice and/or are necessary for proper operation of transformer, will be deemed to be also included in this specification. The successful bidder shall not be eligible for any extra charges for such accessories etc. notwithstanding the fact that at the time of an initial offer bidder had segregated such items and quoted for them separately.
- IV. **HV Bushing Arrangement ( Cl.no 5.9) ; Metering CT (Cl.No 5.12) are to be finalized by user group during tender.**

## 2. APPLICABLE STANDARDS:

The equipment ( and the materials used ) covered by this specification shall unless otherwise stated, be designed, manufactured and tested in accordance with the latest editions of the following Indian standards & other relevant standards for components, BEE & CEA guidelines with latest amendment from time to time, thereof, some of which are listed below:

Indian Standards	Title
IS 1180	Outdoor Type Oil Immersed Distribution Transformers Upto and Including 2500 KVA, 33 kV-Specification
IS 2026 ( all parts )	Specification for Power Transformers
IS 104	Specification for ready mixed paint, brushing, zinc chrome, priming
IS 335	Specification for new insulating oil.
IS 649	Testing for steel sheets and strips and magnetic circuits.
IS 5	Specification for Colors for ready mixed paints and enamels
IS 1576	Solid Pressboard for Electrical Purposes -Specification

IS 2099	Specification for bushings for alternating voltages above 1000 volts
IS 2362	Determination of water content in oil by Karl in oil Fischer Method – Test Method.
IS 3024	Grain oriented electrical steel sheets and strips
IS3347 (Part I & Part-3)	Dimensions for Porcelain Transformer Bushings for Use in Normal and Lightly Polluted Atmospheres - Part 1 : Up to and including 1 kV
IS 4253: Part II	Specification for cork composition sheets- Part II : Cork and Rubber
IS 4257(Part I)	Dimensions for Clamping Arrangements for Porcelain transformer Bushings - Part I: For 12 kV to 52 kV Bushings
IS 5082	Wrought Aluminum and Aluminum Alloy bars, Rods , Tubes, Sections, Plates and Sheets for Electrical Applications
IS 5561	Specification for Electric Power Connectors
IS 6103	Specification for Testing of specific resistance of electrical insulating liquids
IS 2026	Guide for loading of Oil-immersed transformer
IS 6792	Method for Determination of Electric Strength of Insulating Oil
IS 7404 (Part-1)	Paper Covered conductors: Round Conductors
IS 7421	Specification for porcelain bushings for alternating voltages up to and including 1000kv
IS 8603 (Part-1)	Dimensions for Porcelain Transformer Bushings for Use in Heavily Polluted Atmospheres - Part I:12 kV and 17.5 kV , 24 kV & 36 kV Bushings.
IS 9335	Specification for Cellulosic Papers for Electrical Purposes
IS 10028	Code of Practice for Selection, Installation and Maintenance of Transformers
IS 11149	Specification for rubber gaskets
IS 12444	Specification for Continuously Cast and Rolled Electrolytic Copper Wire Rods for Electrical Conductors.
IS/IEC 60947 ( PART 1& PART 2 )	Specification for LV Switchgear & Control gear
IS 6160	Rectangular electrical conductors for electrical machines
IS 13964	Methods of measurement of transformer and reactor sound levels





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IS 3401	Specification of silica Gel
IS 1897	Copper strip for electrical purposes
IS 60529	Degree of protection provided by enclosure
IS 816	Welding of Mild Steel
CEA	Guidelines for specifications of energy efficient outdoor type single and three phase distribution transformers
IS 6262	Method of test for power factor and dielectric constant of electrical insulating liquids
IS 16659	Fluids For Electro technical Applications - Unused Natural Esters For Transformers And Similar Electrical Equipment
IS 16081	Insulating liquids — Specifications for. Unused synthetic organic esters for Electrical purposes
IEC 60156	Method of determination of electric strength of insulating oils.
IEC 60296	Specification for unused mineral insulating oils for transformers and switchgear.
IEC 60529	Degrees of protection provided by enclosures (IP Code)
IS 1852	: Rolling and cutting tolerances for hot rolled steel products

### 3. CLIMATIC CONDITIONS:

1	Maximum ambient temperature	50 deg C
2	Max. Daily average ambient temp	35 deg C
3	Min Ambient Temperature	0 deg C
4	Maximum Humidity	95%
5	Average Annual Rainfall	1500 mm
6	Average No. of rainy days per annum	120
7	Altitude above MSL not exceeding	1000m
8	Wind Pressure	300 Km/hr
9	Earthquakes of an intensity in horizontal	equivalent to seismic



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	direction	acceleration of 0.3g
10	Earthquakes of an intensity in vertical direction	equivalent to seismic acceleration of 0.15g (g being acceleration due to gravity)

TPCODL/TPNODL/TPSODL/TPWODL service area has heavy saline conditions along the coast and High cyclonic Intensity winds with speed upto 300 Kmph. The atmosphere is generally laden with mild acid and dust in suspension during the dry months and is subjected to fog in cold months.

#### 4. GENERAL TECHNICAL REQUIREMENTS:

S. No.	Description	Requirements										
			*	*	*	*	*	*	*	*	*	*
1.	Continuous Rated Capacity (kVA)	<b>100 kVA</b>	<b>250 kVA</b>	<b>315 kVA</b>	<b>400 kVA</b>	<b>500 kVA</b>	<b>630 kVA</b>	<b>800 kVA</b>	<b>1 MVA</b>	<b>1.25 MVA</b>	<b>1.6 MVA</b>	<b>2 MVA</b>
2.	Application	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor
3.	System voltage (max.)	36 kV	36 kV	36 kV	36 kV	36 kV	36 kV	36 kV	36 kV	36 kV	36 kV	36 kV
4.	Rated voltage HV	33kV	33kV	33kV	33kV	33kV	33kV	33kV	33kV	33kV	33kV	33kV
5.	Rated voltage LV (V)	433-250	433-250	433-250	433-250	433-250	433-250	433-250	433-250	433-250V	433 V-250V	433 V-250V
6.	Line current HV (A)	1.75A	4.4 A	5.5 A	7.0 A	8.7 A	11.0 A	14 A	17.5 A	21.9 A	28.0 A	35 A
7.	Line current LV (A)	133.34A	333.33 A	420.02 A	533.36 A	666.68 A	840.02 A	1066.7 A	1333.4 A	1666.7 A	2133.5 A	2666.7 A
8.	Frequency (Hz)	50 Hz	50 Hz	50 Hz	50 Hz	50 Hz	50 Hz	50 Hz	50Hz	50Hz	50Hz	50Hz
9.	No. of Phases	Three	Three	Three	Three	Three	Three	Three	Three	Three	Three	Three
10.	Connection HV	Delta	Delta	Delta	Delta	Delta	Delta	Delta	Delta	Delta	Delta	Delta
11.	Connection LV	Star (Neutral Brought out)	Star (Neutral Brought out)	Star (Neutral Brought out)	Star (Neutral Brought out)	Star (Neutral Brought out)	Star (Neutral Brought out)	Star (Neutral Brought out)	Star (Neutral Brought out)	Star (Neutral Brought out)	Star (Neutral Brought out)	Star (Neutral Brought out)
12.	Vector group	Dyn-11	Dyn-11	Dyn-11	Dyn-11	Dyn-11	Dyn-11	Dyn-11	Dyn-11	Dyn-11	Dyn-11	Dyn-11
13.	Type of cooling	ONAN	ONAN	ONAN	ONAN	ONAN	ONAN	ONAN	ONAN	ONAN	ONAN	ONAN
14.	Tap changing arrangement (off load)	NA	+5.0% to -10% in steps of 2.5%	+5.0% to -10% in steps of 2.5%	+5.0% to -10% in steps of 2.5%	+5.0% to -10% in steps of 2.5%	+5.0% to -10% in steps of 2.5%	+5.0% to -10% in steps of 2.5%	+5.0% to -10% in steps of 2.5%	+5.0% to -10% in steps of 2.5%	+5.0% to -10% in steps of 2.5%	+5.0% to -10% in steps of 2.5%
15.	No. of tap positions	NA	7	7	7	7	7	7	7	7	7	7
16.	Noise level at rated voltage and frequency	51 dB	55 dB	56 dB	56 dB	56 dB	57 dB	58 dB	58 dB	60 dB	60 dB	61 dB



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17.	<b>Permissible temperature rise over ambient:</b>												
17.1	Of top oil	35 °C	40 °C	40 °C	40 °C	40 °C	40 °C	40 °C	40 °C	40 °C	40 °C	40 °C	40 °C
17.2	Of winding	40 °C	45 °C	45 °C	45 °C	45 °C	45 °C	45 °C	45 °C	45 °C	45 °C	45 °C	45 °C
18.	Max. Total Losses at 50% loading at 75°C (watts)	467.62	989	1026.63	1236.25	1537.25	1875.88	2308.03	2816.5	3461.5	4267.75	5149.25	
19.	Max. Total Losses at 100% loading) at 75°C (Watts).	1612.5	2902.5	2956.25	3579.75	4407.05	5213.75	6275.85	7525	9030	12147.5	15157.5	
20.	Short circuit impedance voltage at 75°C (±10% tolerance)	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	5%	5%	5%	6.25%	6.25%	
21	Insulation Class	A	A	A	A	A	A	A	A	A	A	A	A
22.	Normal Flux Density (at rated voltage and frequency)	1.6 T	1.6 T	1.6 T	1.6 T	1.6 T	1.6 T	1.6 T	1.6T	1.6T	1.6T	1.6T	1.6T
23.	Maximum current density (A/mm <sup>2</sup> )	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
24.	Impulse withstand voltage	170 kVp	170 kVp	170 kVp	170 kVp	170 kVp	170 kVp	170 kVp	170 kVp	170 kVp	170 kVp	170 kVp	170 kVp
25.	Power frequency withstand voltage	70 kV	70 kV	70 kV	70 kV	70 kV	70 kV	70 kV	70 kV	70 kV	70 kV	70 kV	70 kV
26.	Max. flux density (Increase of +12.5 % combined voltage & frequency variation from rated voltage & frequency)	1.9 T(Max.)											
27.	Voltage fluctuations permissible	+12.5% to -12.5%	+12.5% to -12.5%	+12.5% to -12.5%	+12.5% to -12.5%	+12.5% to -12.5%	+12.5% to -12.5%	+12.5% to -12.5%	+12.5% to -12.5%	+12.5% to -12.5%	+12.5% to -12.5%	+12.5% to -12.5%	+12.5% to -12.5%
28.	<b>Metering CT for LV side (optional, refer 5.12)</b>	200/5	400/5	500/5	600/5	800/5	1000/5	1200/5	1500/5	2000/5 A	2500/5 A	3000/5A	
28.1	Accuracy Class for metering CT	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s
28.2	Burden	20VA	20 VA	20 VA	20 VA	20 VA	20 VA	20 VA	20 VA	20 VA	20 VA	20 VA	20 VA
28.3	ISF (Instrument security factor)	5	5	5	5	5	5	5	5	5	5	5	5
29.	Neutral terminal	Two separate brought out neutral from main neutral bus bar, One for taking out the neutral for 4 wire system and other additional neutral for solid earthing.											
30.	<b>Minimum clearances in air (mm) :</b>												



