TPCODL
TP CENTRAL ODISHA
DISTRIBUTION LIMITED
(A Joint Venture of Tata Power and Government of Odisha)

Contracts Dept, 1st Floor, Anuj Building, Plot No 29, Satya Nagar, Bhubaneshwar, Odisha 751007
NIT No.: TPCODL/P&S/1000000723/2024-25

Open Tender Notification

for

SITC Work of E-House at Cuttack, Odisha

Tender Enquiry No.: TPCODL/P&S/1000000723/24-25

Due Date for Bid Submission: 26 June 2024 [15:00 Hrs.]

TP Central Odisha Distribution Limited
(A TATA Power and Odisha Government Joint Venture)
Procurement & Stores Department,
Contracts Dept, 1st Floor, Anuj Building, Plot No 29,
Satya Nagar Bhubaneshwar, Odisha 751007

Tender Enquiry No.	Description	EMD (Rs.) *	Tender Fee (Rs.) **	Last Date and Time for payment of Tender Fee
TPCODL/P&S/1000000723/24-25	SITC work of E-House at Cuttack	18,00,000	5000	14.06.2024

*** EMD is exempted for MSMEs registered in the State of Odisha. MSME certificate number should start with "OD".**
**** MSMEs registered in the State of Odisha shall pay tender fee of Rs. 1,000/- including GST. For details of MSME norms, please refer "Annexure A" below.**

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.

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 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: SBI, IDCO Towers, Bhubaneswar
Bank Account No. : 10835304915
IFSC Code : SBIN0007891

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:

Sl No	Description	Bidder's Response
i)	Tender Enquiry No.	
ii)	Description of materials / Works Tendered	
iii)	Name 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	

E-mail has to be sent to <asish.karmakar@tpcentralodisha.com> with copy to <Sudhakar.behera@tpcentralodisha.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 TPCODL 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.

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".**

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"**

CONTENTS OF THE ENQUIRY

1.0 Event Information

1.1. Scope of Work

Open Tenders are invited from interested Bidders SITC Work of E-House at Cuttack as stated below:

S. No.	Description	EMD Amount (Rs.)	Tender Fee* (Rs.)
1.	SITC Work of E-House at Cuttack, Quantity: 1 No	18,00,000	5,000

**inclusive of GST*

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	04.06.2024
(b)	Last date and time of Payment of Tender Fee	14.06.2024
(c)	Last Date of receipt of pre-bid queries, if any	18.06.2024
(d)	Last Date of Posting Consolidated replies to all the pre-bid queries as received	21.06.2024
(e)	Last date and time of receipt of Bids	26.06.2024, 15:00 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 Requisite Documents for compliance to Qualification Criteria mentioned in Clause 1.7.
1.4.3 Acceptance of Specification, drawing with filled in GTP as per Annexure II.
1.4.4 Duly signed and stamped 'Schedule of Deviations' as per Annexure III on bidder's letter head.
1.4.5 Duly signed and stamped 'Schedule of Commercial Specifications' as per Annexure IV on bidder's letter head.
1.4.6 Duly filled in Annexure V and VI.
1.4.7 Proper authorization letter/ Power of Attorney to sign the tender on the behalf of bidder.
1.4.8 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, where applicable.
ii. Tender fee of requisite value.
iii. Price Bid as per the Price Schedule mentioned in Annexure I.
iv. Necessary documents against compliance to Qualification Requirements mentioned at Clause 1.7 of this Tender Document.
v. Receipt of Bid within the due date and time.

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

1.7 Qualification Criteria

a) The bidder should have an average annual turnover of Rs.1000 crore in last three financial years. Copy of audited Balance Sheet and P&L Account to be submitted in this regard.

b) The bidder should have own manufacturing facility to manufacture E-House of required specifications and should have in-house facilities for acceptance tests as per technical specifications. Switchgear must be of same make of E-house. Bidder must submit undertaking in this regard.

c) The bidder should have supplied at least one E-House of same rating or higher rating in the last 5 years. Copy of work orders / completion certificates to be submitted in this regard. In case the bidder has a previous association with TPCODL / other Odisha Discom/TPDDL/Other Tata Group Company for similar products and services, the performance feedback for that bidder by TPCODL/ Other User Group shall only be considered irrespective of performance certificates issued by any third organization

d) The bidder must have all statutory compliance like valid PAN no.,GSTN, PF,ESI 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, TPCODL 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. This includes all bidding information submitted to TPCODL. All tender documents remain the property of TPCODL 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 on the compliance to tender terms and conditions.
- The bids will be evaluated commercially on all-inclusive lowest cost. Details mentioned under Conditions of Annexure I enclosed.
- Bidder has to mandatorily quote against each item of Price Schedule *[Annexure I].* Failing to do so, TPCODL may reject the bids.

NOTE: *In case a new bidder is not registered with TPCODL, factory inspection and evaluation shall be carried out to ascertain bidder's manufacturing capability and quality procedures. However, TPCODL 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 shall be final and binding on the bidder in this regard.

2.1 Price Variation Clause: The prices shall remain firm during the entire contract 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.

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 TPCODL 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 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 (Procurement & Stores)
TP Central Odisha Distribution Limited
Contracts Dept, 1st Floor, Anuj Building, Plot No 29, Satya Nagar,
Bhubaneshwar, Odisha 751007

In case EMD is exempted then copy of MSME certificate to be submitted.

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

i. Details of EMD of requisite value and validity.
ii. Requisite Documents for compliance to Qualification Criteria mentioned in Clause 1.7.
iii. Acceptance of Specification, drawing with filled in GTP as per Annexure II.
iv. Duly signed and stamped 'Schedule of Deviations' as per Annexure III on bidder's letter head.
v. Duly signed and stamped 'Schedule of Commercial Specifications' as per Annexure IV on bidder's letter head.
vi. Duly filled in Annexure V and VI.
vii. Proper authorization letter/ Power of Attorney to sign the tender on the behalf of bidder.
viii. 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 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 alongwith break up of basic price, Taxes & duties, Freight 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 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

"SITC Work of E-House, TENDER NO 1000000723"

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

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: Asish Karmakar
Contact No.: 8768455566
E-Mail ID: asish.karmakar@tpcentralodisha.com

Senior General Manager (Material Procurement):

Name: Mr. Sudhakar Behera
Contact No.: 9437282663
E-Mail ID: Sudhakar.behera@tpcentralodisha.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. 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 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.

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

The type tests specified in TPCODL 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's 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 TPCODL Office, Bhubaneswar. Technical Bids will be opened online on date & time to be intimated to bidders one day in advance. Bidder may join online to witness bid opening process. Online link will be shared on the mail id which will be mentioned in tender fee submission details. Technical bid must not contain any cost information whatsoever, else bids shall be liable to be rejected.

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, and whether the Bids are generally in order. TPCODL 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 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 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 may, at its discretion, ask the Bidder for a clarification on its Bid for any deviations with respect to the TPCODL 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.

4.5. Price Bid Opening

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

4.6. Reverse Auctions

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 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.

Reverse Auction shall be as per the below approach:

Number of bidders allowed to participate in RA process shall be: Tentative total number of bidders among which tender quantity/items intended to be split PLUS 2 more bidders.

Illustrative example: Total no of qualified bidders is 10 & tender needs to split amongst 4 bidders.
PLUS 2 means (04 + 02 = 06) means lowest 6 bidders i.e., L1 to L6 bidders would be allowed in the RA process. Balance, H1 to H4 bidders would not be allowed in the RA process.

In case – Total no of qualified bidders is equal to or less than the **PLUS 2** number, all qualified bidders shall be allowed in the RA process.

Illustrative example: Total no of qualified bidders is 4 & tender needs to split amongst 2 bidders. PLUS 2 means (02 + 02 = 04), so all 4 qualified bidders would be allowed in the RA process

5 Award Decision

TPCODL 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 (Price Schedule). The decision to place purchase order/LOI solely depends on TPCODL on the cost competitiveness across multiple lots, quality, delivery and bidder's capacity, in addition to other factors that TPCODL may deem relevant.

In case any supplier is found unsatisfactory during delivery process, the award will be cancelled and TPCODL 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:

i) Price Schedule (Annexure I)
ii) Post Award Contract Administration (Clause 7.0)
iii) Submission of Bid Documents (Clause 3.0)
iv) Technical Specifications (Annexure II)
v) Acceptance Form for Participation in Reverse Auction (Annexure VI)
vi) General Conditions of Contract (Annexure VIII)

7 Post Award Contract Administration

7.1. Special Conditions of Contract

- Purchase order shall be placed post finalization of bidder through the tender process. Rate shall remain FIRM till the execution of the job and handover to TPCODL.

- Business Associate (BA) shall submit applicable Contract Performance Bank Guarantee (CPBG) as per GCC within 30 days of issuance of order. CPBG applicable shall be 10% of Purchase Order Value. Validity of CPBG shall be worked out as "Delivery date of Purchase Order+Warranty Period". Claim period shall be one additional month from the expiry date of CPBG in both cases.

- 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.
- 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.
- Quotation of all items Price Schedule, Annexure-I, is mandatory, and bid shall be rejected if any line of found blank in price bid.
- Within 15 days of Rate Contract issuance by TPCODL, it is the responsibility of BA to get manufacturing clearance and CAT-A issued from TPCODL. In case BA does not get necessary approvals for issuance of CAT-A within mentioned / mutually agreed timelines, then TPCODL reserve the right to cancel issued rate contract / release order and also reserve the right to forfeit EMD / PBG.
- Delivery period shall be 120 days from date of receipt of release order / CAT-A issuance, whichever is later
- Guarantee applicable shall be as per technical specifications.
- All other terms and conditions of TPCODL General Conditions of Contract shall be applicable.
- TPCODL shall short close the issued Release Order / Rate contract, in case of any quality issues

7.1 Terms of Payment:

Supply of equipment

10% advance against CAT-A approval and submission of Advance BG of equivalent amount valid till the delivery of the equipment.

80% within 90 days against delivery of the complete equipment and submission of certified invoice. Balance 10% within 90 days against installation, testing and commissioning of the equipment.

Installation, Testing Commission of the equipment

100% within 90 days against successful installation, testing and commissioning of the equipment alongwith statutory approval and service membership and submission of certified invoice.

7.2 Drawing Submission and Approval

The relevant drawings and GTPs need to be submitted as per special condition of contract mentioned in point no. 7.1.

7.3 Payment Terms

As per SCC, clause number 7.1.

7.4 Climate Change

Significant quantities of waste are generated during the execution of job and an integrated approach for effective handling, storage, transportation and disposal of the same shall be adopted. Also as per the directive from Government of India, there shall be no use of Single Use Plastic, having thickness less than 120 micron, by Associate in the execution of the job. 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, Annexure-X for more details.

7.5 Ethics

TPCODL is an ethical organization and as a policy TPCODL 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.
- 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 / Ajit.Maleyvar@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.

10 Safety

All jobs are this tender have to be executed strictly in compliance to the Safety terms and Conditions of TP Central Odisha Distribution Limited. Please refer attached Safety terms and conditions, Annexure-VII, for details. Violation of Safety norms will result in Penalty as mentioned in the above document.

Annexure-I, Price Schedule

Sl	Item	Qty	UOM	Unit Price(Rs)	GST(Rs)	Unit Price with GST(Rs)	Amount with GST (Rs)
		A		B	C	D=B+C	E=DXA
1.	Supply of the assembled E-House	1	Each				
2.	Erection, Testing & Commissioning of the E-House	1	Each				
3.	Statutory Approval	1	Each				
4.	Service Membership	5	Years				
	Total						

Conditions:

i) Rate for supply is to be quoted on delivered basis at Cuttack, Odisha and should be inclusive of freight, insurance, loading & unloading, handling charges and any other charges which may be applicable.

ii) The bidders are advised to quote prices strictly in the above format. Failing to do so, bids are liable for rejection.

iii) 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.

iv) No cutting/ overwriting in the prices is permissible.

v) All price shall remain firm and fixed for one year for placement of RO.

Signature & Seal of Bidder

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*'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:

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.)

S. No.	Particulars	Remarks
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:

Name:

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

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 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 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.
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 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.

Supply, Erection, Testing and Commissioning of 33/11kV E-House with Equipment as per BOM

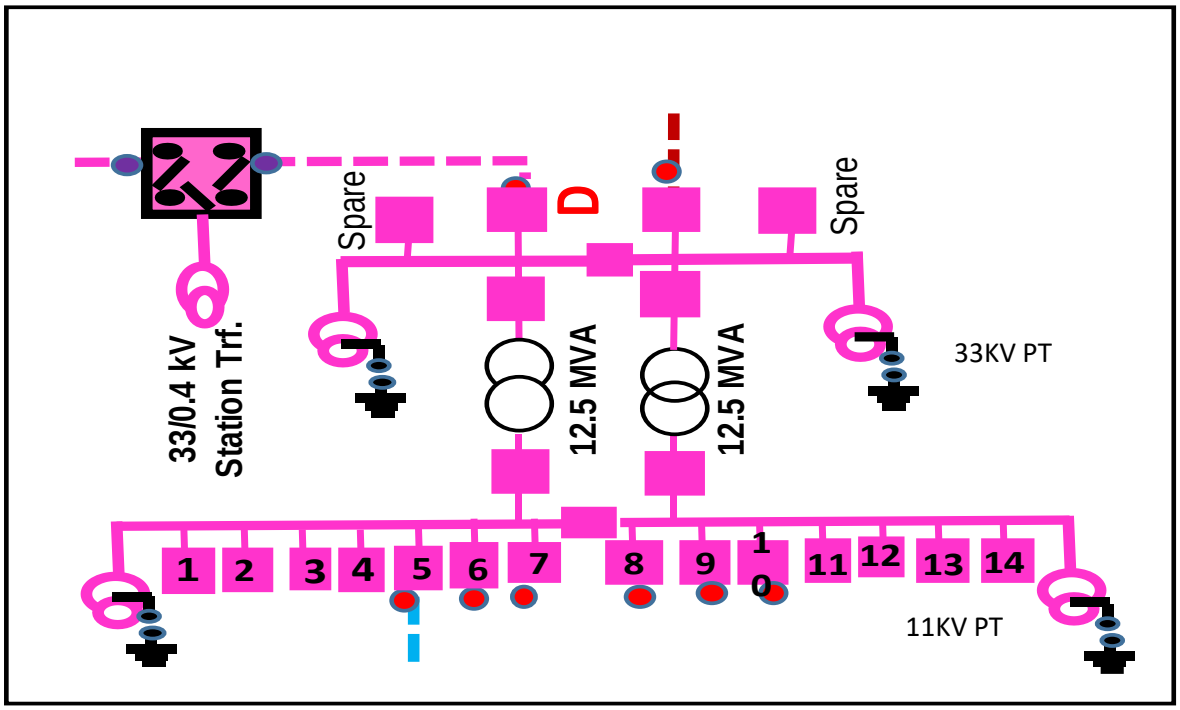
Supply, installation, Testing & commissioning of 33/11KV E House consist of below equipment's

S.N	Description of Items	Qty
	Inclusions	
1	33kV GIS panel 1250A 25KA CU busbar	7 Nos.
2	11KV SSIS panel 1250A 25KA CU busbar	3 Nos.
3	11KV SSIS panel 630A 25KA CU busbar	16 Nos.
4	33/11kV, 16/20.0 MVA Oil cooled outdoor type Power Transformer	Free Issue by TPCODL
5	33/0.433kV, 100kVA Aux Transformer	1Set
6	E House Enclosure (L20M x W4.2M x H4.0M) with ladder & access platform	1 Set
7	Gateway & SCADA	1 Set
8	Battery & Charger	1 Lot
9	Distribution Boards	1 Set
10	Substation auxiliaries – Illumination, earthing, lightning protection, CCTV surveillance, UPS (2KVA), Fire Alarm system, Air Conditioning system etc.	1 Set
11	Digital Solution - Asset Condition Monitoring with 1 year subscription of predictive support & ETE for two transformers	1 Set
12	Erection, Testing & Commissioning	1 Job
13	Local statutory approval limited to CEIG	1 Job
14	Exclusive Service Membership	1 Job

A. The Bidder has to unload the E house at Site .Bidder has to necessary security & supervision arrangement during commissioning of E House.
B. The Bidder has to do the necessary civil work for installation & commissioning of E House along with required HT & Control cable trench at site..
C. The Bidder has to do the necessary Scada integration of PSS along with TPCODL existing SCADA system.
D. TPCODL will free issue the Power Transformer & will construct Power transformer foundation. TPCODL will install the Power Transformer on the foundation.
E. Bidder has to supply necessary 33KV & 11KV Cable along with Termination for connecting the Power Transformer 33KV & 11KV Side.
F. Bidder has to supply necessary 11KV & LT Cable along with Termination for connecting the Station Transformer 33KV & LT Side.
G. Bidder has to do the necessary pre -commissioning test at site & same has duly verified & accepted by TPCODL engineer.
H. Bidder has supply necessary mandatory spares along with E House for 33KV & 11KV Switchgear

I. Bidder has to obtain all necessary statutory approval from the competent authority for charging of E House including power transformer.