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30.1	HV phase to phase/ phase to earth	350/32 0	350/32 0	350/3 20	350/3 20	350/3 20	350/3 20	350/3 20	350/3 20	350/3 20	350/32 0	350/320
30.2	LV phase to phase/ phase to earth	75 / 40	75 / 40	75 / 40	75 / 40	75 / 40	75 / 40	75/40	75 / 40	75 / 40	75 / 40	75 / 40
<b>31.</b>	<b>Minimum clearances in Cable Box (mm) :</b>											
31.1	HV phase to phase/ phase to earth	350/22 0	350/22 0	350/2 20	350/2 20	350/2 20	350/2 20	350/2 20	350/2 20	350/2 20	350/22 0	350/220
31.2	LV phase to phase / phase to earth	25 / 20	25 / 20	25 / 20	25 / 20	25 / 20	25 / 20	25/20	25 / 20	25 / 20	25 / 20	25 / 20
32	<b>Wheels</b>	The transformer shall be provided with four uni-directional rollers with locking arrangement suitable for rail gauges in both the axis for movement of transformer in either direction.										
* : Ratings are for optional/ future use												

**5. GENERAL CONSTRUCTION:**

- I. The transformer shall be stacked core, copper coil, oil immersed, naturally cooled (ONAN), non-sealed type with plain rectangular tank.
- II. The transformer shall be suitable for service with fluctuations in supply voltage up to +12.5% to -12.5%.
- III. The transformer shall be designed suitable for service life of 25years.
- IV. The transformer and accessories shall be designed to facilitate trouble free operation, inspection, maintenance and repairs under the various operating and atmospheric conditions specified in clause no. 3.
- V. The design shall incorporate every precaution and provision for the safety of the equipment as well as staff engaged in operation and maintenance of the equipment.
- VI. All outdoor apparatus of the transformer, including bushing insulators with their mountings, shall be designed so as to avoid any accumulation of water.

**5.1 CORE:**

- I. Transformer core shall be stack type, 2D, constructed from high grade cold rolled, non-ageing, grain oriented, silicon steel lamination which shall be properly annealed (under inert atmosphere, if required) to relieve stresses.
- II. The core shall have low loss and good grain properties.
- III. Core should be coated with hot oil proof, with insulation coating, an inorganic coating equivalent to C-5 type as ASTM A976 or IS 3024, like Carlite -3.
- IV. All core should be clamped together with frames to prevent vibration and noise. The core clamping shall be preferably without through bolts and if any bolt used same shall be

- effectively insulated.
- V. The core thickness should be 0.23mm or less. 23HP85 as per IS 3024 or better with Minimum Polarization in Tesla at a Field Strength of 800 A/m
  - VI. Only single grade and same thickness of core stampings shall be accepted and mixing of different grades shall not be allowed.
  - VII. The complete design of the core must ensure maximum permanency of the core losses without continuous working of the transformers.
  - VIII. The value of the maximum flux density allowed in the design and grade of lamination used shall be clearly stated. The vendor shall submit the calculations in support of the same.
  - IX. The handling of core lamination and stacking should be smooth and uniform.
  - X. The transformer shall be suitable for continuous service without damage under 'over fluxing' where the ratio of voltage over frequency exceeds the corresponding ratio at rated voltage and rated frequency up to 12.5% and the core shall not get saturated. The BH graph to be submitted by bidder for core material.
  - XI. The No Load current shall not exceed 2% of the Full Load current for  $\geq 250\text{kVA}$  and will be measured by energizing the transformer at rated voltage and frequency. Increase of 12.5% of rated voltage shall not increase the no-load current by 5% maximum of full load current for  $\geq 250\text{kVA}$  rating
  - XII. The bidder shall be required to submit the following documents in regard to procurement of core material during stage inspection:
    - a. Invoice of supplier
    - b. Mill's test certificate
    - c. Packing list
    - d. Bill of landing
    - e. Bill of entry certificate by custom (if required)
    - f. Description of material, electrical analysis, physical inspection certificate for surface defects, thickness and width of material.
  - XIII. The bidder shall offer the core for inspection and approval of TPCODL/TPNODL/TPSODL/TPWODL during manufacturing stage. Heavy penalty or black listing shall be imposed on the bidders using defective CRGO sheets i.e in case of nonconformance w.r.t TPCODL/TPNODL/TPSODL/TPWODL Specifications.
  - XIV. Transformer core assembly shall have enclosed type lifting lugs for lifting arrangement.
  - XV. **Bidder shall provide the below details in below table:**

Sl. No.	Description	Unit	To be furnished by bidder
1	Magnetizing (No Load) Current		
	90% Voltage	%	
	100% Voltage	%	
	112.5% Voltage	%	
2.	Core grade		
3.	Thickness of core Lamination	Mm	
4.	Core Dimension: Length X height X diameter	mm x mm	
5.	Gross core area	Sq.cm	
6.	Net core area	Sq.cm	
7.	Flux density (calculated)	Tesla	
8.	Over fluxing without saturation (BH curve to be submitted)	Tesla	
9.	Mass of core	Kg	
10.	Loss per Kg of core at the above specified flux	Watt	
11.	Core window height	Mm	
12.	Center to center distance of the core	Mm	
13	Mass of Core Lamination (min.)	Kg	
14	Make of Core offered		

## 5.2 WINDING CONNECTIONS

- I. Primary and secondary windings shall be constructed from high- conductivity (copper conductors), Double Paper Covered (DPC) copper conductor with min. 25% overlap per layer of paper .
- II. The conductor should be drawn uniformly without any deformation and any burr.

- III. No metallic or non-metallic dust should be present in-between DPC conductor.
- IV. The current density for HV and LV winding should not be more than 2.5 Ampere per sq.mm.
- V. The insulation between core and bolts, core and clamps shall withstand **2.5 kV for one minute.**
- VI. Proper bonding of inter layer insulation with the conductor shall be ensured.
- VII. All turns of windings shall be adequately supported (by which material) to prevent movement. The core/coil assembly shall be securely held in position to avoid any movement under short circuit conditions.
- VIII. The joints in the winding shall be avoided but if it is necessary then, they shall be properly brazed and the resistance of the joints shall be less than that of parent conductor. Crimping is not allowed at any joints.**
- IX. LV winding shall be such that neutral formation is at the top.
- X. Bidder shall provide the below details in below table:**

Sl. No.	Description	Unit	To be furnished by bidder
1.	No. of LV coils		
2.	No. of HV coils		
3.	HV conductor grade		
4.	Dia of HV conductor (Bare)	Mm	
5.	Dia of HV conductor with (DPC)	Mm	
6.	Conductivity of HV conductor	%	
7.	Purity of HV conductor	%	
8.	No. of HV Turns	Nos.	
9.	Current density of HV winding(calculated)		
10.	Wt. of the HV winding copper without insulation	Kg	
11.	LV conductor grade		
12.	Dimension of LV conductor (Bare)	mm x mm	
13.	Dimension of LV conductor with (DPC)	mm x mm	
14.	Conductivity of LV conductor	%	
15.	Purity of LV conductor	%	
16.	No. of LV Turns	Nos.	

17.	Current density of LV winding(calculated)	A	
18.	No. of parallels of LV conductor	Nos.	
19.	Wt. of the LV winding copper without insulation	Kg	
20.	Resistance of windings at 20°C		
	HV winding	Ohm	
	LV winding	Ohm	
21.	Height of LV winding	Mm	
22.	Height of HV winding	Mm	
23.	ID of HV winding	Mm	
24.	OD of HV winding	Mm	
25.	ID of LV winding	Mm	
26.	OD of LV winding	Mm	
27.	Thickness of the duct in LV winding	Mm	
28.	Thickness of the duct in HV winding	Mm	
29.	Thickness of the duct between HV & LV	Mm	
30.	Make of the copper winding conductors		

### 5.3 INSULATING PAPER AND INSULATING PRESSBOARD

- I. Inter layer insulation both for HV and LV windings shall be Epoxy diamond dotted Kraft paper and compressed pressboard of make (refer Clause no.5.32) subject to approval of TPCODL/TPNODL/TPSODL/TPWODL
- II. Primary and secondary windings shall be constructed from high- conductivity (copper conductors), Double Paper Covered (DPC) copper conductor with min. 25% overlap per layer of paper.
- III. Kraft paper and Pressboard should be made of pure Cellulose from soft wood pulp manufactured from sulphate process. No additive, adhesive or coloring matter shall be present.
- IV. Kraft paper and Pressboard should be of class A (105°C) insulation material.
- V. All spacers, axial wedges / runners used in windings shall be made of pre-compressed solid pressboard.
- VI. All axial wedges/runners shall be properly milled to dovetail shape so that they pass through the designed spacers freely.
- VII. Insulation shearing, milling and punching operations shall be carried out in such a way, that there should not be any burr, sharp edges and dimensional variations.



- VIII. Kraft paper self-adhesive tape to be used for bonding of insulating paper layer, spanner and paperboards that are immersed in the oil filled transformer.
- IX. **Below required values could be verified if required at any stage of the inspection and it should fulfill the requirement as per below table:**

Characteristics	Kraft Paper	Pressboard (all Sizes)
1. Dimension	As specified by bidder with +5% tolerance.	As specified by bidder with tolerance as per IS1576.
2. Apparent Density	>0.80 g/cm <sup>3</sup>	as per IS 1576 w.r.t Thickness
3. pH of Aqueous extract	6-8%	6-8%
4. Electrical strength i) in air ii) In Oil	7KV/mm -----	12KV/mm 35KV/mm
5. Ash content	Maximum 1%	Maximum 0.7
6. Moisture content	Maximum 8%	Maximum 8%
7. Oil absorption	-----	Minimum 9%
8. Heat stability	As per IS 9335-part 3	As per IS 1576
9. Tear index	As per IS 9335-part 3	As per IS 1576

Bidder has to submit the test certificates as per IS-9335, IS-1576 for all type of insulating materials covering above stated parameters along with **below parameters during stage inspection** :

- a. Substance (Grammage) (g/m<sup>3</sup>)
- b. Compressibility
- c. Tensile strength
- d. Conductivity of water extract
- e. Shrinkage in air
- f. Flexibility
- g. Cohesion between plies<sup>1</sup>.
- h. Elongation
- i. Air permeability
- j. **Bidder shall provide the below details in below table**

Sl. No.	Description	Unit	As furnished by bidder
1.	DPC Paper for HV and LV conductors :		
	Type of DPC Paper		
	Make of DPC Paper		
	Thickness DPC Paper	mm	
	Percentage Overlapping (25% overlap per layer of paper.)	%	



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2.	Type of Paper for Interlayer Insulation		
	Make of Paper for Interlayer Insulation		
	Thickness of Paper for Interlayer Insulation	mm	
3.	Type of Paper for Insulation Between HV and LV winding		
	Make of Paper for Insulation Between HV and LV winding		
	Thickness of Paper for Insulation Between HV and LV winding (for all sizes)	mm	
4.	Type of Pressboards used for Insulation Between HV and LV winding		
	Make of Pressboards used for Insulation Between HV and LV winding		
	Thickness of Pressboards for Insulation Between HV and LV winding (all size)	mm	
5.	Type of Paper used for insulation between core and LV		
	Make of Paper used for insulation between core and LV		
	Thickness of Paper used for insulation between core and LV (All sizes)		
6.	Type of Pressboard used for insulation between core and LV		
	Make of Pressboard used for insulation between core and LV		
	Thickness of Pressboard used for insulation between core and LV (All		