J. The Bidder has to submit the Projection execution PERT chart along with milestone for execution of the project.



CONTENTS

1 SCOPE

This specification covers the Design, Manufacture, Supply, Transport, Assembly of Shipping sections at Site, Supervision of Erection, Testing & site Commissioning of Containerized Substation. The OEM of containerized 33kV/11kV Substation shall use their own make of 33kV / 11kV Switchgear Panels & other equipmens. Supply of Containerized substation includes the followings:

1) 11kV & 33kV Indoor Switchgear – As per ENG-EHV-1003, ENG-EHV-GIS
2) ACDB & DCDB
3) Battery and Battery Charger – As per ENG-EHV-1028
4) Power & Control Cable and earthing – As per ENG-HV-2007, ENG-EHV-1010, ENG-LV-3004
5) Air Conditioner for the Switchgear Container.
6) Basic SCADA System
7) Fire Fighting equipment's – Fire Extinguisher.
8) Lighting and Video Integration (CCTV)
9) Metallic Container suitable for housing all comprising Substation Equipment except Transformer
10) Earthing
11) Supply and Installation of all necessary equipments in switchyard / Transformer yard.
12) All type of Civil Work in switchyard / Transformer yard.

Containerized substation shall be complete with all the accessories for efficient and trouble-free operation.

It should be Heavy-Duty with IP 54 Rating, Fire Retardant capable to house 33Kv, 11KV Switchboards, ACDB, DCDB, Battery & Battery Charger and other Auxillaries.

The equipment offered shall be safe, reliable, and compact to install. The workmanship shall be of highest order. The 11kV & 33kV Panels, Protective devices etc. shall be of latest design to ensure rapid and efficient interruption of fault current low arc energy, small arcing time, three phase copper bus bar system and freedom from fire hazards.

2 APPLICABLE STANDARDS

b

a) Steel: load bearing members : IS 10748; Grade IV Structural Steel : IS 2062.
b) Side-end walls & roof panels :IS 206
c) Square/Rectangular hollow sections: IS STKR-41/ IS 1161
d) Design Code : IS 800

3 CLIMATIC CONDITION

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 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)

UTILITY 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 REQUIREMENT

		Requirement
IP Rating of Enclosure		
Dimension of Panel	LXBXH (In mm)	
Equipment Details (Qty and Weight)	33KV Switchboard	
	11KV Switchboard	
	LT Switchboard	
	Control relay Panel	
	Battery Bank & Charger	
	AC Distribution Panel	
	DC Distribution Panel	

	RTU Panel	
Weight Distribution	As per attached GA	
Construction material	Frame	
	Side Wall	
	Top Floor	
	Base Plate	
	Door	
Cooling System	Type & Tonnage	
Lighting System	LUX	
Security System	Required/Not Required	

4.1 General

Bidder should have own design & manufacturing facility for HT/LT Switchboard, Protective IEDs & LT Panels those will be installed in containerized substation. The containerized SS design shall be suitable to accommodate 7 Panel Board (33 kV GIS) & 19 Panel Board (11 kV AIS), ACDB, DCDB, Battery & Battery Charger, Automation system & other necessary equipments, following the best industry practices / international practices. Container shall have minimum 20 years design life & shall be suitable to be used in the coastal areas, high cyclonic wind zones & highly saline weather.

a) Pre-fabricated enclosure design shall be suitable for all pre- service and in-service loading conditions in industrial applications. Pre-fabricated enclosure(s) shall be suitable for operation as per following ambient conditions.
b) The environment which the machine will be operating will be extreme in term of temperature, humidity, corrosion and dust.
c) Particular attention shall be given to the mounting of the switchboards and control equipment to ensure that they are not subjected to vibration. Provision for mounting RTU and associated communication power supply equipments shall be considered in the design.
d) Physical access to all equipment shall be possible for maintenance purpose.
e) The container/ E House shall be manufactured to IP54.
f) Containerized Substation shall be designed for walk in operating only. Suitable space / operating aisle shall be provided inside container for safe operation and maintenance of all equipments like Electrical Switchboards,Control Panels,Battery Banks etc.
g) Bidder shall ensure that with above ambient condition the performance of any equipment installed inside pre-fabricated enclosure is not affected. All performance parameters of equipment should remain within specified limit.
h) Pre-fabricated enclosure(s) design shall be of metal construction and shall be self supporting and free standing. All metal work shall be free from burrs and sharp edges. Elements may be connected by bolts, thread forming screws, or welds.
i) The pre-fabricated enclosure(s) shall be designed to withstand loading induced by land transportation, installation and operation. Lift analysis and design shall be in accordance

with latest revision of Indian Building Congress. Building shall be designed to limit lift and operating base deflection to L/240.

j) The pre-fabricated enclosure(s) shall be constructed of structural members sized by design structural calculations and reinforced to meet or exceed specified static and dynamic loads. Structural members shall be located to coordinate with the enclosed equipment so as to properly support it and allow maximum access to equipment floor openings for cable penetration.

k) It shall be the bidder's responsibility to ensure all necessary alignment and interconnection between component sections. The entire assembly must be electrically and mechanically assembled into one single lineup prior to final inspection and shipment.

5. General Construction

5.1 Structural Components

Base Frame:

The prefabricated enclosure(s) frame shall be constructed as a rigid, self-supporting steel structure. Enclosure base frame shall be Hot Dip Galvanized / Zinc Spray Metallization made of ISMC base channel. Four corners of the base frame to be suitably welded to ensure rigidity to absorb shock and vibration during transportation and lifting.

The base frame shall be able to resist both dead and live loads expected during construction, installation, and operation.

The Enclosure floor framing shall be fabricated from ISMC base channel manufactured of HRCA / CRCA or Superior Material steel members to form a rigid rectangular frame as per relevant IS or equivalent. The frame shall be braced with cross members as required to support the equipment installed in the enclosure.

Base frame of the enclosure to be designed along with lifting hooks/arrangement capable of lifting the fully equipped structure at the specific lifting points with no distortion of any equipment inside E House.

Supporting Structure shall be manufactured using HRCA / CRCA square tubes / channels of suitable thickness.

The roof framing and the columns shall be designed to support any additional dead load suspended from the roof such as air conditioning unit if vendor chooses to have ceiling mounted indoor units, false ceiling only where applicable, light fixtures, and conduit piping.

The pre-fabricated enclosure(s) floor framing shall be fabricated from IS Standard, ASTM A36/ JIS 3101 or Equivalent steel members to form a rigid rectangular frame. The frame shall be braced with cross members as required to support the equipment installed in the building.

The pre-fabricated enclosure(s) shall be analyzed to resist both dead and live loads expected during construction, transportation, installation, and operation.

The pre-fabricated enclosure(s) shall be designed for the maximum in-place structural loading consisting of the structure, equipment dead weight, all operating loads, and the maximum environmental loads.

B. Shell

The outer shell of the pre-fabricated enclosure(s) shall be manufactured with galvanized sheet steel of 2mm thickness (275 GSM).

The main load bearing members such as posts, base members, bottom and top side rails, end rails headers are pressed formed profiles of appropriate geometry. Thickness of such profile shall be minimum thickness of 3mm.
Lifting hooks shall be provided at minimum 4 corners. The adequacy of the same shall be verified by structural analysis.
Adequate number of doors with reinforced framework and locking device shall be provided as per requirement. The door has to be effectively sealed against water ingress in closed condition.
The shell structure is to be rigid enough to withstand rough handling rigorous transportation hazards etc. and able to stand flexing/distortion even when placed on uneven ground.

C. Side & End Walls
External walls are to be made from vertically corrugated GI sheet of minimum 2mm thickness for external side and 1.5mm thickness for internal side.
Adequate thermal insulation using Rockwool between inner and outerwalls is required to maintain the inside conditions with air-conditioned operation.
The side wall shall also provide cut outs for door, windows If any.

D. Flooring System
Thickness medium tensile steel sheet will be laid, and stitch welded to the cross members and also to the peripheral structure to cater load .
Floor plating shall be covered with a non-skid surface.
Top floor / walkway shall be of min 5 mm thick MS Chequered plate fully welded to the base frame excluding panel mounting areas.
The exposed floor in front of electrical panels shall be insulated with high grade PVC insulation mat, rated for 36kV

E. Insulation
Pre-fabricated enclosure(s) shall be insulated on sides, end walls, roof & doors with 50mm thick Rockwool insulation. Densities should be minimum 48 kg/m3.
Inner Paneling
Interiors of the pre-fabricated enclosure(s) shall be aesthetically finished so as to give a pleasing appearance with high quality workmanship. All joints shall be neatly finished.

F. Doors
All exterior doors shall be of weather-proof construction with four sided frames.
All exterior hardware shall be stainless steel, including, but not limited to hinges. Hinges shall be concealed type. If non concealed type then the hinge should be tamper proof arrangement.
Doors shall be lockable with one master key for all key locked doors. Minimum four keys shall be provided per lock.
The size of door shall be as per equipment inside container substation .Suitable arrangement for the entry of existing panels at site.
Doors shall be fabricated from GI/aluminum with SS hardware. A minimum of two doors shall be provided unless otherwise specified. The personnel door of minimum 1.2m x 2.5m shall be provided.Secondary Door shall be 1.2m x 3.5m.
The doors shall be provided with door switches with provision for connecting to RTU for obtaining door open indication through SCADA system.
Also doors with access control should have interlocks to defeat the access control automatically in the event of an emergency exit.

5.2 Grounding

The container shall be furnished complete with ground pads which shall bond with electrical equipment enclosure frames and ground buses to the container frame at the exterior base in two locations and at opposite ends of the container so as to provide a continuous path to ground.
The Grounding system shall connect to each end of the ground bus in each assembly of installed equipment.
Connection to the ground/earth pit shall be done with properly calculated ground bar material

5.4 Lighting

The lighting system shall maintain average levels as given below:
Lux level shall be 300 inside the enclosure. For the outside platforms/ stairs it shall be 100.
All luminaries shall be suitable for industrial duty and provided with IP65 housings for outdoor application and IP54 for indoor applications. All fittings shall be weatherproof and able to withstand direct hosing.
The luminaries shall be with LED lamps of sufficient wattage to cater the lux requirement.
The wiring for lighting shall be routed through GI conduits either concealed or outside the wall of the enclosure

Emergency Lighting
The enclosure shall be furnished complete with factory installed emergency lighting and with EXIT light fixtures at each access doors. Minimum Ten percent of total lighting fixtures shall be emergency lighting with Battery backup. The lighting system shall provide immediate emergency light (for at least 3 Hour) upon failure of the normal power source and shall switch off automatically when power is restored.

5.5 Fire Detection & Control

A Fire Detection and alarming system shall be installed by bidder consisting of fire alarm control panel with display utilizing an detection system suitable for multi-area detection and control.
The fire detection and alarm system shall include multi sensor smoke detectors suitable for the intended service, break glass type manual call points, indoor and outdoor alarm hooters.
CO2 Fire Extinguishers (4.5 / 5Kg) 2 Nos shall be placed nearer to entrance door.
The wiring for fire alarm panel to smoke detectors shall be done through separate conduits and shall not be mixed with any other circuits.SIignal from fire detection unit shall be provided as an input to RTU/SCADA.

5.6 Air Conditioning System
The E-House shall be equipped with suitably sized air conditioning .
Air Conditioning units shall be able to maintain a temp of 24 degree centigrade within enclosure for operation of Switchgears, RTU etc. when outside temperature is 50 degree centigrade.
Temperature sensors shall be provided for monitoring the temperature inside the container and the sensors shall have the provision for connecting to RTU for obtaining temperature indication through SCADA system.

The capacity of Air conditioning system should be capable of meeting 10% additional heat load calculated.

5.7 Surveillance System

CCTV Camera shall be placed inside the E House container for Surveillance. Minimum 2 Nos of CCTV cameras shall be placed inside each E House Container and 2 Nos number Bullet Type CCTV cameras shall be outside of E-House (PDC). Each system will comprise of CCTV Camera, Digital Video recorder, LED Monitors with local display, Control cable for connection.

5.8 Safety Equipment & ToolBox

a) Safety charts Danger boards as per IE rules shall be provided.
b) Entrance, exit and emergency exit sign, first aid box, and no smoking board to be provided.
c) Fire bucket with sand -6Nos
d) 33 kV Gloves, goggles and discharge rod etc shall be considered in scope.
e) Laminated overall SLD at suitable place on the wall of the Ehouse.
f) Toolbox with minimum tools for O&M shall be provided.

5.9 Other Items

Lifting Tools and Tackles
When specified on the accompanying Data Sheets or when requested as an option, a lifting system shall be designed and furnished. The system will consist of a spreader bar, slings, shackles and other tools to lift the equipment building in one piece.
A lifting system installation &operational diagram shall accompany all shipping documents.
Identification & Labels
All signs shall be made out of painted steel or non-flammable material. All operating instruction fire exit route etc shall also be marked.
All equipments including junction boxes, safety switches, switchgears, circuit breakers, control devices, communication equipment, marshalling panel etc shall be labeled.

6.0 Electrical Auxilaries

Each prefabricated enclosure(s) shall have auxiliary distribution boards for catering auxiliary power supply (AC & DC) system. The panel can be wall mounted type and shall have feeders for lighting circuits, sockets, battery chargers, air conditioning units, fire and alarm panels, spare etc. The incoming supply for this panel shall be from a 3 phase 4 wire 415V 50Hz supply and will have a main TPN MCB of sufficient rating depending upon the load inside E-house. The feeders shall be through 2 pole MCBs for single phase circuits and TPN MCBs for 3 phase circuits. The feeders shall be arranged such that the load shall be balanced among three phases. The enclosure shall be of minimum IP41 rating, powder coated paint
The wiring circuit of the E House for lightings will include a suitable 1-phase power input socket, distribution board with MCB for the light connections and other additional points as required. Sufficient quantity of 240 V, 1 Ph, 5A socket outlet shall be provided inside the Ehouse. There shall be at least 5nos 5 pin sockets of 5/10A rating

Containers shall be provided with proper electrical wiring & sockets. Electrical wiring shall be done as per respective IS standard with proper earthing system. All wires used for lighting system should be by FRLS 1100V grade.
The enclosure shall be furnished complete with all utilities wiring, factory installed and connected, with steel wire un-armored copper cables with FRLS outer sheath.

6. Nameplate & Marking

The nameplate shall be as per IS 1180:2014.
Additionally following Points shall be displayed.

- Make
- Sl.No
- Year of Manufacture
- Property of TPCODL
- Emergency Contact Number

7. Tests

- Visual Inspection
- Test for ingress protection as per Technical Particulars
- Measurement of Thickness/Dimension of Wall/Supporting Structures as per Drawing etc
- Paint Thickness Check.
- Quality of welding through NDT. (Non-Destructive Test)
- Inspection and test shall be carried out on the complete assembled switchgears and items used in construction of the containerized substation as per the specifications.The routine tests may be carried out in the factory for the purpose of all the items used in construction of the containerized substation as per the respective specifications/ standards/ practice.

8. Type Test Certificates

The Bidder shall furnish all relevant test certificates of the offered specs

9 PRE-DESPATCH INSPECTION

1. Bidder to raise the inspection calls for stage inspection and only after getting clearance from TPCODL shall proceed for further manufacturing. The bidder shall raise the inspection call for Final Inspection or prototype Inspection in TPCODL format.
2. Equipment shall be subject to inspection by a duly authorized representative of the TPCODL.
3. 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.
4. Bidder shall grant free access to the places of manufacture to TPCODL's representatives at all times when the work is in progress.

5. Inspection by the TPCODL or its authorized representatives shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specifications.
6. The BA shall ensure that 100% of the lot must be ready for inspection and atleast 10% must be ready with all accessories during inspection.
7. Material shall be dispatched only after getting MDCC (Material Dispatch Clearance Certificate) from TPCODL.
8. 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)
9. 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.
10. Advance intimation of 7 Days (Within Delhi)/12 Day (Outside Delhi) is required for both Stage and final inspections.
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.
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 Active Inspection during Acceptance Tests.
13. The stage inspection shall be done as per the format given in Annexure – I.
14. TPCODL also reserves the right to inspect the tank of transformer before surface preparation and painting. The same shall be informed to TPCODL accordingly.
15. Final inspection Call for carrying out acceptance tests as per relevant IS/IECs shall be sent by the Bidder along with routine test certificates.
16. 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.
17. 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. Also 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.
18. 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.