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	sizes)		
7.	Material used for top and bottom yoke insulation		
	Make of material used for top and bottom yoke insulation		
	Thickness of material used for top and bottom yoke insulation	mm	
8.	Type of material used for Spanner, wedge and Axial for insulation		
	Make of material used for Spanner, wedge and Axial for insulation		
	Thickness of material used for Spanner, wedge and Axial for insulation (all sizes)	mm	

#### 5.4 LOSSES

- I. The bidder shall individually guarantee No load loss (Iron loss at rated voltage and frequency) and full load Copper Loss (at 75°C) without any positive tolerance.
- II. **The bidder shall also guarantee the total loss at 50% and 100% load condition (at rated voltage and frequency and these should be within the limits of maximum total losses declared by TPCODL/TPNODL/TPSODL/TPWODL for both 50% and 100% loading values ( as per table below ) :**

Description	Rating (kVA)					
	100	250	315 *	400 *	500	630*
Maximum Losses at 50% loading at 75°C (Watts)	467.63	989	1026.63	1236.25	1537.25	1875.88
Maximum Losses at 100% loading at 75°C (Watts)	1612.5	2902.5	2956.25	3579.75	4407.5	5213.75

Description	Rating (kVA)				
	800*	1000	1225*	1600*	2000
Maximum Losses at 50% loading at 75°C	2308.0	2816.	3461.5	4267.75	5149.25



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(Watts)	3	5			
Maximum Losses at 100% loading at 75°C (Watts)	6275.8 5	7525	9030	12147.5	15157.5

**No positive tolerance shall be allowed on the losses as mentioned above. However, bidder can offer losses less than specified but no consideration in cost will be given for the same.**

**\* : Ratings are for optional/ future use**

- III. **The successful bidder shall guarantee the quoted losses for at least five years.** If at any point of time during operation if it is found that the total losses at 50% and 100% load are more than the values given in specifications, then bidder shall be liable to pay a fine of Rs 250 per watt to the amount by which losses at 50% loading and 100% loading increase with respect to the values given in specifications.
- IV. During testing at Bidder's works if it is found that the actual measured losses are more than the values quoted by the Bidder, **TPCODL/TPNODL/TPSODL/TPWODL shall have the right to reject the complete lot.**
- V. During testing at Bidder's works, if the temperature rise exceeds the specified values, **the entire lot shall be rejected by TPCODL/TPNODL/TPSODL/TPWODL.**
- VI. During testing at Bidder's works, if the impedance values differ from the guaranteed values including tolerance, **the entire lot shall be rejected by TPCODL/TPNODL/TPSODL/TPWODL.**
- VII. Transformer losses shall be checked on any one of DT from supplied lot at TPCODL/TPNODL/TPSODL/TPWODL workshop. If it is found that the actual measured losses are more than the values quoted by the Bidder, **TPCODL/TPNODL/TPSODL/TPWODL shall have the right to reject the complete lot.**
- VIII. **Bidder shall provide the below details in below table:**

Sl. No.	Description	Unit	To be furnished by bidder
1	No Load losses	Watt	
2	Load losses at 50%loading at 75° C	Watt	
3	Load losses at 100% loading at 75° C	Watt	
4	Total losses at 50%load at 75° C	Watt	
5	Total losses at 100% load at 75° C	Watt	
6	<b>Efficiency at 75 deg. C</b>		
7	<b>Efficiency at Unity P.F.</b>		
7.1	100% load	%	
7.2	80% load	%	

7.3	60% load	%	
7.4	40% load	%	
7.5	20% load	%	
8	<b>Efficiency at 0.8 P.F.</b>		
8.1	100% load	%	
8.2	80% load	%	
8.3	60% load	%	
8.4	40% load	%	
8.5	20% load	%	
9	<b>Regulation at :</b>		
9.1	Unity P.F. at 75 deg. C	%	
9.2	0.8 P.F. at 75 deg. C	%	
9.3	% Impedance at 75 deg. C	%	

### 5.5 TRANSFORMER TANK AND TANK CONSTRUCTION

- I. The transformer tank shall be of robust construction, **rectangular in shape** and shall be built up of electrically tested welded mild steel plates.
- II. The tank shall be fabricated by welding at corners. No horizontal or vertical joints in tank side walls and its bottom or top cover shall be allowed.
- III. All welding operations should be carried by **qualified welders** (performance qualification certificates to the customer) as per the relevant ASME standards and a copy of the **welding procedure** has to be submitted to TPCODL/TPNODL/TPSODL/TPWODL at the time of drawing approval.
- IV. The **thickness of tank** should be as below:  
For top and bottom : 6 mm (min.)  
For Sides : 5 mm (min.)  
Tolerance shall be applicable as per IS 1852 as per above thickness band.
- V. The **thickness of tank** for all DTs 100 KVA should be as below:  
For top and bottom : 5 mm (min.)  
For Sides : 3.15 mm (min.)  
Tolerance shall be applicable as per IS 1852 as per above thickness band.
- VI. In addition the cover of the main tank shall be provided with an **air release plug**.
- VII. The tank plates shall be of such strength that the complete transformer when filled with oil may be lifted bodily by means of the lifting lugs provided. The top cover shall have no cut at point of lifting lug.
- VIII. The transformer tank cover shall be bolted with tank rim so as to make a leak proof joint.

- IX. The tank plate and lifting lugs shall be of such strength that the complete transformer filled with oil may be lifted by means of lifting shackle.
- X. The tank cover shall have slight slope (10 mm  $\pm$  2mm) towards HV side to drain rain water.
- XI. There must be sufficient space from the core to the top cover to take care of oil expansion. The oil volume inside the tank shall be such that even under the extreme operating conditions, the **pressure generated inside the tank does not exceed 0.4 kg/sq. cm positive or negative** and the tank shall be of adequate mechanical strength to withstand it.
- XII. The transformer should be capable of **withstanding 0.8kg/sq.cm air pressure and a vacuum of 0.7kg/sq.cm**. The permanent deflection of the flat plate, when the tank without oil is subjected to a vacuum of 525 mm of mercury shall not be more than the values specified:

<u>Length of Plate</u>	<u>Deflection</u>
Up to 750 mm	5.0 mm
751 mm to 1250 mm	6.5 mm
1251 mm to 1750 mm	8.0 mm
Above 1750 mm	9.0 mm

- XIII. **The tank design shall be such that the core and the windings can be lifted freely without dismantling the bushings.**
- XIV. All joints of tank and fittings shall be oil tight and no bulging shall occur during service.
- XV. Anti –theft stainless steel fasteners with breakaway nut shall be provided at top cover (minimum 4 nos. at corners) placed in between other bolts without affecting pitch of bolts.
- XVI. The tightening torque chart to be provided for all bolts used. This shall be submitted along with each rating drawings.
- XVII. The transformer shall be provided with four pulling lugs of MS plate of 8mm thick to pull the transformer horizontally.

**Lifting lugs:**

- XVIII. The transformer shall be provided with a minimum of four welded heavy duty enclosed lifting lugs of Structural steel E250 or better grade quality A (Minimum quality A) as per IS 2062 plate of minimum 16mm thickness for lower rating and gradually increased for higher rating as per weight suitably reinforced by vertical supporting flat stiffener smooth welded properly on the side walls up to reinforcing angle. They shall be so extended that cutting bend plate is not required. The transformer lifting lug shall be painted with yellow colour.
- XIX. The location of lifting lugs shall be such that the clearance between lifting chain and nearest part of bushing shall be at least 100 mm.
- XX. There shall be facilities for lifting the core coil assembly separately.
- XXI. The lifting lugs shall be designed in such a way that any two diagonal lugs are capable of lifting two times of the total weight of the transformer. The design of should be such that it should be suitable for 120degree lifting rope angle as per ASME B30.9 and at any point of time the maximum stress allowed on the Lug martial shall be lesser than 82MPa as per ANSI C.57.12.10
- XXII. Calculation sheet for Lifting lug design to be submitted by Bidder. The calculation shall include the Stress on lifting lug material and stress on welding both. The Stress on the welding should be less than 840kg/cm<sup>2</sup> as per ANSI C.57.12.10. All calculation to be done for considering lifting on any diagonal opposite two lugs conditions.

- XXIII. The lifting lugs shall be located on the side walls only and conservator on LT box side. Separate drawing to be submitted stating welding thickness, welding length and location on tank along with stiffener support for all rating and all lugs.
- XXIV. **Bidder shall provide the transformer size and clearances in below table:**

Sl. No.	Description	Unit	To be furnished by bidder
1	<b>Transformer overall Length x Height x width</b>	mm x mm x mm	
2	<b>Only Tank overall Length x Height x width</b>	mm x mm x mm	
3	HV Cable box overall LxWxH	mm x mm x mm	
4	LV Cable box overall LxWxH	mm x mm x mm	
5	<b>Clearances</b>		
5.1	Core and LV (minimum 5mm)	Mm	
5.2	LV and HV (minimum 8mm)	Mm	
5.3	HV Phase to phase (minimum 10mm)	Mm	
5.4	Between HV winding and Yoke (minimum 20mm)	Mm	
5.5	Between LV winding and Yoke (minimum 5mm)	Mm	
5.6	Between yoke and inside of tank to cover (minimum 100mm)	Mm	
5.7	Between yoke and bottom (minimum 10mm)	Mm	
5.8	Any point of winding to tank (minimum 20mm)	Mm	

6	<b>Calculated Impedance</b>	%	
7.1	HV to Earth Creepage distance in oil (minimum 15mm)	Mm	
7.2	LV to Earth Creepage distance in oil (minimum 5mm)	Mm	
8.	Conservator dimension (dia x Length)	Mmxmm	
9.	Size of Pipe used for conservator to Tank	Mm	
10.	Size of Pipe used for Valves	Mm	
11.	Base Channel size	Mmxmm xmm	
12.	No. of Radiators	Nos	
13.	No. of fins per Radiator	Nos	
14	Dimension of radiator fins (L x W)	Mmxmm	
15	Make of Tank material		

## 5.6 RADIATORS

- I. Radiators of pressed steel type conforming to the design requirement suitable for mineral oil and Ester oil (all type) type transformer.
- II. The Pressed Steel type should be used in vertical formation without any bending and should be individually tested for leakage and pressure test etc. before welding with the main tank.
- III. **Thickness** of sheet for radiators shall be **1.20 mm (min)**.
- IV. The **mounting** of the radiators shall be **non-detachable** uptill 500KVA & Detachable for above 500KVA & till 2 MVA
- V. The number / cross section / length / fixing arrangement of radiators shall be indicated in the general assembly drawing.
- VI. Radiator thickness must be uniform without any dent or damage and also no bulging or concave should occur even after performing pressure/ vacuum test and temperature rise test.
- VII. Corrugated designs are not accepted.