10.0 INSPECTION AFTER RECEIPT AT SITE:

The material received at the TPCODL, Bhubaneswar, Odisha store shall be inspected for acceptance and shall be liable for rejection, if found different from the reports of the pre-dispatch inspection.

11.0 GUARANTEE:

1. 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 60 months from the date of commissioning or 48 months from the date of last supplies made under the contract, whichever is earlier.
2. 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.
3. 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.

12.0 PACKING

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.

13.0 TENDER SAMPLE :

NA

14.0 TRAINING

NA

15.0 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'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:

1. 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.
2. List of manufacturing facilities available, level of automation achieved and the areas where manual process exists.

3. List of areas in manufacturing process where stage inspections are normally carried out for quality control and details of these tests and inspections
4. QAP withhold points for TPCODL inspection.

16.0 MINIMUM TESTING FACILITIES

Bidder shall have adequate in house testing facilities for carrying out all relevant tests and pre-dispatch inspection as per relevant International / Indian standards.

17.0 MANUFACTURING ACTIVITIES

Manufacturing to start only after getting approved drawings or as per intimation from TPCODL.

18.0 SPARES, ACCESSORIES AND TOOLS

Bidder shall provide special tools and tackles (if any) required for Maintenance of the unit.

19.0 DRAWINGS AND DOCUMENTS

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 compliance to each clause of Technical Specification and any Additional Details and Fittings.
b. General arrangement for Transformer.
c. Bill of material.
d. Experience Certificate and list
e. Test certificates.
f. 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:

1. Technical Parameters as asked in Specification (General Technical Particulars, General Technical Requirements
2. General Arrangement Drawing
3. Foundation Plan drawing.
4. Marking plates and Markings (as mentioned in clause 6)
5. Test Certificates.
6. Installation/ Mounting Instructions/Drawing.
7. Quality Assurance plan.

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.

Instruction Manuals:
Bidder shall furnish soft copies 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.

20.0 GUARANTEED TECHNICAL PARTICULARS

All clauses and points in the Specification to be complied for along with GTR and offered design details.

21 . SCHEDULE OF DEVIATIONS

(TO BE ENCLOSED WITH THE 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:

S.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

ANNEXURE – I

INSPECTION TEST PLAN FOR STAGE INSPECTION

S No.	Particulars	Details
(A)	**GENERAL INFORMATION:**	
1	Name of firm	
2	Order No. and Date	
3	Details of offer	
4	Sheet and Supporting Framework	
5	Paint	
6	Fittings & Fixtures	

ANNEXURE-II

FINAL INSPECTION TEST PLAN

1	Name of the firm / BA	
2	Date of inspection	
3	Details of offer made	
4	Dimension Checks as per approved drawing	
5	Checking of Hinges,Fixtures and other movable components	
6	Electrical Fixtures and Wiring	
7	Air Conditioning System (If fitted at facility)	
8	Fire Alarm System	
9	Check for Manufacturing defects	
		Sr. No.----------

PURCHASER'S OFFICER BIDDER'S REPRESENTATIVE

DATE OF INSPECTION

Specification for

SUBSTATION AUTOMATION SYSTEM

Section – A

Scope of Work for Substation Automation System

TP Central Odisha Distribution Limited (TPCODL) hereinafter called the "OWNER" or "TPCODL", proposes to implement **Substation Automation System** for the Substations to integrate with SCADA, DMS & OMS System at the TPCODL Main Control Center (MCC) and Backup Control Centre (BCC) for remote monitoring and control. The proposed Remote Terminal Unit (RTU) shall communicate with the SCADA, DMS & OMS System at MCC and BCC over IEC 60870-5-104 protocol for real time status of the switchyard and other accessories in the substation. The RTU shall be capable to acquire signal through hardwiring and communication (IEC 61850 Ed 1 and Ed2, IEC60870-5-103, IEC60870-5-104 and Modbus Protocol). The proposed RTU shall communicate simultaneously with minimum eight (8) SCADA System (redundant) over IEC 60870-5-104 with different network.

Bidder shall refer the entire project specifications to understand the execution methodology and interface equipment specification for the complete Scope of Work of this project. The bidder shall consider the entire scope of supply and services accordingly.

The document covers the specific requirements for complete design, detailed engineering, installation, testing, integration with SCADA, DMS, OMS and Substation IED's and commissioning of Substation Automation System.

1.0 Scope of Work

The scope of this specification covers all the technical requirement with all accessories, tools and tackles of Design, Engineering, Supply, Insurance, Testing at Manufacturer's works, packing, forwarding, Transportation, Delivery at site, unloading at site/stores Installation, Testing & Commissioning of Substation Automation System and seamless integration with TPCODL SCADA Systems, and other systems for the proposed substation, Warranty and Post Warranty support as per the detailed specifications. Including all works required for successful integration with all IEDs, meters etc.

Any item though not specifically mentioned but is required to complete the project shall be considered and the same shall be supplied and installed by the bidder.

The indicative Bill of Material is attached with this document for bidder's reference and for bid purpose only ***(Refer Section C Annexure 5 Indicative Bill of Material for Proposed Substation Automation System).*** Attached BOM is indicative, Bidder shall submit the detailed BOM along with the offer, as per the System/Architecture offered to meet the specified requirements.

Bidder to note that the proposed system architecture shall give more emphasis on the following aspects

a. Reliability

b. High Availability

c. Cyber Security Resilience

1.1 **General**

a. Bidder to note that any system (Hardware & Software) considered under this RFP for meeting the functional requirement shall be from the same OEM.

b. ***No Hardware & Software shall be manufactured, delivered, customized exclusively for this project/contract.***

c. ***Bidder to note that this substation is envisaged to be unmanned and operated from TPCODL Main Control center or from Backup Control Center. Therefore, all functional requirement for remote monitoring and control shall be implemented.***

1.2 **Engineering**

a. Finalization of Functional Design Specifications, Substation-wise Automation System Architecture, GTP, I/O List, Schematic Diagrams of Panel, Cable Requirement, Auxiliary Power System requirement.

b. Preparation of Interconnecting Schedule (Field, Communication, Inter/Intra Panel)

c. Layout finalization for installation of Panels, Cable route etc.

d. Bidder to ensure optimal utilization of space to accommodate all the required equipment. Bidder shall consider panel enclose with IP54.

1.3 **Installation & Commissioning**

1.3.1 **CRP**

a. Supply, Installation and Commissioning of the MFM in the CRP panel.

b. All the MFM shall be looped for communication with the proposed Redundant RTU.

c. Integration of IEDs through Ethernet Cable with RTU. Bidder to consider all networking accessories for Integration with RTU.

d. Structural cabling shall be done properly.

1.3.2 **RTU**

a. Data acquisition and Control is primarily planned through BCPUs, therefore the integration of these BCPUs through Ethernet switch with the RTU is in the scope of the bidder.

b. Supply, laying with proper termination of Ethernet and Instrumentation cable for extending the status inputs from control panels to the RTU panel.

c. TMU shall be integrated with RTU for WTI, OTI & TPI. / Analog output of WTI, OTI & TPI shall be connected with Analog input card of the RTU. Required instrumentation cable supplying, laying and termination is in the scope of the bidder.

d. Supply, laying, wiring with proper termination of copper control cable for extending the status inputs from control panels (CMR output contact) to the RTU panel.

e. Interposing Relay (Heavy duty Relay) shall be supplied and installed in the RTU panel along with wiring of the control cable to extend the control output of the RTU to CRP/Field panel.

f. Configuration of the RTU as per requirement, integration of the IEDs and Condition Monitoring devices of the Auxiliary System (e.g. FDS, Battery Charger etc.)

g. Proposed Temperature and Humidity sensor shall be installed at appropriate location and integration of the same with RTU.

h. Remote Configuration of RTU from TPCODL Main Control Center and from Back up Control Center.

i. Configuration of the Ethernet switch.

j. Bidder shall provide redundant terminal server for serial communication (All Serial Protocol defined in the specification of RTU).

k. Bidder shall use surge protecting device for all serial communication port.

1.4 **Substation Electronic Earthing**

a. Bidder to submit the details of earthing requirement for the proposed solution.

b. Providing of proper earthing to RTU and armored cable with separate Earth pit shall be in the scope of the Bidder.

c. Earthing cable with proper sizing shall be laid from the RTU panel to the earth pits.

Bidder to ensure maximum earth value of 2 Ohms

1.5 **Panel Erection and installation**

a. All Unused slots shall be filled

b. Proper Vermin Proofing of Panels shall be done.

c. Name plate at front and back shall be provided for system identification.

d. All Equipment identification label shall be provided along with cross ferruling of Inter and intra cable

1.6 **Control, Instrumentation and Communication Cable**

a. The bidder shall supply armored control cable and shall lay the cable through the cable trenches.

b. The auxiliary contact used in CRP panel for Digital Inputs (Status and Protection) shall be used for contact multiplication to extend the same to proposed RTU panel.

c. Supply, Laying and termination of control cable from RTU to CRP Panel for digital output.

d. Supply, Laying, Wiring and Termination of control cable, multi-strand copper control cable for extending CT & CVT / PT inputs to the MFM in the CRP.

e. Supply, Laying and termination of communication cable for IEDs and Condition monitoring devices and auxiliary system

f. Supply, Laying and termination of control cable from Isolator Box to RTU panel.

g. Supplying, Laying and Termination of auxiliary power supply cable for extending 24V/48V DC inputs from DCDB to the MFM in the CRP. All the MFM shall be looped to the RTU panel for communication with the RTU.

h. All the MFM shall be looped to the RTU panel for communication. Looping from MFM to MFM shall be done from MFM to the terminal block and subsequently terminal block to terminal block in the panel.

1.7 **Communication Infrastructure**

a. Communication components and accessories such as Converters, Serial Server, Ethernet switches, and other accessories such as cables, connectors etc. required for the Substation automation systems shall be in the scope of the bidder.

b. Installation of communication equipment, communication establishment, cable supply, laying, and termination is in the scope of the bidder for the Substation automation system supplied at conventional substations to meet all the functional requirement specified in this RFP.

c. Supply, Laying and termination of communication cable for IEDs and Condition monitoring devices of auxiliary systems.

d. All Communication cable for intra panel wiring shall be armored cable.

e. All the MFM shall be looped to the RTU panel for communication with the proposed RTU. Looping from MFM to MFM shall be trough terminal blocks.

f. All unarmored cable used for intra panel wiring shall be laid through PVC coated steel flexible conduit.

g. CAT 6 SFTP cable shall be used for IED communication to Ethernet Switch.

h. IO box and Patch panel shall be used for termination of Armoured CAT 6 SFTP cable.

i. All Power supply and communication cabling is in scope of bidder.

j. Communication equipment's like Router cum Firewall, POE will be free issue by TPCODL and mounting is in scope of bidder. All dimensions of free issue items will be provided by TPCODL during detailed engineering.

1.8 **Integration**

a. All substation IEDs configuration and integration with RTU is in the scope of the bidder or system supplier. The successful bidder of the project will be solely responsible for integration of all IEDs of a different system.

b. The Offered/Proposed product shall comply to all open protocols such as IEC 61850, Serial Protocols, IEC 60870-5-104 etc. and compatible with all OEMs product. Any interoperability issues arising during commissioning and guarantee period, bidder shall undertake to resolve them within maximum one month period.

c. Configuration of the RTU and other Systems as per RFP shall be carried out by the Bidder followed by local testing, FAT and SAT.

d. During local testing (Pre-SAT) each Digital Input, Digital output and Analog Inputs shall be tested with the RTU, by simulating at switchgear end with satisfactory result. Each MFM data shall be verified with RTU after integration over Modbus protocol.

e. RTU configuration shall be tested complete in all respect so that integration testing shall be carried out smoothly without any technical issues during point to point testing with TPCODL SCADA Systems. However, the necessary configuration at the Control Centre end shall be taken care by the TPCODL.

1.9 **Safety**

a. Bidder to adhere the safety guidelines and policy of TPCODL. Bidder shall refer the Safety document attached with the bid document.

1.10 **Documentation, Backup**

a. The Documents shall be submitted as proposed. Master Document List (MDL) shall be prepared by Bidder and submitted for TPCODL approval.

b. Bidder shall provide all documentation in soft / hard form about licensing information for each software supplied (OS, application software, configuration, diagnostics, simulation & testing tools).

c. The offered system shall store the copy of the system configuration, user configurable database, tools and relevant software as a backup at TPCODL identified location for restoration under a disaster recovery plan.

d. The bidder shall provide complete engineering data, drawings, reports, manuals and services offered etc. i.e. complete set of documentation / drawings / architectures/ Inter-Operability Tables (IOTs) submission of Test Reports, job progress reports etc.

e. It is the responsibility of the Bidder to handover all project related drawings in AutoCAD formats only. The pdf version of above drawings / documents shall also be submitted for formal approval process.

f. Submission of technical documentation related to design, installation, testing, operation & maintenance of the equipment and submission of Test Reports, job progress reports etc. in hard copies (3 sets) and soft copies (3 sets, preferably in PDF).

g. Providing complete source code, including customization

1.11 **Training**

a. Training of TPCODL Personnel at site with all required training setup for each individual trainee.

1.12 **Mandatory & Recommended Spares**

a. Supply of recommended and mandatory spares for all supplied as mentioned in the RFP

Bidder shall refer the entire project specifications of the RFP to understand the execution methodology, supply, services and interface requirement for complete Scope of work of this project.

It is the bidder's responsibility to complete the installation and commissioning of the system as per the functional requirement mentioned in the RFP.

It is not the intent of this specification to specify completely herein, all details of design & construction of the proposed System. However, the bidder is encouraged to provide latest hardware and software technology used worldwide to meet the specified requirement and at the same time system shall conform in all respects to high standards of engineering, design & workmanship.

2.0 Terminal Points

2.1 **Bidder**

2.1.1 Engineering, Preparation of Architecture, Layout, ICS and other documents for the proposed Substation/s, activities covering all the functional requirement envisaged by the TPCODL and documented in the RFP.

2.1.2 Supply and Installation of Substation Automation System and other offered systems.

2.1.3 Integration of the field devices and hardware signals (IEDs, MFM & hardware signals) to proposed Substation Automation system. Supply of the required material including cables, erection, installation, cable laying & termination, database and logic development, FAT, pre-SAT testing, SAT and demonstration of the required performance is the sole responsibility of the bidder.

2.1.4 Integration with Control Centre SCADA Systems as specified in the specifications

2.1.5 Bidder shall depute adequate manpower, resources and material to complete the project as per the schedule mentioned in the RFP. If TPCODL feels that the adequate resources and material are not provided, reserves the right to ask the bidder to supply the required material and depute additional resources to complete the project in time.

2.1.6 There shall be only one point of contact for Purchaser L, i.e. the bidder who will be awarded the contract will be responsible for delivering the project solely. Any Sub-Contracting of any part of the work will be the responsibility of the lead Bidder as specified by Purchaser.

2.1.7 All application software, hardware, data, plans, drawings, specifications, designs, reports and other documents procured or developed by the selected Bidder in the execution of the contract shall remain the property of the TPCODL, right from the beginning of the contract, during the whole duration of the project and after the expiry or termination of the contract. TPCODL shall also remain the sole owner of the property (Hardware/software) in case the contract is terminated for any other reason. The source code/Application of the customized part of the application software in RTU will remain as exclusive property of TPCODL, even after the termination or expiry of the contract. The ownership shall also remain with TPCODL in case the selected Bidder fails to execute tasks to the satisfaction of the TPCODL.

2.1.8 Any deviation from this RFP / Technical Specification or as per the requirement of TPCODL, if noticed, may be brought forth in the Bid offer / pre-bid meeting / meeting before award of contract. Any such deviation, if informed thereafter bidder will supply Hardware and Software as per the site and functional requirement free of cost to the TPCODL. The decision of TPCODL will be final.

2.1.9 The selected bidder, after award of contract, will finalize the actual quantities to be deployed based on site survey, after approval from TPCODL, before initiating the purchase process of such items. All the hardware and software shall be procured and delivered after taking prior approval of TPCODL for each consignment. However, if any change in the quantity of the material, there should not be any additional cost to the TPCODL.

2.1.10 Engineering and technical assistance during the contract and extended warranty and maintenance period.

2.1.11 Provide calculation for power requirement for each cabinet and equipment

2.1.12 Bidder to submit all the purchase order placed on Sub-vendor to TPCODL for their review and records.

2.1.13 Maintaining backup of all RTU configuration for all substations and handover the same in duplicate to TPCODL.

2.1.14 Provide a Quality Assurance Plan and access to the manufacturing process.

2.1.15 The bidder shall provide all additional equipment and services required to ensure compatibility with TPCODL systems.

2.1.16 The bidder shall demonstrate a specified level of performance of the offered system during FAT and SAT.

2.1.17 Bidder shall submit the project plan with major mile stone prior to the start of the execution of the project

2.1.18 Bidder must agree for handing over, to Purchaser, all project related drawings in AutoCAD format as a part of as built drawings at the end of the project in addition to pdf. The pdf versions of above drawings shall be submitted for formal approval process during detailed engineering.

2.2 **Purchaser**

2.2.1 Will assist the bidder to provide the necessary work permits for working in operational area

2.2.2 Participation of TPCODL engineers during RTU Engineering & Configuration, however bidder shall be responsible for validation of this database.

2.2.3 Providing all the necessary data regarding the electrical network

2.2.4 Providing details of the existing systems for specified integration

2.2.5 Review and Approval of IP Schema for all the IEDs, RTU, in-line with existing System

2.2.6 Providing communication backbone for interconnection with existing systems

2.2.7 Review and approval of the Bidder's designs, drawings, and recommendations

2.2.8 Review and approval of test procedures

2.2.9 Participation in and approval of "Type", factory and site acceptance tests

2.2.10 Review and approval of training plans.

2.2.11 Coordination of the Bidder's activities with the TPCODL concerned departments

3.0 Instruction to Bidders

The Bidder, System OEM, Integrator shall be responsible jointly and severally for the design, supply, erection, commissioning & satisfactory performance of the supplied system and specified Post Warranty Maintenance, Activities and support. The bidder and their system expert shall vet the design and participate in the engineering, commissioning at site, Acceptance Tests & Training. The Bidder and its sub vendors shall have full facilities for design, Supply, erection, commissioning, system integration, factory and site acceptance test, satisfactory performance of supplied system and specified post warranty maintenance.

Bidder/Principal shall demonstrate required functionality and capability in TPCODL office during technical evaluation before bid submission

In case of agreement dishonored by any party (Bidder/ sub vendor/System integrator), during life of the delivered system, Bidder shall be responsible for providing the services to the TPCODL.

The Bidder/sub vendor/system integrator shall give an undertaking to provide full range of services (including hardware and software maintenance, modifications and upgrade support) for the life of the delivered Substation Automation System.

3.1 **Type Tests Reports**

The type tests specified in TPCODL 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. Type test reports should be issued by third party government accredited laboratory or internationally recognized laboratory like CPRI / ERDA / KEMA / International Accredited Lab.

3.2 **Technical Clarifications**

TPCODL do not entertain any deviation on the project specifications. The bidder should submit declaration on no deviation. However, if there are any deviations the Bidder should bring in notice of the TPCODL with proper documentations justifying the deviation. The TPCODL will take a call after going through the document and the decision of the TPCODL will be final. No explanation shall be provided to the Bidder for that. After scrutiny of qualifying criteria, technical commercial criteria offered by the bidder, clarifications will be sought from the bidders for any deviations with respect to the TPCODL specifications and attempt will be made to bring all bids on a common platform.

3.3 **Safety Considerations**

Safety related requirements as mentioned in our safety Manual. All Associates shall strictly abide by the guidelines provided in the safety manual at all relevant stages during the contract period. Bidder is advised to refer GCC attached for more information.

a. All the equipment shall be as per IEC / IS standards.

b. As the work has to be carried out in operational area, necessary work permit shall be prepared and approved from authorized persons.

c. While working on site, use of PPE (personal protective equipment) is mandatory.

d. Installation and commissioning of equipment, laying of cables activities shall be done by adequately trained persons with proper procedure including required outages of equipment/system.

e. Bidder shall furnish O & M manuals clearly bringing out safety aspects of equipment.

f. Bidder's all site persons have to go through Safety Training at TPCODL site

g. Bidder to depute Safety officer, to ensure the activities at site during installation and commissioning of the system are as per TPCODL safety policy and procedures.

h. The Bidder's safety officer shall work along with TPCODL Safety officer as per the policies and requirement stated in the Safety document.

4.0 Codes and Standards Applicable

The design, manufacture and performance of the RTU System shall comply with all the requirements of the latest editions of international codes and standards applicable. Nothing in this specification shall be construed to relieve the Bidder of this responsibility.

Emissions Standards		
1	EN55011 (CISPR 11)	ISM RF Equipment – Electromagnetic Disturbance Characteristics
2	60255-25	Electromagnetic emission tests for measuring & protection equipment
3	61000-3-2:2000	EMC-Limits for harmonic current Emissions.
4	61000-3-3:1994+2001	EMC Limits-Limitations in voltage changes, voltage fluctuations and flicker in public low-voltage supply systems.
Immunity Standards		
1	61000-4-2 1995-01 60255-22-2, IEEE C37.90.3	Electrostatic discharge (ESD) immunity test
2	61000-4-3 1998-11 60255-22-3, IEEE C37.90.2 (10V/m)	Radiated, radio-frequency electromagnetic field immunity test
3	61000-4-4 1995-01 60255-22-4, IEEE C37.90.1	Electrical fast transient/burst immunity test
4	61000-4-5 1995-02	Surge immunity test
5	61000-4-6 1996-03	Immunity to conducted disturbances, induced by radio-frequency fields
6	60255-22-6	Electrical fast transient/burst immunity test
7	61000-4-81993-06	Immunity to power frequency magnetic fields
8	61000-4-12	Oscillatory waves immunity test

9	1995-05 60255-22-1 IEEE C37.90.1	Damped Oscillatory and Ring wave
Safety		
1	61010-1	Harmonized Safety Standard
2	60255-5 2000-12	Insulation coordination for measuring relays and protection equipment-Requirements and tests
Power Supply Standards		
1	61000-4-11 1994-06	AC Power supply interruptions
2	61000-4-16 1998-01	Immunity to conducted, common mode disturbances.
3	61000-4-17	Ripple on DC power supply
4	61000-4-29+ 2000-08 60255-11	Voltage dips, short interruptions & voltage variations on DC input power port immunity test
Environmental Standards		
1	60068-2-1 1994-05	Environmental Testing Cold
2	600068-2-2 1974	Environmental Testing Dry Heat
3	60068-2-6 1995-03 60255-21-1	Environmental Testing Vibration tests (sinusoidal)
4	60068-2-27 1987	Environmental Testing Shock
5	60068-2-29 1987	Environmental Testing Bump
6	60068-2-30 1980	Environmental Damp Heat cyclic (12+12 hour cycle)
7	60068-2-31 1969	Environmental Testing Drop and Topple
8	60255-21-2	Shock and bump tests
9	IEC 61850-3	Substation Environment Requirement
Communication Standards		
1	IEC 61850-5 to 10 IEEE 802.3 CSMA/CD	Substation Comm. Standard access method and physical layer specifications
Other Applicable Standards		
1	IS 9000	Basic Environmental testing procedure for electrical and electronic items
2	IS 694-1990	PVC insulated cables for working voltage up to and including 1100V
3	IS 2629-1985	Recommended practice for Hot Dip Galvanizing of iron & Steel.
4	IS 2633-1986	Test for uniformity of Zinc Coating
5	IEC 60529	Degrees of Protection provided by enclosures (IP Code)
6	IEC 62052-11	Electricity metering equipment (AC) – General requirements, tests & test conditions
7	IEC 62053-22	Static meter for active energy (Class 0.2S and 0.5S)

Product Conformance as per GoI Letter No. 12/34/2020-T&R dated 8th June 2021, Ministry's Order No. 25-17/6/2018-PG dated 2nd July 2020	
• **IEC 60870-5-101 & IEC 60870-5-104, Security Conformance** • **IEC 62351-100-1:** ***Clause 5, Clause 6, Clause 7, Clause 8*** • **IEC 62351-100-3:** ***Clause 5, Clause 6, Clause 7*** (IEC 62351-3:2014 / AMDI: 2018, Clause 7), • **IEC TS 62351-5/IEC TS 60870-5-7**	IEC 60870-5-7 Telecontrol equipment and Systems – Part 5-7; Transmission protocols – Security extensions to IEC 60870-5-101 and IEC 60870-5-104 protocol (Applying IEC 62351) IEC 60870-5-7 Security extension & IEC 62351 series (IEC 62351-100 parts 1 & 3) and other cross-referenced standards. IEC 61850 – 5, 6, 7, 8, 9, 10 Certificate of Common Criteria as per ISO/IEC 15408

Wherever, new standards & revisions are issued during the period of the contract, the Bidder shall attempt to comply with such standards, with no financial implication to TPCODL.

In the event of the bidder offers to supply material and/or equipment in compliance to any standard other than those listed herein, the bidder shall include with their proposal, full salient characteristics of the new standard for comparison.

4.1 **Bidder's Project Experience**

4.1.1 The offered product shall comply with all open protocols used in electrical substation application such as IEC60870-5-xxx, IEC61850 (ED1, ED2), Modbus, DNP 3.0 etc. and compatible with all other OEMs product. Any interoperability issues arising during commissioning and during guarantee period, bidder shall undertake to resolve them within maximum 1 months' period without any additional cost to the TPCODL.

4.1.2 Product shall confirm to Cyber Security norms from product development, design and engineering for Power Utility, compliance to industry standard NERC-CIP, IEC62443, NIST and IEC62351, ISO 27001 and NCIIPC guidelines. Bidder to ensure that all the product own and sub-vendor product offered are tested at CPRI Lab for cyber security as per the Guidelines of MoP Order No.25-L7 /6/2O18-PG dated 2nd July, 2020. All the Cyber Security measures shall address Operational Technology requirement. Bidder shall ensure the proposed architecture at Substation are certified by Cyber Security auditor for the compliance as per Industry standards. Bidder to demonstrate all the cyber security measures considered and implemented during FAT and SAT.

4.1.3 Bidder shall agree to comply with minimum quality requirements and Contractor Safety Code of Conduct, defined in bid documents.

4.1.4 Bidder must agree for handing over, to TPCODL, all project related drawings in AutoCAD format only. The pdf drawings shall be submitted for formal approval process.

4.1.5 Bidder shall submit the acceptance of TPCODL's preferred list of Vendor / Sub Vendor / OEM, which is shared as part of Technical Specifications and the same shall be acceptable to the bidder. ***(Refer Section C Annexure 4 Preferred/Approved make of Equipment/System).***

4.1.6 Bidder shall confirm the equipment and Spare Support and Availability for the period of 15 years. Bidder shall submit each equipment product life cycle details along with the technical proposal (for Own and Sub Vendor Equipment).

4.2 **Bid Evaluation Criteria**

4.2.1 The Bids will be evaluated technically (in terms of quality, technical merit, functional characteristics, schedule, after-sales service, local support in India and technical back-up).

4.2.2 The technical merits and quality and functional characteristics of the offered equipment and work will be evaluated in terms of its ability to meet specific technical requirements included in the Contract Documents. The Bidder shall therefore be prepared to submit at the request of TPCODL adequate information or Work meets the intent of the technical requirements.

4.2.3 TPCODL shall be fully entitled to adopt whatever means it deem fit to evaluate the bids at its sole discretion, which shall not be questioned by the bidder under any circumstances whatsoever.

5.0 Submissions by Bidders

5.1 **Mandatory Documents required along with the Bid**

Bidders are requested to submit their offer in line with this bid document. TPCODL shall respond to the clarification raised by various bidders and the replies will be sent to all participating bidders through ARIBA.

Technical bid shall be properly indexed and to be submitted in Soft and three nos. Hard Copy.

5.2 **Departure from Specifications**

Bidder shall necessarily submit a signed and stamped copy of this BID (in original) as a token of acceptance of all the terms and conditions of this BID. Replication of this BID on bidders' document shall not be acceptable. Normally no deviation is accepted to BID document supplied with the bid & bid with deviation is liable to be rejected. However, in case of any deviations to this BID, all such deviations shall be furnished by the bidders

5.3 **Right of Acceptance / Rejection of Technical Proposal**

Bids would be rejected in absence of following documents:

a. Complete technical details are not enclosed

b. Proposed Architecture not submitted

c. The offer does not contain un-priced detailed Bill of Material as per the proposed architecture and in-line with Indicative BoM attached with RFP

d. False Information / Details

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

5.3.1 **Bidder's Responsibilities**

The Bidder's specific responsibilities shall include:

a. Providing all RTU and other systems equipment and related support materials, including all interconnecting cables and wiring between all Bidder-provided equipment and between the RTU and any equipment furnished by TPCODL

b. Defining the stock of spare parts needed to maintain for system availability

c. Providing all engineering, software design, development, and integration services necessary for RTU and Other Systems implementation

d. Ensuring that all reasonable security measures have been incorporated in the RTU and Other Systems upon delivery, is free of viruses, trapdoors, and other software contaminants, contains no software enabled with "electronic self-help", is purged of all sample scripts and sample code, and has had all default accounts and passwords removed or disabled

e. Managing, coordinating, and scheduling the activities of all Sub-vendors employed by the Bidder for this project. This shall include the resolution of all problems that may arise in connection with the hardware, software, and services supplied by the Sub-vendors.

f. Implementing the RTU and Other Systems according to the quality standards acceptable to TPCODL

g. Training TPCODL staff so that they will be self-sufficient and able to operate, maintain, and upgrade the complete RTU and Other Systems

h. Supplying RTU and Other Systems documentation such as instruction manuals, maintenance manuals, drawings, software design and user documentation, and other appropriate material that together fully defines the supplied system and allows TPCODL to operate, maintain, backup, restore, and upgrade the RTU and Other Systems hardware and software

i. Supplying final ("as built") documentation that is accurate and complete.

j. Providing adequate facilities and resources for, as well as performing, factory testing

k. Providing an environment that allows for reproducible execution of all RTU and Other Systems functional performance tests conducted during factory acceptance testing

l. Performing, with TPCODL assistance, system start-up after satisfactory system installation, i.e. powering up the system, loading correct versions of all software and databases, activating data

links, verifying correct operation of the system, and turning over to TPCODL an operational system ready for site testing

m. Performing after delivery and start-up of the system, but prior to any site testing, setting up all functions for proper operation (system and function "tuning")

n. Performing the test at TPCODL site, including correcting all reported variances

o. Maintaining the RTU and Other Systems up to the start of the warranty

p. Providing and implementing all required warranty services

5.3.2 **TPCODL Responsibilities**

TPCODL will be responsible for the following:

a. Reviewing and approving project deliverables such as, but not limited to, detailed implementation schedule, software and hardware functional design documents, user manuals, drawings, progress reports, training program, quality assurance plan, test plans and procedures, test results, support services (including maintenance), and as-built system documents

b. Coordinating and supervising the Bidder's work to be performed at TPCODL facilities

c. Attending pre-factory tests (at TPCODL discretion)

d. Participating in factory tests and approving test results

e. Assist the Bidder with the installation

f. Monitoring the site tests and approving test results

g. Monitoring the availability test and approving test results

h. Preparing variance reports, resolving variance issues, and approving corrected variances

i. Determining if the Bidder's work is progressing in accordance with the schedule

j. Verification of all Bidder materials, installation practices, and workmanship conform to requirements

6.0 Quality Requirements, Inspection, Installation, Commissioning and Testing

6.1 Quality Assurance

Quality of service - Bidder must provide details of their proposed approach to quality assurance to ensure the quality of services in accordance with RFP Document. This should include:

a. Responsibility of quality of service;

b. How the bidder will ensure quality service is provided;

c. How quality will be measured

d. Bidder shall submit their quality certification / Assessment document. Bidder shall provide the following information along with the documents.

Description	Bidder's Response
Certification / Assessment Name	
Who issued the Certification / Assessment?	
When was the Certification / Assessment obtained?	
Does this Certification / Assessment process involve periodic reviews and observations / remarks after such review? If so, please provide details and specify when your company is due for its next quality review?	

Table: Details of Certification

All materials and parts of the Bidder's own and Sub-Vendors System / Sub-System to be supplied under this project shall be current, in line with industry standard.

6.1.1 **Quality Assurance and Testing**

To ensure that the Bidder produces a well-engineered and contractually compliant RTU and Other Systems, a quality assurance program shall be followed and both structured and unstructured tests shall be performed.

6.1.2 **Quality Assurance Program**

The Bidder must employ documented Quality Assurance (QA) techniques and practices throughout this project. This QA program shall be adhered to for the preparation of all Contract deliverables, including documentation, hardware, firmware and software. The program shall provide for the minimization of defects, the early detection of actual or potential deficiencies, timely and effective corrective action, and a method to track all such deficiencies.

6.2 Inspection

TPCODL shall be allowed access to the Bidder's facilities during system design, manufacturing and testing and to any facility where hardware or software is being produced. The Bidder shall provide office facilities, equipment, and documentation necessary to complete all inspections and to verify that the Substation Automation and Other Systems is being fabricated and maintained in accordance with the Specification to TPCODL representatives.