## 5.7 GASKET

- I. **Cork rubber gaskets** conforming to Type C , grade RC70 as per IS 4253 (Part-2) shall be provided for all oil bearing & water ingress resistant requirements for components like HV & LV bushings bottom gasket, HV & LV terminal box, Top Cover, Conservator, Valves etc.



- II. **Nitrile/Neoprene rubber gaskets** conforming to Type IV – 4C (heat and oil resistant) as per IS 11149 shall be provided for bushing O ring (oil gaskets).
- III. **Only Joint free Gasket to be used. Only in case of top cover gasket and terminal box gasket up to two dove-tail joints with adhesive shall be allowed. The terminal box gasket joint shall come at bottom part.**
- IV. Cork sheet, Nitrile/Neoprene rubber gaskets shall be free from cracks, pinholes and shall be capable of being cut or punched without crack or tearing.

#### **5.8 TAPS (All DTs above 100 kVA)**

- I. Rotary/Ring type tap changing mechanism to be mounted on side of the transformer in such way that could be easily operated in smooth way.
- II. Tap changing shall be carried out by means of an externally operated self-position switch and when the transformer is in de-energised condition.
- III. The taps shall be provided in HV winding and each tap change shall result in voltage variation of 2.5%.
- IV. Switch position no.1 shall correspond to the maximum plus tapping (+5% ) and position no.7 shall correspond to minimum tapping (-10%).
- V. Tap no. 3 to be considered as principal tap position.
- VI. Provision shall be made for locking the tapping switch handle in position. Suitable plate shall be fixed for tap changing switch to know the position number of tap.

#### **5.9 BUSHINGS AND TERMINAL CONNECTORS**

##### **A. HT Bushings (36 kV/250 A):**

- I. The bushings shall be outdoor type, external part shall be made of porcelain material. Rods, nuts and flat washer (Tightening Nut along with Check Nut) shall be made of tinned brass material.
- II. IS to be followed: IS 8603(Part- I) for porcelain, IS 3347 part3 section 2 for metal part and Complete bushing shall comply IS 2099.

##### **Option 1: Outdoor Bushing on Top with Bird Guard**

- III. The HV bushings shall have Hot Dipped Galvanized or Alu-zinc coated or SS material arcing horns with 8mm diameter. The thickness of coating shall be **86 microns** (minimum at any point).
- IV. The HV bushing shall be fitted with bird guard on the bushing connector.
- V. Complete Tinned Brass jointless connectors shall be provided on HV bushing rods suitable for bare dog conductor connections. The connector should have large contact area. Hardware shall be Hot Dipped Galvanized or Aluzinc coated or SS material

##### **Option 2: Side bushing with Cable box**

- VI. Transformer shall be with HT cable box on sidewall of tank having porcelain bushing as specified above.
- VII. **In some situation Plinth mounted transformer may require outdoor bushing arrangement. This shall be decided during tender by user group.**

##### **B. LT Bushings(1.1kV/suitable current rating):**

- I. The bushings shall be of outdoor type made of porcelain material, The rod shall be Tinned copper for all rating along with neutral. The nuts and washers shall be of (Tightening Nut along with Check Nut) tinned brass material.
- II. IS to be followed: IS 3347(Part-I) (Section-1 for porcelain and Section 2 for metal part) and IS 7421(latest amendment of IS).

- III. The metal portion of the internal HV & LV bushing inside the tank shall remain dipped in oil in all operating condition.
- IV. The LV bushings shall be provided on the side wall of tank along with cable box.
- V. The bushing tinned copper stem sizes to be followed are,

Rating	Size of stem
250kVA	M20
400kVA	M20
500kVA	M30
630kVA	M30
800kVA	M42
1000kVA	M42

### 5.10 CABLE BOXES

- I. Cable boxes made up of Mild Steel 2.2mm thickness with suitable handle and front cover to be provided for both HV and LV side.
- II. Water should not accumulate on cable boxes and proper slope shall be provided in order to ensure drainage of water.
- III. Cable box protection shall be IP 55. Test reports to be submitted from CPRI /ERDA.
- IV. Cable box should be painted in same way as that of tank painting with treatment.
- V. HV and LV cable boxes shall be fixed on opposite sides on the tank with nuts and bolts (gasket placed in between them) in such a way that they can be completely removed whenever required.
- VI. Canopy shall be provided on all gasket joints, the bend edges of cover overlapping gasket to protect from rain and sunlight shall also accepted.
- VII. Cable cleating arrangements shall be provided just below terminal box (outside) to keep Cable straight and to support cables to avoid tension on bushings due to cable weight.
- VIII. For Cable clamping, **Fire retardant nylon grade material to be used for oval shaped clamping arrangement** with GI nut bolt on both HV & LV Side.
- IX. For HV Cable box, Non-magnetic Gland plate shall have thickness of 3mm and shall be in two parts in such a way that HV cable can be easily removed.
- X. For LV cable box, Non-magnetic Gland plate shall have thickness of 4mm and shall be in two or more parts in such a way that LV cables can be easily removed by removing the gland plates.
- XI. Gland plates shall be mounted separately with nut & bolt arrangement and gasket in between them.
- XII. The size of the cable box cover should be moderate so that only one or two people is enough to lift it.
- XIII. The bidder shall submit **drawings for the box with internal details** along with the transformer for approval.

#### **HV CABLE BOX (option 2, ref: 5.9.A):**

- XIV. The HV box shall be designed and fixed on transformer such way that only opening of cover shall facilitate for working on cable termination with ease of accessibility of terminal.
- XV. HV box gland plate shall have Single compression gland designed for 11kV, 3C X 150 or 3CX400 sq.mm XLPE Cable as per drawing approved from TPCODL/TPNODL/TPSODL/TPWODL.
- XVI. Distance between HV gland plate and HV bushings should be minimum 650 mm.
- XVII. Earthing provision (Body earth- outside and for cable earthing- inside of box) shall be provided in the HV box with M12 SS bolt & SS washers.

- XVIII. Gland shall be SCG 18 single compression brass gland suitable for diameter of 91mm cable.
- XIX. Bolted type terminal cover with M14/M16 HDG bolts (M12 bolts for 250KVA DT) with danger marking

**LV CABLE BOX:**

- XX. Neutral terminal of LV winding shall be brought out on LV phase terminals to form four wire system.
- XXI. Epoxy Insulators shall be provided from top side in LV box to support LV busbar.
- XXII. LV busbar shall be of AL material & shall have clearances as mentioned in GTP.
- XXIII. Lugs shall be of AL material with tin coating & shall comply the IS requirements.
- XXIV. Arrangement in the LV box shall be BYRN from left to right when viewed from LV front.
- XXV. All Nut bolts shall be as per Clause 5.24 and size selection shall with as per the hole size of the AL lugs to be used.
- XXVI. The Neutral to be brought out from box through bushing and shall have same dimension as that of phase bushing.
- XXVII. GI earth strip (Size - 50 x 6 mm) shall be provided from neutral bushing to both side of the box and shall be extended up to bottom of the terminal box both sides.
- XXVIII. Insulator support to be provided on terminal box both sides for GI earth strip so as to avoid tension on secondary neutral bushing.
- XXIX. There shall be gland provision in side wall bottom or base plate of the LV box with gland of size suitable for 10core cable for taking out voltage terminal to box. 10 core cable up to box shall also be provided wired up from bus bar to TB.
- XXX. For Transformer up to 1 MVA ratings, In LV box, there must be provision for flexible mounting arrangement to fix multiple sized CT.
- XXXI. There must be proper provision of connecting voltage wires with closed thimble/lug on LV bus bars (Phases and neutral) with nut bolt size of 6mm & wires to be taken out and connected in the Metering terminal box.

Transformer Rating	Size of cable for Phase & Neutral	Gland Size for LV Box	No. of runs per phase	No. of runs for neutral
315 kVA	1C x 630 sq. mm(1.1 kV Class)	SCG10	1	1
400 kVA			2	2
500 KVA			2	2
630 kVA			2	2
800kVA			3	3
250 kVA	1C x 300 sq.mm (1.1 kV class)	SCG7	2	2
100 kVA	4C x 150 sq.mm (1.1 kV class)	SCG10	1	0

- XXXII. Earthing provision (Body earth) shall be provided in the LV box with M12 bolt.
- XXXIII. The clearance above bushing shall be 120mm and below busbar cable mounting bolt shall be 450mm up to gland plate.
- XXXIV. The no. and size of cables for installation on LV side shall be as follows:

Transformer Rating	Size of cable for Phase & Neutral	No. of runs per phase	No. of runs for neutral
1 MVA	1C x 630	3	3

1.25MVA	sq. mm (1.1 kV Class)	4	4
1.6 MVA		5	5
2 MVA		6	6

XXXV. The LV busbar shall be one continuous conductor strip with current density of 1A/mm<sup>2</sup> and length should be min. 225mm for 250kVA. The support insulator shall be provided at the end of busbar such that cable load shall be on top end support. Neutral busbar shall be of same size of phase. The lug shall be have single hole. Busbar shall be connected on four bolts on brass palm connector.

XXXVI. Bolted type terminal cover with M14/M16 HDG bolts (M12 bolts for 250KVA DT) with danger marking

### 5.11 TERMINAL CONNECTORS

#### HT TERMINAL CONNECTOR:

- I. Tinned Brass connectors shall be provided connected with HV bushing rods for bare top plate bushings .
- II. UV resistant polymeric insulating shrouds shall be provided on the HV bare bushing terminals.
- III. For 250 kVA and above ratings Aluminium lugs (with minimum of 2 hole) suitable for 3CX300 sq.mm XLPE shall be provided at HT side for cable connection.

#### LT TERMINAL CONNECTOR:

- IV. Tinned Brass palm connector (with current rating w.r.t Load current), and Aluminium busbar (current density: not more than 1 A/mm<sup>2</sup>) shall be provided.
- V. Busbar shall be supported with insulator at the top portion of terminal box.
- VI. Aluminum lugs (with minimum of two holes) shall be provided with suitable size (no. of lugs as per clause 5.10 and size of lugs as per IS 8309) for the LV cables. (Can be share our drawing or specs)

### 5.12 METERING CURRENT TRANSFORMERS (This shall be decided during tender by user group.)

- I. Cast Resin Type CTs shall be provided for transformers on the LT side for metering purpose.
- II. The CTs shall be Resin Casted ring type and a thickness of min 2mm of resin above the coil of the CT to be ensured.
- III. The core of the CT shall be of high grade non-ageing electrical silicon CRGO Steel or better grade of first quality having low hysteresis loss and high permeability to ensure accuracy at both terminal and over current/ voltage.
- IV. The grade of the Core shall be M4 or better
- V. The Resin Casted CTs shall be embossed as 'P1' and other side as 'P2'. Lock side pole of coupler shall have S1 terminal and other pole shall have S2 terminal.
- VI. The Coil shall be insulated with electrical grade Polyester Tape and the insulation shall be of high insulation grade, excellent mechanical strength (tensile, tear, and stretch), high purity, chemical stability, and heat resistance.
- VII. The Copper wire used shall be super enameled as per the IS 4800 Part IX/ IEC 317.
- VIII. The wiring shall be enclosed in such a way that it can't be disturbed during maintenance activities.