TPCODL shall be allowed to review and verify the functional implementation of RTU and Other Systems software informally in conjunction with scheduled project meetings at the Bidder's facilities. No test plans, procedures, or reports are required to support these informal software demonstrations.

TPCODL shall be allowed to inspect the Bidder's hardware and software quality assurance standards, procedures, and records. Documents identified in the approved product quality

assurance plan will be inspected to verify that the Bidder has performed the required quality assurance activities.

The inspection rights described above shall not apply to sub-bidders supplying standard computer or peripheral equipment and third-party software products. However, inspection rights shall apply to Sub-Vendors that are developing new software, offering solutions for inclusion in the RTU and Other Systems.

6.3 Commissioning

6.3.1 Installation

Installation of the complete system is under Bidder's scope. Installation work shall be scheduled and carried out in coordination with TPCODL representatives. All related drawings, installation manuals and recommended practices shall be submitted in advance for TPCODL approval. Installation shall be certified by the Principal's representative.

6.3.2 Cabling Scope (Supply, Laying, Installation and Termination)

The following shall be in the bidder's scope

a. All cables to and from any equipment supplied by Bidder

b. All cables shall be tagged appropriately, cross ferruling shall be used for identification of the Cable, Inter/Intra Panel wiring.

c. All cables from Power Supply Distribution Board to any equipment supplied by the Bidder.

d. Earthing interface to earth pit based on the earthing scheme provided by the Bidder (It shall be completely Bidder's responsibility to ensure proper earthing).

e. The above includes all electrical and communication cables (if any) and all associated terminals, Connectors, tools, distribution board, MCBs and other accessories.

6.3.3 Commissioning Activities

a. The commissioning of the system (hardware and software) including SAT and one Month Trouble free operation shall be the responsibility of Bidder.

b. Adequate number of qualified engineers (Hardware & Software) as approved by TPCODL shall be posted at site during the entire period of installation & commissioning for Substation automation.

c. Daily site work shall be planned and executed as per due approvals from TPCODL representative.

d. Bidder shall submit detailed site organization chart of Personnel for TPCODL approval. TPCODL reserve the right to review the same. Bidder's commissioning engineers shall also train TPCODL engineers during commissioning apart from scheduled Training.

e. The responsibility for Installation, Commissioning, Performance guarantee and warranty shall remain with the Bidder.

f. The Bidder shall furnish procedures, protocols for commissioning and acceptance test activities.

g. All tools (both hardware and software), test instruments, simulation jigs, documents, programming equipment etc. required for Installation, Testing & Commissioning are in the scope of bidder.

h. All passwords, access keys etc. are the property of the TPCODL and shall be handed over to the TPCODL.

i. All interoperability tables for interfacing to other systems shall be supplied.

j. Principal's qualified representatives including specialists shall participate at site for supervision, & certification of commissioning and Acceptance tests.

The Bidder shall comply and adhere to the safety policy of the TPCODL. Hence necessary safety apparels shall be arranged by the Bidder for their personnel. Also, it is the responsibility of the Bidder to ensure compliance to all statutory requirements of their workmen. All workmen engaged at TPCODL site should have necessary ESIC & PF registration.

6.4 Testing

6.4.1 Test Responsibilities

Both TPCODL and Bidder shall designate test coordinator, prior to the start of the factory test, each coordinator shall be responsible for insuring that the tests are conducted in accordance with the requirements of this Contract. The coordinators shall each have the authority to make binding commitments for their TPCODL such as approvals of test results and scheduling for variance corrections or, as a minimum, to cause such commitments to be expeditiously made.

Unless otherwise stated in this Specification, the Bidder shall be responsible for all factory tests. This responsibility shall include the conduct of the tests and all record keeping and document production. Bidder will support the factory testing by supplying staff to execute the test procedures under the TPCODL supervision.

6.4.2 Test Documents

Test plans, procedures, and records shall be provided by the Bidder for all tests to ensure that each test is comprehensive and verifies the proper performance of the RTU and Other Systems elements under test. During the development of test plans and test procedures, emphasis shall be placed on testing each conditional logic statement, checking error conditions, and documenting the simulation techniques used. The test plans and test procedures shall be modular to allow individual test segments to be repeated as necessary.

All test plans and test procedures (standard, modified standard, and custom functions) shall be submitted to TPCODL for approval and shall be subject to the approval process as defined in ***Document Review and Approval.***

6.4.3 **Test Plans**

The test plans shall describe the overall test process, including the responsibilities of individuals and the documentation of the test results. The following shall be included in the test plans:

a. The schedule for the test

b. The responsibilities of Bidder and TPCODL personnel, including record-keeping assignments

c. Any forms to be completed as part of the tests and the instructions for completing the forms

d. Procedures for monitoring, correcting, and testing variances

e. Procedures for controlling and documenting all changes made to the hardware and software after the start of testing

f. Block diagrams of the hardware test configuration, including the Bidder- and TPCODL-supplied RTUs, external communication channels, and any test or simulation hardware.

Test plans shall be provided for the Factory Acceptance Test, Site Acceptance Test, and Availability Test.

6.4.4 **Test Procedures**

The test procedures shall describe the methods and processes to be followed in testing the RTU and Other Systems. The test procedures shall be modularized, such that individual functions of the RTU and Other Systems can be independently tested and so that the testing proceeds in a logical manner. This section uses the term segment to refer to a higher-level part of a test procedure and the term step to refer to the most detailed level of test instruction.

The test procedures shall include the following items:

a. The name of the function to be tested

b. References to the functional, design, user, and any other documents describing the function

c. A list of test segments to be performed and a description of the purpose of each test segment

d. The set-up and conditions for each segment, including descriptions of the test equipment and data to be supplied by the Bidder and by TPCODL.

e. Descriptions of the techniques and scenarios to be used to simulate system field inputs and controlled equipment

f. Descriptions, listings, and instructions for all test software tools and displays

g. Step-by-step descriptions of each test segment, including the inputs and user actions for each test step

h. Forms for the recording of test results

i. The expected results for each segment, including pass/fail criteria

j. Copies of any certified test data to be used in lieu of testing, if approved by TPCODL.

The Bidder shall note that TPCODL will not accept any certified test data in lieu of testing except where specifically stated in the Contract.

6.4.5 **Test Records**

Complete records of all tests result shall be maintained. The records shall be keyed to the test procedures. The following items shall be included in the test records:

a. Reference to the appropriate test procedure

b. Date of the test

c. Description of any test conditions, input date, or user actions differing from that described in the test procedure

d. Test results for each test segment including a passed/failed indication. All information recorded during the test such as measurements, calculations, or times shall be included in the results.

e. Identification of the Bidder's and TPCODL representatives performing and witnessing the test

f. Provision for comments by TPCODL representatives

g. References to all variance reports generated

h. Copies of reports, display copies, and any other hardcopy generated as part of the test.

6.4.6 **Variance Recording and Resolution**

A variance tracking system shall be placed in service no later than one month before the start of Pre-FAT and shall remain in use through the completion of the warranty. Both the Bidder and TPCODL may initiate variances at any time. Variances may be used to record system deficiencies at any time, even if the system is not undergoing testing. This variance tracking system shall record and track variances for:

a. Documentation deficiencies

b. Functional deficiencies

c. Performance deficiencies

d. Procedural deficiencies (as when deviations from contractually required QA procedures are observed)

e. Test deficiencies (as when the system cannot satisfactorily complete a test procedure due to a problem with the test).

The variance recording and tracking system shall produce reports of all variance information and shall produce subsets of the variances based on searches of the variance parameters singly and in combination. Variance reports shall always be available to TPCODL. The Bidder shall periodically distribute a variance summary that lists for each variance the report number, a brief overview of the variance, its category, and its priority.

6.4.7 **Variance Records**

The record of each variance shall include the following information:

a. The date of the initial discovery of the variance

b. A variance number – a sequential number assigned when the variance is entered into the tracking system

c. An identification of the person submitting the variance and the names of any other witnesses or knowledgeable TPCODL or Bidder staff

d. An identification of the RTU and Other Systems component, such as a hardware item or software function, against which the variance is being written

e. An identification of the test plan or procedure, if applicable. The stage or step of the plan or procedure shall be identified

f. An overview of the variance suitable for use in keyword searches

g. A detailed description of the variance

h. A variance category:

i. Open (recorded but not scheduled for further action)

ii. Assigned (scheduled for further action)

iii. Pending (the variance has been resolved but not tested)

iv. Closed (TPCODL has accepted the resolution)

i. The date of assignment into each category

j. A variance priority:

Critical To be used only if the RTU and Other Systems is in commercial use, this priority identifies a problem that prevents the use of a system features that is essential to TPCODL operation of the power system

High Denotes the failure of the RTU and Other Systems to perform a required feature in a manner that significantly reduces the utility of the systems or feature or which delays further testing of the systems or features

Normal Denotes the failure of the RTU and Other Systems to perform a required feature in a manner that reduces the utility of the systems or features. Normal priority variances shall not delay any testing

Low Denotes the failure of the RTU and Other Systems to perform a required feature in a manner that reduces the utility of the systems only slightly. Low priority variances shall not delay any testing. Variances that record transient failures, which cannot be readily

reproduced, shall be initially assigned to this priority. Subsequent occurrences of the transient failure shall result in raising the priority of the variance.

A description of the resolution, including identification of all hardware, software, and documents modified or otherwise changed and the names of the Bidder or TPCODL staff involved with the resolution

k. A record of all testing performed

l. Identification of TPCODL staff accepting the resolution and the date of acceptance.

6.4.8 **Schedule for Variance Correction**

The Bidder and TPCODL shall meet periodically to review the variance list. Each new variance opened since the previous meeting shall be scheduled for correction at the meeting. TPCODL and Bidder shall follow these guidelines for scheduling corrections:

a. A schedule for the correction of critical and high priority variances shall be set within one working day of their discovery. The schedule for correction of all other variances shall be set within one working week of their addition.

b. TPCODL and the Bidder shall assign resources for the correction of critical variances with the intent of correcting the variance within two working days of their opening.

c. TPCODL and the Bidder shall establish a mutually agreeable date for the correction of high priority variances, with the overall objective of:

i. If the RTU and Other Systems is in productive use, correcting the variances within one calendar week of their discovery

ii. Prior to the commencement of productive use, maintaining the overall project schedule

d. TPCODL and the Bidder shall establish a mutually agreeable date for the correction of normal priority variances, with the overall objective of:

i. If the RTU and Other Systems is in productive use, correcting the variances within one calendar month of their discovery

ii. Prior to the commencement of productive use, maintaining the overall project schedule

e. Low priority variances may be scheduled for correction at any time and shall not exceed 30 days after identification.

6.4.9 **Variance Resolution**

A variance shall be deemed resolved only upon written acceptance of the correction by TPCODL. Prior to submitting the corrected variance for acceptance by TPCODL, the Bidder shall take all reasonable steps to verify that the correction has resolved the variance and the Bidder shall update the variance record to reflect the corrective action taken. TPCODL shall then schedule any testing to be performed in conjunction with the Bidder.

A variance shall be deemed accepted and the variance record shall be completed only after TPCODL has tested the corrected variance to its satisfaction. The Bidder shall support all testing deemed necessary by TPCODL to verify the corrections.

6.4.10 **Test Schedule**

The sequence of tests to be performed and their scheduling with respect to other activities shall be mutually decided.

6.4.11 **Test Initiation**

The following conditions must be satisfied before starting any test:

a. TPCODL has approved all plans and procedures for the test

b. TPCODL has reviewed or approved all relevant documentation

c. A copy of all relevant documentation including design and maintenance documents, user manuals, test plans, and test procedures has been placed on the test floor

d. A complete regeneration of the software under test has been performed immediately prior to the start of testing

e. All operating system parameters, files, and configuration information has been saved to archive media so that the RTU and Other Systems operating environment can be recreated

f. All database, display, and report definitions have been saved to archive media so that the System databases, displays, and reports can be recreated if necessary

g. All source code libraries have been saved to archive media so that RTU and Other Systems software can be regenerated if necessary

h. For the factory test, preliminary testing, as described in ***Item-7.4.15 Preliminary Factory Testing*** has been completed and the Bidder has submitted written certification that the preliminary testing has been successfully completed

For the availability test, all critical, high, and normal variances have been corrected and verified to the satisfaction of TPCODL

6.4.12 **Test Completion**

A test shall be deemed to be successfully completed only when:

a. All variances have been resolved to the satisfaction of TPCODL

b. All test records have been transmitted to TPCODL

c. TPCODL acknowledges, in writing, successful completion of the test.

6.4.13 **Test Suspension**

If TPCODL believes, at any time, that the quantity or severity of RTU and Other Systems variances warrants suspension of any or all testing, the test shall be halted, remedial work shall be

performed, and the test shall be repeated. The repeat of the test shall be scheduled for a date and time agreed upon by both the Bidder and TPCODL.

6.4.14 **Modifications to the RTU and Other Systems during Testing**

No changes shall be made to the RTU after factory testing has started without the express authorization of TPCODL. It will be TPCODL intent to carefully control the test environment so that all changes can be readily identified and so that any changes installed for any purpose can be removed and the previous test environment restored. TPCODL shall have the right to suspend testing, to revert to a previous version of any software or hardware, and to restart any testing previously performed if, in its opinion, changes have been made to the system under test without authorization.

6.4.15 **Preliminary Factory Testing**

The Pre-FAT shall be a complete dry run of the FAT, following the test plans and procedures. The intent is for the Bidder to detect and correct most design, integration, database, display, and performance problems prior to the FAT. The Bidder's project manager shall sign off each test. The completed test results shall be sent to TPCODL for inspection before TPCODL personnel travel to the Bidder's facilities for the FAT. All tests shall be conducted using TPCODL-specific databases unless TPCODL authorizes the Bidder to use a test database.

The Bidder shall notify TPCODL at least fifteen days prior to the start of the Pre-FAT, and TPCODL shall have the option to witness all or parts of it. The Bidder shall notify TPCODL when the Pre-FAT has been successfully completed and the RTU and Other Systems is ready for FAT.

6.4.16 **Factory Acceptance Test (FAT)**

Factory tests shall include:

a. Equipment test
b. Functional test
c. Performance test
d. Stability test
e. Unstructured test

a. **Equipment Test**

The equipment test shall verify that the RTU and Other Systems includes all required equipment, that the equipment is properly configured, and that the equipment can successfully execute the diagnostic programs provided.

The equipment tests shall include a visual inspection for proper workmanship, including cables, connectors, and labeling. The assembly drawings and configuration drawings shall also be verified

at this time. These tests shall also verify that the required RTU and Other Systems capacity performance and expansion requirements as specified in this specification have been satisfied.

b. **Functional Test**

The functional test shall use an equipment configuration that may include an extension of the Bidder's deliverables as required to prove the correct functionality of the RTU and Other Systems. The test procedures shall consider all additional test equipment and shall ensure that the additional equipment does not create false test results. The functional tests shall rigorously exercise all functions and devices, both individually and collectively, and shall verify the correct functional operation of all hardware and software. These tests shall include the following, as may be applicable to the system under test:

a. Verification of all required functionality of the system, such as RTU and Other Systems, applications, data exchange, and information storage and retrieval. Verification shall include all standard and custom functions as well as purchased options.

b. Verification that all software has been correctly sized and meets TPCODL capacity requirements

c. Verification of proper acquisition, processing, and storage of data from appropriate sources, and verification of protocol and data exchanges with all external systems that will interface with the system. Where necessary, the Bidder shall provide appropriate simulations of the external systems; such simulations must themselves be verified before being used.

d. Verification of all user interface functions

e. Verification of the application program and system development capabilities including, software configuration management, source code development, documentation management, user interface development, real-time data set development, database generation and maintenance, report generation and modification, alarm and event message definition, test environments, and other utility functions

f. Verification of communications maintenance capabilities including diagnostics, communications maintenance (RTU, data links, interfaces etc.), and local input/output maintenance.

g. Verification of all hardware maintenance capabilities.

h. Verification of the proper response of the system to at least the following abnormal situations:

i. Loss and restoration of processors and servers, including auxiliary memory

ii. Loss and restoration of user interface equipment

iii. Loss and restoration of archive storage devices

iv. Loss and restoration of external subsystems

v. Loss and restoration of input power

vi. Loss and restoration of communication network processors

vii. Loss and restoration of any other peripheral devices

viii. Loss and restoration of local and wide area network elements

ix. Detection of and recovery from communication errors

i. Demonstration of the security of the system from unauthorized access

j. Verification of the redundancy and failure recovery schemes of the system

k. Verification that changes of system time will not prevent the system from operating properly and that the system can correctly handle the beginning of a new day, month and year; leap years and the change in century and decade.

l. Documentation verification that will verify that all documentation to be delivered with the system is present and meets requirements.

c. **Performance Test**

The performance test shall verify that the specified performance requirements are met. Simulation shall be provided by the Bidder, where necessary, to create the conditions for the specified performance scenarios. The simulations shall be tested first to verify that the desired activity is being simulated. Execution of the performance tests shall be automated as much as possible so that test runs can be reproduced.

d. **Stability Test**

A 100-hour continuous run of the system shall be performed after successful completion of the functional and performance tests. The stability test will be considered successful if no critical function is lost, no major hardware failure occurs, no failover occurs, and no restarts occur within the test period.