- IX. The CT shall be mounted outside the tank with suitable clamping arrangement (fiber glass material).
- X. The position of secondary terminals shall be such that, it will face towards outside after installation on bushing or bus bar of transformer.
- XI. Mounting arrangement should be such that the CT shall be replaceable at site.
- XII. The terminals shall have shorting facility and it should not get saturated up to 200% of rated current.
- XIII. The weight of the Ring type CTs shall not exceed approx. 2.5 Kg +/- 10%.
- XIV. The CTs shall have following parameters.

Accuracy class	0.5s
Burden	20 VA
Application	Metering
ISF	5
CT ratio for	As mentioned in clause 4.28

### 5.13 AUXILIARY TERMINAL BOX

**Note: Aux. Terminal Box shall be required for 250kVA to 1MVA and ratings above 1MVA marshalling box shall be required.**

- I. Aux. terminal box of suitable size made up of **Mild Steel** and with **theft proof locking arrangement** for box.
- II. Box shall be provided with Stud Type terminal blocks with 2 spare terminals. shorting links required for CT connections.
- III. 10 core multi stranded PVC armored cable (2.5 sq.mm Cu FRLS PVC stranded panel wires) shall be used to terminate connections from CT and voltage terminals (6 CT wires and 4 voltage wires) at LV side to the CT terminal box.
- IV. PVC ferrules engraved with black letters shall be used to mark the wires coming from LV box for CT and volatge.
- V. **PVC ferrules** engraved with black letters shall be used to mark the wires in the terminal box.
- VI. Holes with PVC glands to be provided on bottom side of this box as incoming (01nos.) and outgoing (02Nos.) for 10CX2.5 sq.mm cable and for Auxiliary cables of magnetic float switch, PRV contacts, OTI aux. cable.
- VII. Terminal and cable entry for secondary wiring of Magnetic Float switch in conservator, OTI aux cable, PRV cable (for plinth mount DT) to be provided as required.
- VIII. Terminal box shall have IP 55 protection with rubber gasket and bend cover canopy over joints.
- IX. Terminal box must have provision for connecting I-type or U-type pin arrangement without spring arrangement.

### 5.14 EQUILISING/ EQUIPOTENTIAL STRIP

- I. The Transformer top cover shall be connected with main tank using **tinned copper strip (30mm wide, 0.7mm thick)** at two places (diagonally opposite with each other).



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- II. The strip should touch bare surface of tank in order to ensure proper electrical connection of tank body with top cover with the strip.
- III. All the covers like inspection cover, LV box cover, HV box cover, Conservator cover must be electrically connected using **tinned copper strip (30mm wide, 0.7mm thick)**.
- IV. Separate arrangement to be made and cover tightening bolt not to be used for equipotential strips.

### 5.15 EARTHING CONNECTIONS

#### NEUTRAL EARTHING:

- I. Separate LV neutral bushing to be provided on top of LV box for neutral earthing.
- II. For connecting LV neutral bushing shall be provided with 2 Nos of 50x6 mm GI strip, one on each side of terminal box (The thickness of GI coating of neutral earthing strip shall be **86 microns** (minimum at any point).
- III. At the bottom of the GI strips two concentric holes of 12 mm diameter shall be made and M12 size SS nuts, bolts and SS washer shall be provided for them.

#### BODY EARTHING:

- I. Two body earthing terminals pads boss arrangement (up to 500sq.mm) shall be provided on Transformer tank with M12 SS Bolt with 70 sq. mm lug. with SS plain washer and spring washer.
- II. It shall be located on the lower side of the transformer, diagonally opposite to each other.
- III. Each Earthing terminal pad on DT shall be provided with two SS M12 bolts on each pad on each side with two 70 sq.mm AL Lugs and washers.

### 5.16 OIL

**Note: Default Oil shall be Mineral oil only if not specified / asked for other oil.**

**Mineral Oil: In case of Mineral Oil below are the requirements to be fulfilled:**

- 1. All transformers shall be filled with new, unused, clean, standard mineral oil in compliance with IS 335-2018 / IEC 296 type-II and shall be free from all traces of polychlorinated biphenyl (PCB) compounds.
- 2. The use of recycled oil is not acceptable.
- 3. Oil shall be filled under vacuum before filling it shall be filtered and tested (as per IS 6103).
- 4. The test parameters should be as per the table below:

Test parameters	Values
Break Down Voltage (min )	70 kV
Water content ppm, (max.)	30 ppm
Specific resistance (min.) ( at 27°C )	2.5 × 10 <sup>12</sup> ohm-cm

Bidder has to provide the oil data in below table:

Sl.	Description	Unit	To be furnished by
-----	-------------	------	--------------------

No.			bidder
1	Type of oil		
2	Oil Qty. for first filling	Ltr.	
3	Grade of Oil		
4	Maker's name		
5	BDV at the time of first filling	kV	

### 5.17 CONSERVATOR

- I. The conservator shall be supported / fixed on the main body of the transformer tank.
- II. The capacity of the conservator tank shall be designed keeping in view the total quantity of oil and its contraction and expansion due to temperature variations. The total volume of conservator shall be such as to contain **10% quantity of the oil used in transformer**. Normally, at least **30% volume of conservator** shall be filled with Oil.
- III. The connecting pipe of the conservator shall be so fitted to transformer tank that the pipe can be detached from the tank.
- IV. Jointless pipe shall be used which shall be connected with round flanges.
- V. The inside diameter of the pipe connecting the conservator to the main tank shall be within 25 to 50 mm and it should be projected into the conservator so that its end is approximately 20mm above the bottom of the conservator so as to create a sump for collection of impurities. The minimum oil level corresponding to -5°C should be above the sump level.
- VI. The conservator oil filling cap/hole shall be of 32mm diameter & female type cap to be provided.
- VII. For DT up to 1600kVA, the conservator to be fitted with float switches such that it shall operate/open contact when the oil level in conservator goes below Minimum mark/ -5 degree C. The float switch shall be with normally closed type. This contact shall be wired up in auxiliary terminal box. (Not applicable for 100 kVA).
- VIII. Buchholz relay: The pipe should not contain any right angle elbows. Its diameter should correspond to the diameter of the hole for the passage of oil of the relay. The pipe must be arranged to slope upwards towards the conservator at an angle of about 2 to 4 degrees to the horizontal (max 5 degrees). The part of the pipe preceding the relay should be straight for a length equal to at least five pipe diameters; the part of the pipe leading to the conservator immediately adjacent to the relay should be straight for a length equal to at least three pipe diameters.
- IX. The Oil conservator shall be provided with:
  - a. **Oil level indicator** (as per clause no. 5.18).
  - b. **Dehydrating breather** (as per clause no. 5.22).
  - c. **Drain plug**
  - d. **Oil filling hole** (1.25 inch/32mm with thread size of BSP 1.25inch, 11TPI) with cover.
  - e. **Detachable end plate** on one side (the side on which the gauge glass is fitted), to enable the maintenance staff to periodically clean the inside of the conservator tank

### Center of Gravity

The transformer should be designed in such a way that the centre of gravity of complete transformer with oil and with all accessories shall fall at the vertical centre at lower height such that the transformer should be stable on flat surface ground and while lifting at lifting hooks.

### 5.18 OIL LEVEL INDICATOR

- I. Oil level indicator with **prismatic glass and red colour background** shall be provided.
- II. The oil gauge glass shall be removable and so embodied in the end plate so as to prevent oil leakage.
- III. The Oil level indicator should indicate oil level at minimum, normal and maximum as -5°C, 30°C and 90°C respectively.

### 5.19 PRESSURE RELEASE DEVICE (For DTs 250 KVA and above)

- I. All DTs, 250 kVA and above shall be provided with PRV with auxiliary contacts. The contact to be wired up in the auxiliary terminal box.
- II. PRV shall be provided to operate before reaching the test pressure as specified in the above class.
- III. PRV shall not have air release arrangement.
- IV. The PRV shall seal-off after the excess pressure has been released and it shall have mechanical flag arrangement.
- V. The PRV shall have NO, NC contacts wired up in auxiliary terminal box.

### 5.20 AIR RELEASE PLUG

The cover of the main tank shall be provided with an **air release plug on all ratings.**

### 5.21 DRAIN VALVE AND FILTER VALVE

- I. The drain valve and filter valve shall be of Brass with gate valve.
- II. The drain valve and filter valve shall have double round flanges. One side shall be fixed with tank and other side should be left open for oil filling/filtration purpose.
- III. The drain valve and filter valve shall be provided with embossed name plate stating drain valve and filter valve.
- IV. The drain valve shall be located on the bottom and filter valve shall be provided at side top of tank.
- V. Locking arrangement shall be provided to stop movement of hand wheel.
- VI. The valves shall be covered with a MS box of 2mm thickness by welding on tank. The paint thickness shall be min. 80 micron on the box.

### 5.22 DEHYDRATING BREATHER

- I. The breather pipe shall enter the conservator from the upper side of the conservator.
- II. The breather shall contain 500 g for 100 kVA; 1 kg of silica gel for 250/315/400/500/630 kVA/800kVA & 1MVA DTs and 2kg for above 1 MVA rating.
- III. The silica gel shall be blue colored as per IS: 3401 – 1992. The granules size should be 3-5 mesh (4 to 6.73mm) up to 2kg capacity breather.
- IV. The body of the breather shall be unbreakable, transparent, UV stabilized seamless polycarbonate tube of minimum thickness 3mm
- V. The top cover shall be of pressure die cast aluminum and powder coated.
- VI. The oil cup shall be of UV protected polycarbonate.
- VII. Oil cup shall have marking of oil filling level
- VIII. The breather shall be supplied as per approved make and as per specifications.
- IX. The gasket should be of Class 3B, Type III as per IS 11149 Nitrile rubber (Oil resistant gaskets)
- X. All tie rods and all hardware should be of stainless steel material ( SS 304)
- XI. Breather mounting arrangement,





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- a. Up to 2 kg capacity of Silicagel breather shall have top threaded mounting arrangement with 1/2" pipe having BSP threading.
  - b. 2kg and above capacity shall have flange mounting with 4 holes of 12mm diameter on 83 PCD.
- XII. While fixing of breather on transformer Teflon tape should be used to make it air tight & water tight. This shall be checked during inspection and after receipt at our stores on each transformer.
- XIII. The breather should have passed air pressured test as per our specification i.e. Breather shall be tested at an air pressure of 0.35kg/cm<sup>2</sup> (5 PSI) for period of 30 minutes. NABL lab test report to be submitted from OEM. For further details please refer our specifications of breathers.

### 5.23 OIL TEMPERATURE INDICATOR (Not applicable for 100 kVA DTR)

- I. Dial Type Oil temperature indicator shall be provided on the top cover of the transformer. It should be suitable for outdoor mounting with maximum indicator pointer. Fixing union shall be of female thread.
- II. Range: 0- 120 °C, Accuracy:  $\pm 4$  °C.
- III. The OTI shall have auxiliary contacts for alarm and trip contacts at preset temperatures, both the contacts should be wired up in the auxiliary terminal box.
- IV. The IP65 gland should be used for dial for taking out auxiliary wires.
- V. The OTI shall be IP55 tested.

### 5.24 FASTENERS

- I. All the bolts or studs shall be **at least 6 mm in diameter** except when used for small wiring terminals. **All bolts shall be of grade 8.8.**
- II. All nuts/bolts/washers exposed to atmosphere shall be as follows:

Size 12mm (or below)	Stainless Steel
Above 12mm	Steel with antirust coating (aluzinc coated), Hot dip galvanized

- III. All ferrous bolts, nuts and washers placed in outdoor positions shall be hot dip galvanized to prevent corrosion (except high tensile steel bolts and spring washers which shall have electrolytic action between dissimilar metals).
- IV. In case the galvanization is removed due to welding or manufacturing, the parts should be properly cleaned and painted to avoid exposure to atmosphere.
- V. The cup type washers to be used as spring washers, cut spring washers are not accepted.
- VI. Taper washers shall be provided where necessary. Protective washers of suitable material shall be provided on front and back of the securing screws.
- VII. Each bolt shall project at least one thread but more than three threads through the nut. If bolts and nuts are placed so that they are inaccessible by means of ordinary spanners, special spanners shall be provided. The length of the screwed portion of the bolts shall be such that no screw thread may form part of a shear plane between members.
- VIII. Core bolts shall be black colored high tensile grade-8.8

### 5.25 SURFACE PREPARATION AND PAINTING

- I. The paint shall be applied by airless spray.

- II. Steel surfaces shall be prepared by **shot blast cleaning** (IS-9954) to grade Sq.2.5 of ISO 8501-1 or **chemical cleaning** including phosphating of the appropriate quality (IS 3618).
- III. **Heat resistant (Hot oil proof) paint** shall be used for the **inside surface** and whereas for **external surface one coat of thermosetting powder paint or one coat of epoxy primer (zinc chromate/Zinc Phosphate) followed by two coats of polyurethane (P.U.) base paint.** as per table given below

S.No.	Paint type (should be UV restraint, non-fading)	Area to be painted	No of coats	Total dry film thickness (min); micron
1.	Thermosetting powder paint	Inside Outside	01 01	30 60
2.	<b>Liquid Paint</b>			
a.	Epoxy (primer)	Outside	01	30
b.	P.U. Paint (finish paint)	Outside	02	25 (each)
c.	Hot oil resistant paint	Inside	01	35

The two coats shall be of oil and weather-resistant nature with final coat as flossy and non-fading paint of shade 631 as per IS 5.

- IV. The dry film thickness shall not exceed the specified minimum dry film thickness by more than 25%.
- V. Any damaged part shall be cleaned to bare metal with an area extending 25 mm around its boundary. A priming coat shall be immediately applied followed by full paint finish equal to that originally applied and extending 50 mm around the perimeter of the original damage. The repainted surface shall present a smooth surface which shall be obtained by carefully chamfering the paint edges before and after priming.
- VI. Tank Paint thickness of 120micron
- VII. Painting shall not affect by weather changes & performance against pilling out or fading etc. to be guaranteed for 5 Years.

### 5.26 RADIO INTEREFENCE

When operated at voltages up to **12.5%** in excess of the normal system rating, transformers shall be substantially free from partial discharges (i.e. corona discharges in either internal or external insulation) which are likely to cause interference with radio or telephone communication.

### 5.27 OVERLOAD CAPACITY

The transformer shall be suitable for loading as per IS 2026 part 7

## 5.28 FITTINGS

The following standard fittings shall be provided:

- I. Two earthing terminal pads/ boss with earthing symbol  $\perp$  for body earthing on opposite sides with 70sq.mm AL lug and M12 SS bolt and washers.
- II. Air Release Device.
- III. Thermometer Pocket with cap.
- IV. 1MVA and above with Inspection Cover.
- V. Drain cum Sampling Valve & filter valve (Double Flanged for 630kVA and above & Up to 500kVA with T type drain valve without filter valve) and (0.75 inch nominal size thread, IS 554) with locking arrangement and a valve cover made of M.S. steel painted with minimum 70 micron layer.
- VI. Pressure relief device with auxiliary contacts for DT up to 250 kVA and above.
- VII. Welded fixed type Radiators upto 1MVA.
- VIII. LV cable box for all DT. For HV side, cable box or Bare bushings can be provided. **User group shall decide this during tender.**
- IX. For HV bare bushing DT- bird guard on bushings terminals connectors
- X. Terminal Connectors for HV (Tinned brass for pole mounted DT) /LV side (tinned brass palm connector, Al busbar with support insulator on top and Al lugs) up to 500kVA DT.
- XI. HV and LV two part Gland plates (Non-Magnetic and with Single compression Brass glands).
- XII. Conservator with Dehydrating Breather on LV side.
- XIII. Prismatic Oil level Gauge and magnetic float switch in conservator.
- XIV. Lifting lugs (enclosed type) for the top cover, complete transformer and core and winding assembly.
- XV. Pulling Lugs.
- XVI. Jacking Pads
- XVII. Stiffener Angle.
- XVIII. 2 Base channels all DT
- XIX. Marking Plates as asked in clause 6.1
- XX. Oil Temperature indicator with alarm & trip contact ( $\geq 250\text{KVA}$  rating)
- XXI. Magnetic float switch for 250kVA to 1600kVA DT on conservator tank & MOG for above 1600KVA to 2000KVA
- XXII. Two GI earth strip of Size 50x6 mm for neutral earthing from both side of LV box with minimum GI coating thickness of 86 microns. With SS nut bolts and washer.
- XXIII. Magnetic Float Switch for 250KVA to 1MVA; Magnetic Oil level Gauge ( $>1600\text{kVA}$ ), Winding Temperature Indicator ( $>1600\text{kVA}$ ), Magnetic Reed type Buchholz relay (for ratings above 1MVA) in line with IS 1180.
- XXIV. Marshalling Box with stud type terminals (for ratings above 1000kVA).

## 5.29 WINDING TEMPERATURE INDICATOR (WTI) (Not applicable for 100 kVA DTR)

- I. WTI shall be provided in one winding of each phase.
- II. WTI shall be **indicating type**, responsive to the combination of top oil temperature and winding current, calibrated to follow the hottest spot temperature of the transformer winding.
- III. WTI shall operate a remote alarm and trip in the event of attaining the predefined temperature.

## 5.30 BUCHHOLZ RELAY

- I. Only for  $>1\text{MVA}$  DT.

- II. Magnetic Reed type Buchholz relay shall be provided with alarm and tripping contacts to detect accumulation of gas.
- III. The installation shall be fixed and weather proof to avoid any water seepage inside the relay.
- IV. Round flange of nominal pipe bore of **50mm diameter** shall be used.
- V. In addition, pocket with heater coil along with Resistance Temperature Indicator (RTD) shall be provided for WTI and OTI. CT for RTD for winding hot spots shall be provided.

**5.31 MARSHALLING BOX AND PROTECTION**

- I. Marshalling Box of suitable size, made up of **Mild Steel** and with **theft proof locking arrangement** shall be provided.
- II. Marshalling box shall have IP 55 protection.
- III. Above 1MVA DT - Marshalling Box shall have provision for wiring the **WTI, OTI, MOG, PRV, Buchholz relay and LT CT terminals**. The terminals shall be provided as per table below:

Element	Alarm	Trip
Oil Temperature Indicator	NO,NC,COM	NO,NC,COM
Winding Temperature Indicator HT Side	NO,NC,COM	NO,NC,COM
Winding Temperature Indicator LT Side	NO,NC,COM	NO,NC,COM
Buchholz	NO,NC,COM	NO,NC,COM
Magnetic Oil Level Gauge	NO,NC,COM	
PRV	NO,NC,COM	
LT Neutral CT Secondary Terminal	N	
LT Phase CT Secondary Terminal	RYB	
LT Voltage terminals	RYBN	
Spare TB	4 No.	

- IV. WTI meter shall be wired/ installed in the marshalling box.
- V. 10 core PVC wire (4 sq.mm Cu FRLS PVC stranded panel wires) shall be used to terminate connections from CTs at LV side to the Marshalling box.
- VI. Plastic ferrules engraved with black letters shall be used to mark the wires in the marshalling box.
- VII. Wiring in Marshalling box shall be done by 2.5 sq.mm Cu FRLS PVC stranded panel wires.
- VIII. For TPCODL/TPNODL/TPSODL/TPWODL, The equipments connected into marshalling box shall be compatible with power pack relay as per attached specification for 1MVA & above ratings.
- IX. All the cables and conduits between the transformer and control cabinet shall be included in the scope of supply by the bidder.

### 5.32 MAKE OF MAJOR COMPONENTS & RAW MATERIALS

The BA shall procure the following constituent items from the designated vendors as follows:

S.no	RAW MATERIAL/EQUIPMENT	MAKE
a)	Copper	M/S Sterlite, M/S Hindustan Copper, M/S Hindalco.
b)	Core	M/S AK Steels, POSCO, Kawasaki/JFE, Nippon Steel.
c)	Insulation paper and Pressboards	ITC paper, ABB, Raman Boards-Mysore, Senapathy Whiteley – Bangalore
d)	Transformer Oil ( Mineral oil)	Savita, Apar, Gandhar
e)	Gaskets & Corks	Nu Cork, Anchor Corks
f)	Steel For Tank	M/s, TATA Steel, M/s SAIL, M/s. JSW Steel, M/s. IISCO, M/s. RINL/Vizag Steel, M/s. Jindal Steel,
g)	Dehydrating Breather	Yogya, Anushree, Electrical engineers
h)	Bushings HV & LV	GE,Hindustan Chemicals, Rashtriya Electricals,LAMCO

Also, Bidder has to provide all test certificates from original manufacturers & relevant sourcing documents. BA shall also have shot blasting facility.

## 6. MARKING:

### 6.1 MARKING PLATES

**I. Name Plate (Rating) Plate : SS material**

A rating plate shall be fitted to each transformer in a visible position and shall carry all the information as **specified in clause no. 6.2**

**II. Terminal Marking Plate : on same name plate also accepted**

- The terminal marking plate shall be provided which shall be strictly in accordance with **figure 4 of IS 1180-Part 1: 2014**. This plate may be combined with the rating plate or can be provided separately.
- Value of short circuit impedance on extreme tapping and on principal tapping and indication of winding to which impedance is related has to be displayed additionally.

**III. Details Plate : MS sheet of 2.5mm with punched details and welded on tank.**

A separate plate of **size 125 mm x 125 mm** shall be provided having following details:



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- Name of the firm.
- Serial No.
- Rating of transformer.
- Order no. and date.
- Date of dispatch.

**IV. Guarantee Plate :**

A separate warranty plate made of **Stainless Steel** with following clause written on it.

***“THE EQUIPMENT GUARANTEED UPTO A PERIOD OF 48 MONTHS FROM THE DATE OF COMMISSIONING OR 60 MONTHS FROM THE DATE OF LAST SUPPLY”***

All the plates described above (clause 1 to 4) should be as followings:

Material	Stainless Steel
Thickness	1 mm
Engraving	The letters on the rating plate shall be engraved black on the white/silver back ground.
Fixing	Fixing screws shall be of stainless steel.

**V. Danger Plate: On all cable boxes**

Danger notice shall have red lettering on a white background on a plate as specified in **IS: 2551 – 1982**.