Major hardware failure is defined for the purpose of this test as the loss of hardware such as a processor, Power Supply, Communication port, I/O cards etc.

During this test, the system shall be exercised (with simulated inputs, events, and conditions) in a manner that approximates an operational environment. TPCODL will simulate unstructured user activity during this test. TPCODL will not purposely cause any hardware or software failure, that is, failover and restart testing is not a goal of this test.

The Bidder shall assist TPCODL in this test as required by TPCODL; this assistance will be primarily in the form of helping the set-up of the test, explaining the best procedures to run the test, and explaining all unexpected results.

e. **Unstructured Test**

The test schedule shall allow time throughout the functional testing for unstructured testing by TPCODL. Time for unstructured testing shall be reserved at the rate of at least two hours of unstructured testing for each eight hours of structured testing, but no less than two days total. This time will be used by TPCODL to perform additional tests, the need for which may be recovered

during the formal testing, and to investigate any potential problems detected. The unstructured tests will be performed during the functional and performance test period and during the stability test at the discretion of TPCODL.

The Bidder shall assist TPCODL in this test as required by TPCODL; this assistance will be primarily in the form of helping the set-up of the test, explaining the best procedures to run the test, and explaining all unexpected results.

6.4.17 **Site Acceptance Test (SAT)**

The site test includes the installation test, the functional test, and the performance test as specified in the factory test that will be conducted at TPCODL site after shipment and installation of the RTU and Other Systems.

SAT shall cover all equipment and functions as specified for the complete system (all hardware & software) and connectivity with TPCODL system. As such SAT shall cover all the tests listed in FAT along with site-specific tests including interconnections with field equipment and other systems. Apart from testing and commissioning, SAT shall include one month of continuous trouble-free operation of the complete system without major intervention. In case of interruptions, one month trial shall be restarted after attending to the problem.

i. IEDs used for protection, control, etc.; the inter-bay bus (and associated communications hardware/software), the station bus (and associated communications hardware/software), the time synchronization system and the local/station HMI (if any) are to be considered as SAS components, and shall undergo commissioning requirements as part of the SAT.

ii. Vendor shall furnish, advance SAT protocols and list of vendor's instruments for site testing. Tests shall include demonstration of loading & expandability of the system.

iii. SAT shall be performed after the system has been installed, the final software has been loaded in each subsystem, all I/Os and functionality checked, system has been running and all commissioning checks have been completed successfully.

iv. Unstructured tests shall be employed as necessary, to verify overall system operation under field conditions.

6.4.18 **Installation Test**

The installation tests shall be conducted by the Bidder and include:

a. A repetition of the equipment test

b. Loading of configuration of the RTU and Other Systems software and starting the system. At the option of TPCODL, configuration shall be recompiled, if required.

c. In cooperation with TPCODL, establishment of the communication with all data sources and other systems that interface with the Systems

d. Initialization and preliminary tuning of application software as needed.

6.4.19 **Functional and Performance Tests**

The site functional and performance tests shall be comprised of a subset of the functional and performance test. The tests to be performed shall be proposed by the Bidder and approved by TPCODL. These tests shall be extended as necessary to test functions simulated during the FAT, such as communications with all field devices and all other systems that interface with the RTU and Other Systems. The extended tests shall be performed to a test procedure prepared by the Bidder and approved by TPCODL. Unstructured tests shall also be employed, as necessary, to verify overall operation of the systems under actual field conditions.

6.4.20 **Availability Test**

RTU and Other Systems and device availability in accordance with the criteria specified in the specification, System Availability shall be demonstrated by the availability test.

Predicted availability of equipment supplied shall exceed the following:

System Function	System Availability
Control and Monitoring of any one equipment (Breaker, Isolator etc.)	99.99%
Monitoring of Any One Single Alarm	99.99%
Monitoring of Any One Analog Input	99.99%

6.4.21 **Test Activity**

The test activity shall consist of normal RTU and Other Systems in use. TPCODL will modify the configuration during the availability test. Such modifications will be described to the Bidder at least 48 hours in advance of implementation to allow assessment of impact on the availability test, except where such changes are necessary to maintain control of the power system.

6.4.22 **Test Definitions**

The definitions of the time periods used in determining the duration of the test and the success of the test shall be as follows:

Downtime – Downtime occurs whenever the criteria for successful operation defined in specification, Availability Requirements – RTU and Other Systems, are not satisfied. Downtime shall be measured from the start of diagnostic procedures until full service is restored. In the event of multiple failures, the total elapsed time for repair of all problems (regardless of the number of maintenance personnel available) shall be counted as downtime.

Hold time – Certain periods of time during which the RTU and Other Systems is down may be due to circumstances that are beyond the control of either party. These contingencies may prevent successful operation of the systems but are not valid for the purpose of measuring systems availability. Such periods of unsuccessful operation may be declared hold time by mutual agreement of TPCODL and the Bidder. Specific instances of hold time are:

Scheduled shutdown – During scheduled shutdowns or if an equipment failure occurs due to scheduled maintenance, the resulting system outage shall be hold time, provided that service can be restored according to the Bidder-specified procedures within 30 minutes.

Power Interruption & environmental excursion – Loss of power or manual shutdown of the RTU and Other Systems in the event of power excursion or the loss of environmental control shall be considered hold time. If the systems are operated during periods of power or environmental conditions beyond those specified, any resultant downtime shall be considered hold time.

Intermittent failure – Periods during which an intermittent, recurring failure is experienced will be considered hold time, provided that the Bidder is engaged in remedial action and normal operation of the RTU and Other Systems can be restored within 30 minutes by Bidder-defined procedures whenever the failure occurs. Instead of accounting for the actual intermittent downtime, one hour of downtime shall be counted for each 120 hours of otherwise successful operation while the problem persists.

Failure of TPCODL software –Time during which the RTU and Other Systems software is upgraded shall be considered hold time. Of course, Systems can be restored within 30 minutes by Bidder-defined procedures.

Corrected design defect – Hold time may be declared by mutual agreement to ensure against similar future occurrences if a failure occurs due to a defect in design for which the Bidder defines and implements corrective measures. In such a case, enough hold time shall be allocated to allow verification of the corrective action.

Logistics delays – If repairs are delayed due to previous use of spare parts or because of TPCODL failure to purchase recommended spare parts, hold time will be declared after diagnosis of the failure and while the Bidder is pursuing

replacement parts in an expeditious fashion. A maximum of 48 hours of hold time will allowed for each occurrence of logistics delay.

Service response time – Hold time shall be declared from the time that a failure is detected until diagnostic procedures are begun. A maximum 24 hours of hold time will be allowed for each failure.

Total time – The time elapsed from the start of the availability test until the end of the availability test

Test time – The time elapsed from the start of the availability test until the end of the availability test, excluding hold time. That is,

Test time = Total Time – Hold time

6.4.23 **Duration and Criteria for Passing**

In order to establish that all failures have been satisfactorily repaired prior to the end of the availability test, no downtime, intermittent (hold time) failures, or more than one uncommented failover shall have occurred within 200 hours of the test's conclusion. The test shall be extended, if necessary, to satisfy this requirement.

After successful completion of site acceptance test and 72 hours have passed, system availability shall be computed using the following formula:

System Availability = [(Test time – Down Time) / Test time] X 100%

If the system availability requirements presented in the specification, System Availability, have not been met, the test shall continue until the specified availability is achieved. Alternatively, and at TPCODL discretion, the test may be restarted.

When it has been determined that the system availability requirement has been met, the availability of each System device shall be calculated and compared against the device availability requirements as specified, Availability Requirements – RTU and Other Systems. If one or more devices do not meet the requirements, the test shall be extended until TPCODL and the Bidder mutually agree that corrective action has been completed for those devices. Corrective action shall include all necessary procedures to test and verify proper operation to TPCODL satisfaction.

7.0 System Capacity, Performance and Demonstration

Proposed System shall meet performance standards required to maintain real-time monitoring and control of the network. Performance shall be evaluated according to the amount of time and controller resources required for accomplishing a variety of tasks. The tasks are grouped into the following major function areas:

a. Data Acquisition and processing

b. Data Archive processing

c. Data transfer to Control Centre

d. Response to the request of SCADA-DMS-OMS System

7.1 System Capacity

The system functions and associated databases shall be capable of accommodating at least a 100% increase in the delivered capacity without requiring regeneration, recompilation, or any other processing other than definition of the database by TPCODL.

Similarly, the RTU shall have provision to add additional DI (32 DI) module, DO module (16 DO) to meet the site requirement.

a. The system functions and their associated databases shall be dimensioned as per the functional requirement of the TPCODL, specified in this document. E.g. Bay augmentations, Integration of distribution level data etc.

b. The main memory of each processor shall be capable enough to twice the delivered capacity within the delivered enclosures by TPCODL.

c. Fifty percent of the auxiliary memory capacity of each Controller shall be completely available for future use by TPCODL. The auxiliary memory of each processor, console, and storage unit shall be expandable to twice the delivered capacity within the delivered enclosures by TPCODL.

d. Inspection and verification, to the extent possible, that provision to upgrade and expand the system are furnished as required by the contract.

7.2 System Scenarios

The System performance shall be tested under the following system scenarios:

a. Base Conditions

b. Steady-State Conditions

c. High Activity Scenario Conditions

7.2.1 Base Conditions

The following conditions shall apply:

a. The System shall be configured with all hardware and functions required by this Specification including hardware and functions specified as optional.

b. All System function execution parameters shall be as mentioned in this document.

c. System functions shall execute at the periodicities and execution times specified in this document

d. The System software and databases shall be configured in accordance with the required System Capacity.

e. The pre-defined time change shall occur such that all data acquisition and processing associated with the time System functions, including report production, are executed.

7.2.2 **Steady State Conditions**

The Steady State Conditions shall consist of the Base Conditions and the following activities over a sixty- minute period:

a. Twenty-five percent of all the analog points shall change sufficiently each time they are acquired. Sixty alarms per minute (Thirty status alarms and Thirty analog alarms) shall be generated and processed. Each of these alarms may be acknowledged within sixty seconds at TPCODL discretion.

b. One supervisory control sequence consisting of the opening or closing of one device shall be executed at each operation console everyone minutes.

7.2.3 **High Activity Scenario Conditions**

The high activity scenario shall consist of the base conditions and the following activities over a fifteen- minute period:

i. All processor inputs scanning, and processing is in progress and all the data is transmitted over the main data bus every sec

ii. All controls in operation

iii. Control / information request is initiated from all terminals.

a. Hundred percent of all the analog points shall change sufficiently each time they are acquired to require complete processing by the System.

b. A burst of 70% a COS shall be generated and processed within the first sixty seconds of the scenario.

c. Five supervisory control sequences consisting of the opening or closing of devices shall be executed at each operating console every one minute.

7.3 **System Functional Tests**

The purpose of the system functional tests is to rigorously exercise all functions and to verify the correct functional operation of all hardware and software. The system functional tests shall include, but not be limited to, the following tests. The TPCODL shall also be able to perform other tests not specifically mentioned.

a. Verification of proper data acquisition & control from the RTUs, IEDs

b. Verification of proper data acquisition from the Multifunction Meters

c. Verification of proper data acquisition & control from TPCODL other condition monitoring systems.

d. Verification of the proper response of the system to include

i. Loss / Restoration of IEDs and RTUs

ii. Loss / Restoration of Input Power

iii. Loss / Restoration of Communication System

e. Verification of System Redundancy including fail-over procedures and restart.

f. Verification of all development and maintenance capabilities Including:

i. Database Generation and Maintenance

ii. Back-up and Restoration functions of all systems.

7.4 System Response

7.4.1 Satisfaction of the performance requirements will be verified during factory test and the site test for each of the system and applications and the other functional requirement mentioned in the specification. Under Base Condition, Steady State Condition and High Activity Scenario Condition the system response shall be tested and response time as per the specifications shall be achieved.

a. All Digital Inputs shall be reported with a resolution of 1 msec.

b. All Digital Inputs shall have individual channel reporting

c. Supervisory control operation shall be completed, and the result displayed at workstation consoles within 1 seconds plus scan-in progress, communication, and field device operation delays.

d. The system shall report correct Time Stamping when all process inputs scanning & processing is in progress & all the data is transmitted over Data Bus every sec.

7.4.2 Resource Monitoring

Resource utilization shall be measured, calculated and displayed for the System processors, devices, and networks. The minimum set of parameters to be presented include:

a. Time utilization (percent processor utilization) of each function per processor

b. Time Synchronization

c. Time utilization of each function

d. Data transfers per second/minute/hourly

7.4.3 **System Utilization**

Name	Utilization	Comments
Main Memory	30% 50%	Normal Peak
Processor Utilization Application processor Communication processor	 <30% <50% <30% <50%	 Normal Peak Normal Peak
Local Area Networks	40% 60%	Normal Loading Peak Loading
Auxiliary Memory Allocated capacity Access and transfer capacity	 50% 30% 50%	 Normal Peak

8.0 Warranty, Maintenance, Upgrades, Patch Management & Database Modification Requirements

This Section specifies the requirements for Warranty, hardware & software maintenance for the System, Post Warranty maintenance, support, system upgrades, patch management etc.

Bidder to note the environmental condition of locations, the proposed system is being planned to be installed and operational.

a. Bidder shall submit the details to facilitate to carry out online and offline maintenance of the components supplied as a part of the system. In general, this should include adequate testing equipment, tools, safety devices and other accessories.

b. Bidder should provide Maintenance strategy of the product (Own & Sub-Vendor) being offered so as to schedule appropriate timeline for maintenance.

8.1 Maintenance Performance Requirement

TPCODL envisaged that all offered equipment shall not require routine or planned maintenance. Therefore, no fans or moving parts shall be used in any of the system to avoid any need for maintenance. To ensure this, all the supplied equipment should be constructed to resist the entry of Dust, Water etc. A single technician shall be able to remove and replace for repair purposes, without special tools and test equipment, all equipment involved in the offered system. Restoration of equipment to full operational use shall be possible within 15 minutes (nominally) of repairs being completed. It should not be necessary to dismantle (remove multiple pieces of) the system in order to replace a module.

8.2 **Service Life**

Bidder to note that the equipment shall be capable of complying with all standards, including performing its intended purpose, for a minimum of 15 years from the date of commissioning.

The bidder shall indicate the following:

a. The date at which the product was released for sale.

b. The anticipated date at which the product will be withdrawn from sale, but support will continue to be provided for Spares and Services.

c. The anticipated date that product support will be withdrawn, i.e. spares and technical support will also be no longer available.

8.3 **Interchangeability**

All the parts/modules shall be interchangeable individually (e.g. RTU parts/modules shall be interchangeable individually, and as a whole RTU). Any such change or replacement shall not reduce the capability of the equipment to conform to the requirements of this specification. This is applicable for all the parts/module supplied by the bidder under this contract.

8.4 **Definitions**

The responsibility for maintenance of hardware and software will vary depending on the time during the Contract. So that the times for changes in responsibility can be determined, the following definitions shall be used:

Delivery – Delivery of any item shall be interpreted as receipt of the item at TPCODL facility.

Commissioning – Commissioning of any item shall be interpreted as receipt of the item at TPCODL facility, installation on-site, successful completion of the site tests, and correction of all variances from the tests.

8.5 **Deliverable Hardware and Software Version**

The delivered Hardware and Software shall be the latest version being delivered by the manufacturer of the Hardware & Software six months prior to its delivery to TPCODL facility. During delivery of the system, all the RTU of a Bidder across the TPCODL network shall be upgraded to the latest version.

All hardware and software shall be of compatible versions. That is, the Bidder shall be responsible to ensure that all delivered hardware and software versions will inter-operate successfully. If it becomes necessary to upgrade some hardware or software to meet this requirement, the cost and time shall be borne by the Bidder. If it is necessary to revert to a previous version of any hardware or software to overcome incompatibilities among the hardware or software, the Bidder shall bear the cost and time of the "downgrade" and shall present a plan to correct the problems with the newer release. Such corrections shall also be at the Bidder's sole expense.