**VI. BIS Certification Mark: On main name plate**

The Bidder is required to get approval from BIS and display BIS mark on the name plate.

**VII. Control Circuit drawing Plates:**

- Engraved drawing for control circuit unit shall be available on Marshalling box.

**6.2 NAME PLATE DETAILS**

The name plate shall be strictly as per **IS 1180: 2014 (figure 1)**. Additionally, following points shall be displayed :

- I. **Actual no load losses of transformer.**
- II. **Actual total losses of transformer at 50% load and 100% load.**
- III. Standard mark (BIS certification).
- IV. **“PROPERTY OF TPCODL/TPNODL/TPSODL/TPWODL”** shall be written in bold letters.
- V. PO number with date has to be mentioned.
- VI. Overall dimensions of the transformer

**6.3 MARKING**

- I. All transformers shall have HV phase windings marked in both, the terminal boards inside the tank and outside with capital letter 1U, 1V, 1W.

- II. The LV winding for the same phase shall be marked by corresponding small letter 2u, 2v, 2w. The neutral point terminal shall be indicated by the letter 2n.
- III. The markings shall be done by steel strips in which marks had been engraved in black colour.
- IV. Colour marking of the bushings shall be done.
- V. On the top cover of tank and the core channel, Manufacturer's name and Manufacturer's serial no. shall be engraved.
- VI. On the body of tank, Manufacturer's name, rating, serial no. and year of manufacturing shall be written with black paint on yellow base. It should be written in suitable place in approved format that it is readable from ground after installation on pole.
- VII. Durable QR code Sticker with name plate details and warranty details to be fixed on two accessible places i.e one on side wall of LV terminal box and other one is on conservator.

## 7. TESTS:

- I. All routine, acceptance & type tests shall be carried out in accordance with the IS 2026 and IS 1180: Part-1 (2014).
- II. All routine & type tests shall be witnessed by the TPCODL/TPNODL/TPSODL/TPWODL/his authorized representative.
- III. All the components shall also be type tested as per the relevant standards.

**Following tests shall be necessarily conducted on the Distribution Transformers in addition to others specified in IS/IEC standards.**

### 7.1 TYPE TESTS

- I. Lightning Impulse Test [As per IS 2026 (Part 3) Clause no. 12].
- II. Temperature Rise Test [As per IS 2026 (Part 2) Clause no.4].  
**NOTE:** Maximum measured total loss (No load at Rated excitation load loss at maximum current tap converted to 75°C reference temperature) at 100 percent loading shall be supplied during temperature rise test.
- III. Short Circuit Withstand test [As per IS 2026 (Part 5)].  
**NOTE:** Routine tests before and after short circuit test shall be conducted as per IS 2026(Part 1).
- IV. Pressure Test [As per IS 1180: Part 1 (2014)].
- V. Determination of sound levels [IS 2026 (part 10)].
- VI. No load current at 112.5% voltage
- VII. BDV and moisture content of oil in transformer (IS 335).
- VIII. Magnetic balance test.
- IX. Measurement of Zero-phase sequence impedance.
- X. Measurement of Harmonics of no-load current.
- XI. Test to verify IP 55 for CT terminal Box and cable boxes.

**Note:** - Out of the above mention type test, the tests under sl. No. 1, 2, 3 and 4 shall be conducted at CPRI/ERDA labs and the balance tests to be conducted at TPCODL/TPNODL/TPSODL/TPWODL recommended NABL lab. **In-house test labs are accepted if in-house lab is NABL accredited for these tests.**

### 7.2 ROUTINE TESTS

Sr. No.	Test to be done	Reference BIS	Clause no.
1	Measurement of Winding Resistance on each tap.	IS 2026 (Part 1)	16.2.1 & 16.2.3
2	Measurement of voltage ratio, check of voltage displacement, polarity, phase sequence and vector group	IS 2026 (Part 1)	16.3
3	Measurement of short circuit impedance (principal tapping, when applicable) and load loss at 50% and 100% load	IS 2026 (Part 1)	16.4
4	Measurement of no load losses and magnetizing current at rated frequency and 90%, 100% and 112.5% of rated voltage	IS 2026 (Part 1)	16.5
5	Measurement of insulation resistance	IS 2026 (Part 1)	16.6
6	Induced over voltage withstand test	IS 2026 (Part 3)	11
7	Separate Source voltage withstand test	IS 2026 (Part 3)	10
8	Oil leakage test	IS 1180 (Part 1)	21.5.1.3
9	Neutral current measurement	IS 1180	7.9.2
10	BDV and moisture content of oil in transformer (Type-2 oil)	For mineral oil : IS 335 (2018) For Ester oil : IEC 60247 & IEC61099	For mineral oil : IS 335 Table 2

### 7.3 ACCEPTANCE TESTS

- I. Temperature Rise test on one unit of first lot against every release order / PO for each rating. For further lots, TPCODL/TPNODL/TPSODL/TPWODL reserves the right to perform Temperature rise if required. [As per IS 2026 (Part 2) Clause no.4]
- II. Oil leakage test for acceptance shall be conducted at pressure of 0.35kg/sq.cm for one hour. (IS 1180 (Part 1) clause 21.5.1.3)
- III. The painted surface shall pass the Cross Adhesion Test (IS1180 part 1 clause no. 21.4.d).
- IV. Calibration of WTI and OTI.
- V. Magnetic Balance Test.
- VI. OEM test reports for CT if used.
- VII. OEM test reports for breather for air pressure test.
- VIII. At stage inspection -Checking of weight, dimensions, fitting and accessories, tank sheet thickness, oil quantity, material finish and workmanship, physical verification of core coil assembly and measurement of flux density on one unit of each rating of the offered lot with reference to the GTP and contract drawings. Oil BDV of all offered lot.
- IX. At least 10% transformer of the offered lot (minimum of one) shall be subjected to all the tests mentioned under the section 'ROUTINE Test' in presence of TPCODL/TPNODL/TPSODL/TPWODL's representative at the place of manufacture before dispatch without any extra charges. The testing shall be carried out in accordance with IS: 1180 and IS: 2026.
- X. Device trails & test for 1MVA & above (Buchholz trip, Buchholz alarm, PRV trip, WTI alarm, WTI trip and OTI alarm).
- XI. At Stage and Final inspection, the incoming raw material and its movement/consumption record in the related jobs of TPCODL/TPNODL/TPSODL/TPWODL will be verified by inspecting officer. In case of any deviation or non-availability of such records, the offered lot may get rejected.

### 8. TYPE TEST CERTIFICATES:





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- I. The Bidder shall furnish the type test certificates of the offered rating and design of transformer for the tests as mentioned above as per the corresponding standards.
- II. All the tests shall be conducted at CPRI / ERDA or as defined in 7.1 as per the relevant standards.
- III. In the event of any discrepancy in the test reports, i.e. any test report not acceptable or any/all type tests (including additional type tests, if any) not carried out, same shall be carried out without any cost implication to TPCODL/TPNODL/TPSODL/TPWODL.
- IV. Type tests should have been conducted in CPRI/ERDA during the period not exceeding 5 years from the date of opening the bid.

#### 9. PRE-DISPATCH INSPECTION:

- I. Bidder to raise the inspection calls for stage inspection and only after getting clearance from TPCODL/TPNODL/TPSODL/TPWODL shall proceed for further manufacturing. The bidder shall raise the inspection call for Final Inspection or prototype Inspection in TPCODL/TPNODL/TPSODL/TPWODL format.
- II. If the prototype inspections asked for during drawing approval then bidder to make one unit of transformer and raise for inspection call for stage and final for prototype inspection.
- III. Equipment shall be subject to inspection by a duly authorized representative of the TPCODL/TPNODL/TPSODL/TPWODL.
- IV. Inspection may be made at any stage of manufacture at the option of the purchaser and the equipment if found unsatisfactory as to workmanship or material, the same is liable to rejection.
- V. Bidder shall grant free access to the places of manufacture to TPCODL/TPNODL/TPSODL/TPWODL's representatives at all times when the work is in progress.
- VI. Inspection by the TPCODL/TPNODL/TPSODL/TPWODL or its authorized representatives shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specifications.
- VII. The BA shall ensure that 100% of the lot must be ready for inspection and atleast 10% must be ready with all mounting and accessories during inspection.
- VIII. Material shall be dispatched only after getting MDCC (Material Dispatch Clearance Certificate) from TPCODL/TPNODL/TPSODL/TPWODL.
- IX. Following documents shall be sent along with material:
  - a) Test reports
  - b) MDCC issued by TPCODL/TPNODL/TPSODL/TPWODL
  - c) Invoice in duplicate
  - d) Packing list
  - e) Drawings & catalogue
  - f) Guarantee / Warrantee card
  - g) Delivery Challan.
  - h) Other Documents (as applicable)
- X. To ascertain the quality of the transformer oil, the original manufacturer's tests report shall be submitted at the time of inspection.
- XI. Arrangements shall also be made for testing of transformer oil, after taking out the sample from the manufactured transformers and tested in the presence of TPCODL/TPNODL/TPSODL/TPWODL's representative.
- XII. In respect of raw material such as core stampings, winding conductors, insulating paper and oil, bidder shall use materials manufactured/supplied by standard manufacturers and furnish the manufacturers' test certificate as well as the proof of

- purchase from these manufacturers (excise gate pass) for information of the TPCODL/TPNODL/TPSODL/TPWODL.
- XIII. The bidder shall furnish following documents along with their offer in respect of the raw materials:
- a) Invoice of supplier.
  - b) Mill's certificate
  - c) Packing List.
  - d) Bill of Landing
  - e) Bill of entry certificate by custom.
- XIV. To ensure about the quality of transformers, the inspection shall be carried out by the TPCODL/TPNODL/TPSODL/TPWODL's representative at following two stages:
- a) Online anytime during receipt of raw material and during manufacturing/assembly Stage.
  - b) At finished stage i.e. transformers are fully assembled and ready for dispatch.
- XV. Advance intimation of 7Days (Within Odisha)/12 Day (Outside Odisha) is required for both Stage and final inspections.
- XVI. All tests and inspection shall be carried out at the place of manufacture unless otherwise specifically agreed upon by the manufacturer and TPCODL/TPNODL/TPSODL/TPWODL at the time of purchase.
- XVII. The manufacturer shall offer the inspector representing the TPCODL/TPNODL/TPSODL/TPWODL all reasonable facilities, without charges, to satisfy him that the material is being supplied in accordance with this specification. This will include Stage Inspection during manufacturing stage as well as Active Inspection during Acceptance Tests.
- XVIII. During the stage inspection a few assembled core coil and assembled Tanked transformer shall be dismantled (only in case of CRGO material) to ensure that the CRGO laminations, Windings and workmanship are of good quality. TPCODL/TPNODL/TPSODL/TPWODL also reserves the right to review any document or certificates related to material, manufacturing process, quality checks at any point of stage inspection.
- XIX. TPCODL/TPNODL/TPSODL/TPWODL also reserves the right to inspect the tank of transformer before surface preparation and painting. The same shall be informed to TPCODL/TPNODL/TPSODL/TPWODL accordingly.
- XX. Final inspection Call for carrying out acceptance tests as per relevant IS/IECs shall be sent by the Bidder along with routine test certificates.
- XXI. The bidder shall provide all services to establish and maintain quality of workmanship in his works and that of his sub-contractors to ensure the mechanical / electrical performance of components, compliance with drawings, identification and acceptability of all materials, parts and equipment as per latest quality standards of ISO 9000.
- XXII. The TPCODL/TPNODL/TPSODL/TPWODL has the right to have the test carried out at his own by an independent agency wherever there is a dispute regarding the quality supplied. **Also TPCODL/TPNODL/TPSODL/TPWODL has right to test 1% of the supply selected either from the stores or field** to check the quality of the product. In case of any deviation TPCODL/TPNODL/TPSODL/TPWODL have every right to reject the entire lot or penalize the bidder, which may lead to blacklisting, among other things.
- XXIII. At the time of inspection the material should be ready as specified, In case of material non-readiness or material failure in acceptance, Cost of re-inspection shall be borne by bidder.