8.6 **Warranty and Post Warranty support**

a. **Maintenance services** for the supplied Hardware, System and application Software up-gradation, Patch Management services including sub-vendor products during the Standard warranty period of 5 Years from the date of system handover after SAT, resolution of all punch point of SAT and trouble-free operation of the entire system for a period of one month.

b. Bidder shall provide **Maintenance Services** for the supplied Hardware, Software package, Software up-gradation, Patch Management services including sub-vendor products for next 5 years over and above as mentioned in item a.

c. Bidder to ensure minimum one preventative maintenance visit per site per annum for the entire standard warranty period.

d. Training

e. SLA will be prepared and adhered by Bidder, Sub-Vendor's of bidder for extending the Hardware, Software and Service support to TPCODL for the period mentioned above. To mitigate major failure like Complete system failure, RTU system instability, loss or failure of any major subsystem or system component such as to cause a significant adverse impact to system availability, performance, or operational capability. Some of the salient points as example are documented below:

Bidder shall report to site within 48 hours of receipt of reporting of the failure occurrence

Bidder shall provide replacement of the faulty equipment within 7 days after confirmation of the fact that the equipment can't be repaired at site. Failure to this clause may have some penalty reference on Bidder.

Bidder will mandatorily provide detailed analysis report of the faulty equipment within 15 days from the date of the site visit.

Any spare Equipment replacement, testing and its commissioning to be done by bidder, with no cost implications to TPCODL. Any tools, equipment, Software or Hardware required for testing of the System (e.g. IEDs/RTU) will be the responsibility of the Bidder, this includes all system supplied by bidder under this contract.

Any up gradation in application software and hardware will be informed to TPCODL and necessary up gradation to be carried out by Bidder with no cost implications to TPCODL.

Bidder to note that Tri-Party agreement will be prepared for Bidder, Sub-Vendor to have protection against quitting of executing bidder and its alliances during commissioning, warranty and post warranty period as specified in this document.

8.7 **Hardware Maintenance**

The project schedule shall include an allowance for hardware maintenance prior to the availability test. The Bidder will not be granted any relief for project delays caused by maintenance problems prior to the availability test.

8.7.1 **Pre-Delivery Maintenance**

The Bidder shall have the responsibility for maintenance of all hardware prior to delivery to TPCODL site. This maintenance may be performed by a maintenance contract with Original Equipment Manufacturers (OEMs) or other parties.

8.7.2 **Maintenance During Commissioning**

The Bidder shall have the responsibility for maintenance of all hardware after delivery and prior to commencement of the Warranty. This maintenance may be performed by a maintenance contract with OEMs or other parties or by Bidder staff.

Failed equipment shall be replaced or repaired and spares inventories (if any) replenished to their delivered level throughout the period of commissioning. Any spare parts found to be defective during initial delivery inspection or during this period shall be replaced within **one week** after notification. There shall be no charges to TPCODL for these replacement parts, including delivery charges. All spare parts replaced under maintenance shall be new parts unless otherwise accepted by TPCODL.

8.7.3 **Maintenance Under Warranty**

Maintenance during the warranty shall be in conformance with the terms of the warranty sections of this RFP.

During the warranty period, TPCODL hardware maintenance responsibilities will include the following:

a. Provision of trained staff, responsible for call-out when problems occur

b. Providing local assistance to the TPCODL during problem resolutions

The Bidder's hardware maintenance responsibilities shall include the following:

a. Providing maintenance of all equipment, including spare parts

b. Providing materials and instruction for appropriate engineering changes for equipment

c. Provision of technical guidance towards the resolution of all hardware problems for equipment.

When needed, the Bidder shall respond to requests for technical support within Two Hours, 24 hours a day, and seven days a week.

Failed equipment shall be replaced or repaired, and spares inventories replenished to their delivered level throughout this period. Any spare parts found to be defective during initial delivery inspection or during the Warranty period shall be replaced within one week after notification. There shall be no charges to TPCODL for these replacement parts, including delivery charges. All spare parts replaced under maintenance shall be new parts unless otherwise accepted by TPCODL.

The Bidder's technical support staff shall work with TPCODL technical staff to establish a strategy to efficiently resolve each identified problem. If at any time, TPCODL believes that the Bidder's technical support is not effectively resolving a problem, TPCODL may request that the Bidder's system expert or staff from the equipment's manufacturer be dispatched to TPCODL facility. The Bidder's technical team shall be at TPCODL facility within 48 hours of that request to provide hands-on support towards the problem resolution. TPCODL will not be responsible for any expenses connected to the technical support, including travel expenses.

The Resolution time for different complaints shall be as per the below matrix:

Category	Definition	Maximum Resolution Time
Severity 1 Urgent	Complete system failure, severe system instability, loss or failure of any major subsystem or system component such as to cause a significant adverse impact to system availability, performance, or operational capability	0-12 hrs.
Severity 2 Serious	Degradation of services or critical functions such as to negatively impact system operation. Failure of any redundant system component such that the normal redundancy is lost Non-availability of information at control center	0-24 hrs.
Severity 3 Minor	Any other system defect, failure, or unexpected operation. Request for information, technical configuration assistance, "how to" guidance, and enhancement requests.	0-48 hrs.

Failure by the Bidder to comply with the above-mentioned timelines, shall attract a penalty. Penalty amounts shall be recovered from the amounts due to Bidder or by invoking the Contract Performance Bank Guarantee submitted by Bidder against this Contract.

8.7.4 **Post Warranty Maintenance Support**

The following post-warranty maintenance services shall be provided for all hardware:

Contract maintenance, eight hours per day, seven days per week, two-hour response. The Bidder's technical support staff shall work with TPCODL technical staff to establish a strategy to efficiently resolve each identified problem. If at any time, TPCODL believes that the Bidder's technical support is not effectively resolving a problem, TPCODL may request that the Bidder's system expert or staff from the equipment's manufacturer be dispatched to TPCODL facility. The Bidder's technical team shall be at TPCODL facility within 24 hours of that request to provide hands-on support towards the problem resolution. TPCODL will not be responsible for any expenses connected to the technical support, including travel expenses.

The maintenance contracts shall cover preventative and remedial maintenance, spare parts, and installation of all engineering, equipment, and field change and upgrades. TPCODL agrees to notify

the Bidder of their intent to install any changes or upgrades so that their compatibility with the other elements of the System may be determined.

The SLAs for support including response time, resolution time, applicable penalties for non-compliance etc. shall remain same as per the terms and conditions prevailing during the warranty period.

8.7.5 **Hardware Minimum Support Period**

The Bidder shall guarantee the availability of spare parts and hardware maintenance support services for all System equipment for a minimum period of 15 years. Subsequent to this minimum support period, the Bidder shall provide to TPCODL a minimum of two year's advance notice of their intent to terminate such services.

8.8 **Upgrades, Patch Management & Modifications**

a. Bidder shall continuously keep the TPCODL informed of all Software and Hardware upgrades as & when these are released.

b. Bidder shall supply upgrades and patches of all installed software (both own and third party) for a period of eight years from the date of system acceptance without commercial implication.

c. Bidder shall rectify all design defects and software bugs at no extra cost for a period of 15 years from the date of system acceptance.

d. Bidder shall support the system totally for Fifteen (15) years, even if no upgrades are implemented.

e. Bidder shall provide lifetime support (15 years) for the system. To meet this requirement, Bidder shall refer with OEMs on the product's life cycle management and obsolescence. Bidder shall attaché the product life cycle matrix for hardware and software offered under this RFP.

f. The system referred to above includes Bidder's own as well as third party components.

8.9 **Database modification during Warranty and Post Warranty Period**

All database modification major or minor (including new bay, new station inclusion and new equipment/device) is in the scope of the bidder, after the system handover and during the warranty and extended warranty period. The Scope covers RTU configuration and necessary changes for control center communication. It is bidder's responsibility to provide resources as and when required by the TPCODL for these changes and testing of the same as per the project and planned activity schedule. One of the examples of Configuration changes/modification are as mentioned below:

1. Addition/Deletion of 33/11 kV Bays
2. Addition of Auxiliaries Tags
3. Addition/ Deletion of System/IEDs/Devices/SCADA enabled equipment/sensors

4. Reconfiguration of RTU for new Control Centers

9.0 Training

Bidder shall provide training to the TPCODL personnel on the operation and maintenance of the system supplied equipment including Non-OEM equipment/3rd Party equipment. The training shall cover development, integration, installation and commissioning of both software & hardware components of the system.

The Bidder shall provide Classroom as well as hands-on training on the offered System. All required training materials such as System Catalogs, Test Instruments, Demo Equipment, and Simulation Jigs, etc. shall be arranged by the Bidder for own and Sub-Vendor Equipment. The training shall equip the TPCODL engineers for Installation, Commissioning, Operation and Post-Warranty Maintenance of Hardware, Software (Operating System, Administration and Applications), protocols and all Sub-Vendor systems.

The Bidder shall prepare and deliver a comprehensive training program on the operation and maintenance of RTU and associated accessories under this project. Configuration of RTU, training shall cover the skills required for the maintenance and expansion of additional feeder/IEDs/Substation. Hardware training shall qualify TPCODL to perform routine preventive maintenance, diagnostic testing on the processors, peripheral equipment, LANs & communications equipment.

Bidder shall indicate their Training facilities including test tools and simulation facilities. Bidder shall provide the training calendar and details of topics considered for the equipment offered.

The schedule, location and detailed content of each course will be finalized during detailed engineering.

Bidder to consider 10 man-days training for each phase for on-site training to TPCODL personnel. Bidder to note that the indicated man-days will be utilized in batches (2-3), according to availability of the TPCODL personnel.

9.1 Training Requirement

Bidder shall provide training to the TPCODL personnel on the operation and maintenance of the system supplied by him.

General requirements relating to the training are specified below:

a) Personnel who speak understandable English and who are experienced in instruction shall conduct training courses.

b) Class Room and Hands-on training shall be on the identical system being supplied to TPCODL.

c) Bidder shall provide all necessary training material. Each trainee shall receive individual copies of the technical manuals and pertinent documents. These materials shall be supplied at least one month before the scheduled commencement of the training course.

d) The TPCODL shall be permitted to video tape all training classes.

e) Class materials, including documents sent before the training classes and class handouts, shall become the TPCODL property. The TPCODL may copy this material for in-house training and organization use only.

f) Training sessions conducted at site shall accommodate the number of candidates in batches.

g) Bidder to note that, requirement of Training for RTU system is explained in detail, on similar line bidder to arrange training for all Non-OEM systems such as Ethernet Switch etc.

9.1.1 **Course Descriptions**

Course descriptions shall be included with the training plan that shall provide the following information for each course included in the training plan:

a) The course name (and number if applicable)

b) A brief description of the course

c) A description of the intended audience for the course

d) A description of the relation of the course to others in the training plan

e) The duration of the course

f) A breakdown of the course schedule, identifying classroom and hands-on periods

g) A list of the training materials to be supplied

h) A list of reference material to be used in the course

i) A list of any prerequisite training or experience expected of the students.

At TPCODL request, the Bidder shall provide a description of all courses offered by the Bidder and its Sub-vendors.

9.2 Training Curriculum

The training curriculum presented in this section is intended to describe the contents of the training when viewed. The subjects covered by individual courses may differ as long as the overall objectives are satisfied.

9.2.1 RTU Hardware Training

RTU system hardware course shall be designed to provide TPCODL personnel enough knowledge of the overall design and operation of the system so that they can correct obvious problems,

configure the hardware, perform preventive maintenance, run diagnostic programs, and communicate with OEM personnel. The following subjects shall be covered:

a) Configuration of the System Hardware.

b) Basic and advance training of operation, maintenance techniques and diagnostic procedures for each element of the offered system, e.g., Processors, Auxiliary Memories, LANs, Routers etc. Configuration of all the hardware equipment.

c) Techniques and procedures to expand and add IEDs/Feeder/Substation/Communication channels etc.

d) Theory of operation and maintenance of the redundant/non-redundant hardware configuration, failover hardware, configuration control panels, and failover switches. Maintenance of protective devices and power supplies.

e) Theory of design and operation, maintenance techniques and practices, diagnostic procedures, and (where applicable) expansion techniques and procedures. Course content shall include hands-on training for the specific subsystems that are part of TPCODL equipment or part of similarly designed and configured subsystems. All interfaces to the computing equipment shall be covered in detail.

f) Preventive and Corrective maintenance of all equipment, including use of special tools and instruments.

g) Capable to diagnose and debug problem in the RTU. Course should familiarize the different error code of the RTU and how to rectify them.

9.2.2 **System Software Training**

The Bidder shall provide a System Software course that covers the following topics:

a) All applicable programming languages, Stand-alone Service and Utility packages of the system. An introduction to software architecture, effect of tuning parameters (OS software, Network software, database software etc.) on the performance of the system.

b) Operating System course consisting of the user aspects of the operating system, such as program loading and integrating procedures; scheduling, management, service, and utility functions; and system expansion techniques and procedures.

c) System Initialization and Failover, execution of diagnostic procedures and the interpretation of diagnostic outputs.

9.2.3 **Application Software Training**

Comprehensive application software course, covering all applications database Logic and display building etc. The training shall include minimum the following:

a) Overview of the application software and data flows.

b) Programming Standards and Interface conventions.

c) Functional capabilities, design, and major algorithms. Associated maintenance and expansion techniques.

d) Software development techniques and conventions for the preparation and integration of new software functions.

e) Generation of application software

9.2.4 **RTU Configuration/Engineering Training**

The database and logic building course shall cover how to configure the inputs & outputs signals of the RTU, communications with IED, communication with Control Centre, build the configuration database, storing and retrieving of the configuration file, database administration to maintain and modify the database and its structures. Following minimum topics shall be covered:

a) How to set up configuration database for RTU, identifying different component for configuration

b) How to configure I/Os

c) How to configure IEDs

d) How to configure Control Centre Communication

e) How to Configure Cyber Security features of RTU

f) How to Compile Configuration

g) How to Import / Export configuration file

h) How to download/upload configuration file

i) How to maintain different configuration file

9.2.5 **RTU System Administration**

System administration course shall cover the procedures necessary to operate the RTU configuration software, managing users and their roles. At the end of this course, participants shall be able to:

a) Start up the RTU configuration Tools and its components

a) Shut down the Software and its components

b) Switch functions to backup equipment

c) Take equipment out of service and its restoration

d) Interpret and react to messages generated by error-monitoring functions

e) Test field device and communication links

f) Implement procedures for installing new devices

g) Use procedures for altering and replacing the configurations

h) Identify procedures for using diagnostics

i) Describe the backup functions required for normal maintenance

j) Upgradation of System Software, Patch Management and Firmware Upgradation of OS and Application Software etc.

9.2.6 **Simulator Training**

This course shall cover the operation of the Simulator, scenario building, and maintenance. Enable the TPCODL personnel to:

a) Prepare training scenarios using the scenario building tools

b) Simulate the communication over IEC 61850 protocol with devices

c) Simulate the communication over IEC 60870-5-104/101/103 and Modbus protocol

Similarly, the bidder shall arrange training on Sub-vendor equipment supplied under this RFP

10.0 Tools Tackles for Erection & Commissioning

Bidder to consider and supply special tools and tackles (Hardware and Software) required for erection, commissioning and maintenance of the offered system. After commissioning of the system all tools and tackles shall be handed over to TPCODL Project/Maintenance team.

All tools (both hardware and software), test instruments, simulation jigs, documents, programming equipment etc. required for Installation, Testing & Commissioning are in the scope of the bidder.

All configuration cables and other specialized testing passive devices to be provided with the supply of material.

11.0 Spares

a. Bidder needs to include competitive price for Mandatory Spare parts against the below specified list and schedules.

b. Bidder shall include list of spares with quantities as recommended by him required for 15 years trouble free operation of equipment.

c. The spares supplied shall be strictly interchangeable with parts for which they are intended for replacement.

d. The spares shall be treated and packed for long storage (minimum 15 years) under the climatic conditions prevailing at the site.

e. The start-up spares shall be delivered at the site well in time before the start-up and commissioning of the plant.

f. Bidder to note the environmental condition of locations, the proposed system is being planned to be installed and operational.

11.1 **Start-Up Spares:**

The start-up spares are those spares which will be required during start-up and commissioning of the equipment/systems, and until Final Take Over. It is the responsibility of the bidder to supply all the necessary spares as required until the equipment/systems are handed over to the TPCODL. An adequate stock of start-up spares shall be available at the site such that the start-up and commissioning of the equipment/systems, performance testing and handing over the equipment/systems to the TPCODL be carried out without hindrance and delay. All start-up spares which remain unused after the taking over the system shall remain the property of the TPCODL. The Bidder shall furnish the Schedule of Start-up Spares.