## 10. INSPECTION AFTER RECEIPT AT STORE:



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- I. The material received at the TPCODL/TPNODL/TPSODL/TPWODL store shall be inspected for acceptance and shall be liable for rejection, if found different from the reports of the pre-dispatch inspection.
- II. In case the transformers proposed for supply against the order are not exactly as per the tested design, the Bidder shall be required to carry out the short circuit test and impulse voltage withstand test at its own cost in the presence of the representative of TPCODL/TPNODL/TPSODL/TPWODL.
- III. The supply shall be accepted only after such test is done successfully, as it confirms on successful withstand of short circuit and healthiness of the active parts thereafter on un-tanking after a short circuit test.
- IV. Apart from dynamic ability test, the transformers shall also be required to withstand thermal ability test or thermal withstand ability will have to be established by way of calculations
- V. TPCODL/TPNODL/TPSODL/TPWODL reserves the right to conduct all tests on Transformer after arrival at site / stores and the manufacturer shall guarantee test certificate figures under actual service conditions.
- VI. TPCODL/TPNODL/TPSODL/TPWODL reserves the right to conduct short circuit test and impulse voltage withstand test in accordance to IS, afresh on each ordered rating at purchaser cost, even if the transformer of the same rating and similar design are already tested. This test shall be carried out on a transformer to be selected by TPCODL/TPNODL/TPSODL/TPWODL either at the manufacturer's works when they are offered in a lot for supply or randomly from the supplies already made to TPCODL/TPNODL/TPSODL/TPWODL stores. The findings and conclusions of these tests shall be binding on the bidder.

#### 11. GUARANTEE:

- I. Bidder shall stand guarantee towards design, materials, workmanship & quality of process/ manufacturing of items under the contract for due and intended performance of the same, as an integrated product delivered under this contract. In the event any defect is found by the Purchaser up to a period of 48 months from the date of commissioning or 60 months from the date of last supplies made under the contract, whichever is earlier.
- II. Bidder shall be liable to undertake to replace/rectify such defects at his own costs within mutually agreed timeframe and to the entire satisfaction of the TPCODL/TPNODL/TPSODL/TPWODL, failing which the TPCODL/TPNODL/TPSODL/TPWODL will be at liberty to get it replaced/rectified at Bidder's risks and costs and recover all such expenses plus the TPCODL/TPNODL/TPSODL/TPWODL's own charges (@ 20% of expenses incurred), from the Bidder or from the "Security cum Performance Deposit" as the case may be.
- III. In case of Distribution transformer fails within the guarantee period TPCODL/TPNODL/TPSODL/TPWODL will immediately inform the Bidder who shall take back the failed Distribution Transformer within 15 days from the date of intimation at his own cost and replace / repair the transformer within forty five days of date of intimation with a roll over guarantee. The outage period i.e. period from the date of failure till unit is repaired / replaced shall not be counted for arriving at the guarantee period.
- IV. Bidder shall further be responsible for 'free replacement' for another period of THREE years from the end of the guarantee period for any 'Latent Defects' if noticed and reported by the Purchaser.

## 12. PACKING AND TRANSPORT:

- I. Bidder shall ensure that all the equipment covered under this specification shall be prepared for rail/road transport in a manner so as to protect the equipment from damage in transit.
- II. Transformers shall be delivered filled with oil and supplied with all accessories mounted. Screws and bolts shall be thoroughly tightened to ensure no leakage of oil.

**Note: One use plastic not to be used for packing of the material.**

## 13. TENDER SAMPLE:

All offered transformer detailed documents to be submitted as per clause no.18. The sample shall be not applicable

## 14. QUALITY CONTROL:

The bidder shall submit with the offer Quality assurance plan indicating the various stages of inspection, the tests and checks which will be carried out on the material of construction, components during manufacture and bought out items and fully assembled component and equipment after finishing. As part of the plan, a schedule for stage and final inspection within the parameters of the delivery schedule shall be furnished. TPCODL/TPNODL/TPSODL/TPWODL's engineer or its nominated representative shall have free access to the manufacturer's/sub-supplier's works to carry out inspections.

The following information shall necessarily be submitted with the bid:

- I. List of important raw materials, names of sub-suppliers for raw materials, standards to which raw material is tested and the copies of test reports of the tests carried out on raw materials in presence of Bidder's representatives.
- II. List of manufacturing facilities available, level of automation achieved and the areas where manual process exists.
- III. List of areas in manufacturing process where stage inspections are normally carried out for quality control and details of these tests and inspections
- IV. List of testing equipment for final testing with valid calibration reports. Manufacturer shall possess 0.1 class instruments for measurement of losses.
- V. QAP withhold points for TPCODL/TPNODL/TPSODL/TPWODL inspection.

## 15. TESTING FACILITIES:

Bidder shall have adequate in house testing facilities for carrying out all routine tests, acceptance tests and pre-dispatch inspection as per relevant International / Indian standards.

## 16. MANUFACTURING FACILITIES:

The successful bidder will have to submit (after placement of RC) technical compliance document and drawing of each part along with CCA, breather, bushings, terminal box etc. as per RC line items to be submitted for getting approval before mass manufacturing.

The first time supplier will have to make one prototype sample of each line item of RC as per CAT-B approved drawing within 30 days of drawing approval. Inspection call to be raised by bidder before 7 days of date of proposed inspection. TPCODL/TPNODL/TPSODL/TPWODL shall arrange inspectors and intimate or confirm the date. Any observation during inspection



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shall have to be addressed within 7 days and revised improved drawing & technical details to be shared to TPCODL/TPNODL/TPSODL/TPWODL for final approval.

Manufacturing mass quantity to start only after getting CAT-A approved drawings or as per intimation from TPCODL/TPNODL/TPSODL/TPWODL

## 17. SPARES, ACCESSORIES AND TOOLS

Bidder shall give an assurance that the reparability of transformer is ensured by using standard spare parts and accessories available in market in India.

## 18. DRAWINGS AND DOCUMENTS:

Following drawings and documents shall be prepared based on TPCODL/TPNODL/TPSODL/TPWODL specifications and statutory requirements and shall be submitted with the bid:

- a. Completely filled in compliance to each clause of Technical Specification and any Additional Details and Fittings.
- b. Description of the transformer and all components drawings.
- c. General arrangement for Transformer.
- d. LV terminal box drawing along with CT if applicable and cleat arrangement and gland plate drawing.
- e. Bill of material.
- f. Design calculation details of transformer losses, cooling, efficiency and current density, weight of coils and components
- g. Experience Certificate and list
- h. Type test certificates.
- i. List of makes of major components as listed above.

**Drawings / documents to be submitted for approval after the award of the order within 7 days before mass manufacturing are as under:**

### **List of Drawings/Parameters to be submitted:**

- a. Technical Parameters as asked in Specification (General Technical Particulars, General Technical Requirements, Additional Details, Fittings, Type test Reports and Routine test certificates of bought out accessories).
- b. General Arrangement Drawing of the Transformer (Front view, Top view and both sides view. Complete list of fittings to be displayed and quantities to be mentioned with the drawing).
- c. Internal Core arrangement drawing.
- d. Internal Core-coil assembly drawing.
- e. Foundation Plan drawing.
- f. Marking plates and Markings (as mentioned in clause 6 )
- g. HV and LV bushings drawing ( with internal view and metal parts)
- h. HT connector, LT connector (palm connector), Aluminum Busbar
- i. HV and LV Box drawing.
- j. Gland Plate for HV/LV box.
- k. Conservator drawing.
- l. Prismatic oil level gauge drawing.
- m. Silica Gel Breather drawing.
- n. Auxiliary Terminal Box drawing with internal wiring arrangement.



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- o. Gland plate of drawing
- p. BH curve & Loss/Kg graph of core material offered.
- q. The tightening torque chart to be provided for all bolts used in specific rating.
- r. Type Test Certificates.
- s. Installation/ Mounting Instructions/Drawing.
- t. Efficiency vs Load curve of the offered design.
- u. Quality Assurance plan.

**List of Calculations to be submitted:**

- a. All the calculations shall be step by step showing the use of formulas and other practical considerations. **Concise calculations in table or excel sheet shall not be accepted.** Also, the reference (only standard sources as IS, IEC or any such standard is acceptable) of the formulas shall be mentioned.
- b. Resistance Calculation ( 75 deg. C )
- c. Load Losses Calculation ( at 75 deg. C )
- d. No load Losses.
- e. Stray Losses.
- f. Weight of Copper (Bare and with Insulation also).
- g. Weight of Core.
- h. Flux Density calculations.
- i. Current Density Calculations.
- j. Short Circuit withstand.
- k. Temperature Rise Calculations.
- l. Conservator Volume calculations
- m. Cooling Calculations showing cooling with tank and radiators separately with no. of radiators and fins mentioned specifically (For both Mineral oil and Ester oil)
- n. Calculation sheet for Lifting lug design and mounting lug design to be submitted by Bidder.

**Additional Documents to be submitted :**

- a. List of raw materials as well as bought out accessories and name of sub-suppliers selected from those furnished along with offer.
- b. Type test certificates of the raw materials and bought out accessories.
- c. The successful Bidder shall submit the **routine test certificates of bought out accessories** and central excise passes for raw material at the time of routine testing.

All the documents & drawings shall be in English language. After the receipt of the order, the successful bidder will be required to furnish all relevant drawings/parameters/calculation to TPCODL/TPNODL/TPSODL/TPWODL for approval.

**Instruction Manuals:**

Bidder shall furnish softcopies of nicely bound manuals (In English language) covering erection and maintenance instructions and all relevant information and drawings pertaining to the main equipment as well as auxiliary devices.

**19. SCHEDULE- "A" GUARANTEED TECHNICAL PARTICULARS:**

**All clauses and points in the Specification to be complied for along with GTR and offered design details.**



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**20. SCHEDULE "B" DEVIATIONS:**

**(TO BE ENCLOSED WITH TECHNICAL BID)**

All deviations from this specification shall be set out by the Bidders, clause by Clause in this schedule. Unless specifically mentioned in this Schedule, the tender shall be deemed to confirm the purchaser's specifications:

SL. No	Clause No.	Details of deviation with justifications

We confirm that there are no deviations apart from those detailed above.

Seal of the Company:

Signature

Designation

**TPCODL**  
**TPWODL**

**TPNODL**  
**TPSODL**

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