11.2 **Mandatory Spares**

Essential spares are those considered necessary by the owner for ten (10) years of normal Sub-Station Automation System operations. A list of such spares has been listed in the below mentioned table and the same shall be included in bidder’s scope. When an item of spares is indicated as `percentage', it shall be considered as percentage of total number of that item of spares of overall project, unless specified otherwise and the fraction shall be rounded-off to the next higher whole number. Whenever the item of spares has been indicated as `set' the same shall mean the supply for a single equipment/system.. The Owner reserves the right to buy any of the essential spare parts as considered necessary.

In case during start-up and commissioning certain essential spares are used up, the same shall be replaced within one (1) month without any commercial implications.

Bidder shall furnish details for all essential spares as per the approved vendor document list.

Bidder to consider following mandatory spares in the offer.

Note: Bidder to note that all the mandatory spares equipment (please refer the Price Bid) shall be supplied along with Power supply, communication and specialized cables (if any)

Spares mentioned above shall be same as of installed system with necessary software key and licenses. The table above indicate the minimum requirement of the TPCODL, bidder to include 5% spares, which are not part of this table, but required for maintenance and upkeep of the system.

11.3 **Recommended Spares**

In addition to the spares mentioned above, the Bidder shall also furnish in his bid a list of recommended spares which may be required for ensuring the availability during the guaranteed availability period with unit prices. The final list of spares shall form part of scope of supply and accordingly the price thereof shall be quoted by the bidder and shall be considered in the evaluation of the bids. The TPCODL reserves the right to buy any of the recommended spare parts as considered necessary by him. The prices of recommended spares shall be consistent with those of start-up/essential spares. Purchase of these spare parts will be covered under this order / by a separate order / an amendment to the contract.

The Bidder shall provide a list of recommended spares for a period of Fifteen (15) years from the date of handover of the project to TPCODL. The shelf-life of these spares is such as to last for at least Fifteen (15) years from the date of handover of the project. Spare parts supplied by the bidder shall be made available to the bidder for usage subject to replenishment at the earliest (within a month). Thus, at the end of every quarter the inventory of spares with the TPCODL shall be fully replenished by the bidder. However, any additional spares required to meet the availability of the system (which are not a part of the spares supplied by the bidder) should to be supplied immediately by the bidder free of cost to the TPCODL the list shall include the following:

Sl. No	Item Part Description	Recommended Quantity	Procurement Lead Time	Quantity of item held in Local office of Bidder	Quantity of item held in Head Office of Bidder as an emergency spare	Unit Price	Total Price

The Bidder shall provide the MTBF of various components, sub-assemblies, assemblies etc. (recommended as spares) and the relationship between MTBF and spare quantities recommended. The bidder is required to list the spares.

The Bidder shall submit the product life cycle details of the all hardware offered under this RFP.

End of Section-A

Section – B

Detailed Technical Specifications

CONTENTS:

1.0 Remote Terminal Unit (RTU)

RTU is envisaged for data acquisition and integration with control centers to carry out remote monitoring and control of the Substation. A state-of-art microprocessor based industrial RTU designed for the electrical process environment in both decentralized and centralized manner shall be considered. The RTU shall guarantee high availability and ensure safe and secure operations of all substation equipment.

The RTU shall be multifunctional, designed in accordance with applicable International Electro-Technical Commission (IEC), Institute of Electrical and Electronics Engineer (IEEE), American National Standards Institute (ANSI), and National Equipment Manufacturers association (NEMA) standards, unless otherwise specified in this Technical specification. In all cases the provisions of the latest edition or revision of the applicable standards in effect shall apply.

RTUs shall be redundant to provide a reliable system for acquisition of required information from the RTUs, BCPUs, Numerical relays, Multifunction meters, Condition Monitoring Devices, and other communicable devices as well as hardware signal through I/O cards.

All functional capability described herein shall be provided by the bidder even if a function is not initially implemented. As a minimum, the RTU shall be capable of performing the following functions:

1.2 The proposed RTU shall be suitable for decentralized and centralized architecture to address the requirement of present and future.

1.3 The proposed RTU, I/O and Interfacing modules shall be of the same family of RTU or Embedded, industrial grade system with high availability & reliability. RTU hardware shall be easily scalable for expansion and to integrate IEDs in future on open protocols.

1.4 The RTU shall be redundant in hot standby mode with bump less Auto Changeover.

1.5 RTU shall have vast protocol support capability, adaptable for customization and additional protocols and Multi master communication capability.

1.6 The RTU shall support a wide range of Server/Client protocols including IEC61850 (ED1 & ED2 edition), IEC 60870-5-104 (Master/Slave), IEC 60870-5-103, Modbus - RTU, Modbus - TCP/IP (Master).

1.7 The RTU shall have min 5,000 Physical I/O tags and shall support integration of at least 40 IEDs on IEC 61850 and at least 25 IEDs on serial protocols. Bidder to consider the hardware such as I/O peripheral, Serial Ports, Communication processors, Converters etc., in the RTU accordingly.

1.8 The proposed RTU shall communicate simultaneous with eight independent remote master (redundant) stations on IEC 60870-5-104 Protocol.

1.9 RTU to the TPCODL SCADA Systems shall allow scanning & control of all defined points (Physical/Pseudo points) within the substation independently to each of the SCADA systems. Proposed system shall simultaneously respond to independent scans & commands from TPCODL SCADA ADMS Systems. Proposed system shall support the use of a different communication data exchange rate (bits per second), scanning cycle, and/or communication protocol for each remote control center. Also, each control center's data scan and control commands may be different for different data points within the proposed system's database.

1.10 The RTU shall be 19" Rack mounted / Din Rail Mounted.

1.11 Disturbance and fault record collection over IEC 60870-5-104 protocol

1.12 Shall support IEC 61131 based programming logic. The RTU shall support programming language (Functional Block) with arithmetic & logical functions to incorporate Interlock Logic for SCADA Controls. Bidder to ensure supply of necessary hardware and software to achieve the functionality.

1.13 Web Server functionality to monitor and configure the RTU along with Substation IEDs by authorized users (AAA functionality).In addition a facility to provide access to the numerical protection relay, change/modify relay setting, AVR parameters and Fault recorder data shall be provided from Master control center and Backup Control center.

1.14 Should provide latest Microsoft Windows based maintenance and configuration tools. The tools should have functionality of both remote and local access.

1.15 Time synchronization based on SNTP (Server/ Client) and Protocol specific synchronization (IEC 60870-5-104 etc.). The RTU shall accept minimum two independent sources for time synchronization over SNTP/Protocol specific Synchronization. RTU in turn shall synchronize the IEDs integrated on different protocols.

1.16 RTU shall support SNMP protocol for device monitoring and management from TPCODL Network Management System.

1.17 RTU shall support configuration File Upload and Download from the Engineering Station (Configuration Laptop), functionality shall support both Local & Remote configuration.

1.18 RTU shall be capable of acquiring 32-bit analog and accumulator data from Multi-function meters on MODBUS (RTU & TCP/IP)/IEC61850/IEC60870-5-104.

1.19 RTU communication protocol shall be configured to report analog & Status changes by exception to master stations. However, RTU shall support periodic reporting of analog data and periodicity shall be configurable from 1 sec to 1 hour. Digital status shall have higher priority than the analog

data. In addition, analog values shall also be reported to Master station by exception on violation of a defined threshold limit.

1.20 The XML based Substation Configuration Description Language (SCL) of IEC 61850 configuration interfaces shall allow information to be shared between the various configuration tools, reducing the overall engineering time.

1.21 User friendly on-line health and data monitoring facility shall be provided to maintenance engineer for monitoring/analyzing the real time status of the process, program logic from the engineering station (Configuration tool – Laptop) from local and Remote.

1.22 The Master Station user shall be able to perform a virtual connection through RTU with any RTU/BCPU/IED, provided by the communication protocol functionality, to support the information transfer to/from RTU/BCPU/IEDs. e.g., the Master Station shall gather on-demand IED data; visualize IED configuration parameters. On the other hand, the Master Station shall be able to download to the BCPU/IEDs configuration parameters, code changes, etc.

1.23 The system shall comprise of features namely failsafe control (i.e. check-before-execute, selection timeout etc.), Interlock & Sequential Logic Control system, Sequence of Event Recording (SER), Interfacing with third party IEDs (e.g. Multifunction Meters, Condition Monitoring & Protection system etc.), interfacing with third party computer system, Integration of data as per time base (e.g. 15 minutes energy integration), direct GPS clock connectivity, through SNTP server or through the Master (Main & Standby) for time synchronization.

1.24 In case of power supply failure, auto start-up and restoration of the RTU shall be possible without manual intervention.

1.25 All the cards/modules of the RTU, Ethernet Switch etc. must have conformal coating for protection against harsh environments.

1.26 It shall be possible to increase the number of communication ports in the RTU by addition of cards, if required in future. The RTU shall support the use of a different communication data exchange rate and scanning cycle on each port and different database for each master station.

1.27 Internal battery backup to hold data in SOE buffer with time & date in case of failure of supply.

1.28 The proposed RTU shall be KEMA Certified or by equivalent certification body like NABL /CPRI/International Accredited Lab.

1.29 Separate set of communication modules shall be used for communicating to slave IEDs and to TPCODL FEP/Master Systems.

1.30 It shall be capable to perform all functions for entire substation including future requirements. Processor & RAM shall be selected in such a manner that during normal operation not more than 30% capacity of processing & memory are used.

1.31 RTU shall communicate to MCC, BCC system over IEC60870-5-104 protocol.

1.32 Continuous self-supervision function with self-diagnostic feature shall be included.

1.33 RTU & Communication Redundancy

- The RTU shall be redundant with all functionalities, so that the RTU can communicate with the Remote Control Centre, even when one of the units fails.
- The failover process should cause the assignment of all the functions of the failed unit to the healthy unit. The changeover between the two redundant units shall be transparent and shall not require any manual intervention. The changeover process of the RTU shall be bump less and with no data loss.
- Main and Standby RTU shall support all functionalities independently i.e. all Substation IEDs and Communication to Control Centre. Failover should take place in case of failure of the unit and failure of any communication channel.

1.34 **Communication**

a. **Ports**

- Each Communication unit should have redundant Ethernet ports with single IP address for simultaneous communication with Min Eight (8) independent redundant master's using IEC60870-5-104 protocol.
- 2 Nos. Ethernet Ports / CPU, one ethernet port for simultaneous communication with Min Eight (8) independent redundant master's using IEC60870-5-104 protocol.
- Inbuilt Redundant Ethernet ports with single IP address for simultaneous communication with IEDs (IEC61850 ED1, ED2).
- All the serial devices of the substation shall simultaneously communicate to main and standby RTU.
- 4 nos. RS 485 electrical ports for communication with seral devices over IEC60870-5-103, Modbus and IEC 60870-5-101 protocol.
- In addition to above, Ports for internal communication, maintenance and configuration shall be considered.

b. **Protocols**

- The communication protocol for RTU to Master Control Center must be IEC 60870-5-104.
- IEC 61850 Ed.1 & 2, IEC 60870-5-104, IECb60870-5-101, IEC 60870-5-103, MODBUS (Serial and TCP/IP), MQTT shall be supported. The RTU shall meet the IEC 61850 standard in every respect and interoperability with other manufactures IEDs and tools shall be verified.
- Time synchronization over SNTP and Communication protocol from Master.
- Master and slave licenses shall be considered for all the above-mentioned protocols.
- Should generate XML file for integration/engineering with vendor Independent SCADA systems
- RTU shall be RSTP/PRP/HSR compliant for communication redundancy.
- SNMP (v1, v2c and v3) for Health monitoring of the Hardware.

1.35 **Input / Output Requirement**

a. Hot replacement of all I/O modules

b. A complete set of process interface

c. High disturbance immunity, meeting the requirements of the IEC directives 89/336/EEC and 73/23/EEC when placed in cabinets.

d. Comprehensive self-diagnostics

e. On-board processing capabilities such as time-tagging, event handling, filtering and gain control.

f. Shall supports transparent virtual redundancy for Main & Redundant RTU

g. Modularity, permitting step-by-step expansion

h. Reliability and auto-diagnostics

i. Easy to configure

j. Quick fault finding with help of LEDs of each module and channel

k. Support of dual redundancy in power supply

l. The relative time error between events (DI signals) handled within one controller shall be <1 ms (interrupt driven). The relative time error between events handled within separate RTU shall not be more than 2 ms.

m. Input / Output Requirement for each Substation: Typical Input/Outputs requirement

	Digital Inputs (DI)	Digital Output (DO)	Analog Input (AI)
33/11 kV Substation	32	16	8
Expandable	96	48	16

The following Input / Output modules are envisaged to acquire the field information. Bidder to note that, the I/O requirement considered from hybrid architecture, i.e. Acquisition of I/O from IEDs and as well from proposed I/O modules.

a. Analog input

b. Digital inputs

c. Digital outputs

a. **Analog Input Sub System**

- The entire analog, Telemetered, Non-Telemetered and calculated point values shall be stored in the database in engineering units
- The system shall provide the capability to perform analog-to-digital conversion accuracy monitoring and raising an alarm should any such points exceed tolerance

a. Analog Signal Conditioning

- Galvanic isolation of input and output signals
- Input filtering and non-linear filtering for attenuation of noise-level
- Amplification of low-level signals
- Cold junction compensation

b. Analog Signal Monitoring

- Power supply failure monitoring due to lose plug connection, short circuit, wire break and voltage interruption
- Transducer / Energy Meter monitoring for parity, wire break, live zero and end limit values
- Short circuit proof
- Monitoring of A/D conversion
- On-line simulation
- Cable monitoring for open circuit
- Fuse protection and fuse failure detection
- Communication monitoring
- Configurable Dead band

c. Design and Performance requirement of Analog Input modules

The Analog Input module shall be a solid-state type. The following features shall be provided:

- The decoding logic shall ensure that no two channels are selected simultaneously
- Cross-Talk attenuation between selected and unselected channel shall be more than 80 dB
- The Analog – to – digital converter (ADC) shall preferably be of successive approximation type, the following feature shall be provided:
  - Guarded input section to ensure large common mode noise rejection
  - Provisions for ADC overflow detection
  - Repeatability of +/- 0.025% of full scale
- The following design features shall be provided to offer protection to the analog input modules:
  - Protection for continuous overload up to 200% of all input ranges. Such overload on any analog input point shall not affect the accuracy of the next analog input in the same range.
  - Features to ensure that power line voltage variations up to +/-20% and line frequency variation up to +/- 10% do not affect the accuracy of the system
  - Connection of any point for indefinite time shall not damage the system
  - Provision for isolating failed channels and for ensuring that such partial failure does not affect remaining healthy channels
  - Modular design to enable easy field expandability
  - Provision for two high accuracy reference voltages to be used for checking the accuracy of the ADC for linearity, zero drift and gain. The reference voltage shall be set at equal intervals with respect to the ADC range. This check shall be made automatically at periodic intervals not exceed 6 secs and shall be alarmed if conversion is out of tolerance
  - On-line replacement of individual modules in case of failures
  - Surge withstands capability as per IEEE standards.
- Measurement range: +/- 2.5 V, +/- 5 V, +/- 10 V, 0-+/- 5 mA, 0-+/- 10 mA, 0-+/- 20 mA, 4-20mA
- Resolution: 14 bits + sign
- Type of input: Differential
- Input impedance (Voltage input) – 2 Mega ohms
- Shunt resistance – 250 ohms
- Common Mode Voltage – 100 V
- Conversion time - < 100 millisecond

- Fusing of Transducer Supply – Individual
- Temperature drift with Gain=1 - 0.05%/10°C (Typical), 0.1%/10°C (Max)

b. **Digital Input Sub System**

Digital input with memory shall be considered in case when two items of information received simultaneously i.e. the current point state and flag indicating if the state has changed more than once since the last scan cycle. Number of changes shall be computed using the new state, the memory flag & the last state.

a. Digital Input Signal Conditioning

- Galvanic isolation of input signals
- Input filtering for noise-level

b. Digital Input Signal Monitoring

- Contact monitoring
- Contact bounce protection
- Power Supply failure
- Fail safe condition on failure of card / channel
- On-line simulation / blocking
- Fuse protection and fuse failure detection
- Communication monitoring
- Cable monitoring

c. Design and Performance requirement of Digital Input modules

The digital input modules shall be provided for the periodic scanning of both low resolution and high-resolution digital inputs. The following design features shall be provided:

- Internal voltage source to convert contact state of potential free contacts, either changeover or ON-OFF into logic level signals. Possibility of surface film or contamination on the contacts shall be considered while selecting this source
- Voltage level sensing units, with non-zero values for the binary status output
- Differential input circuit to offer common mode isolation
- Choice of polarity and threshold range
- Buffer registers

- Filtering to protect against contact bounce or electrical noise on input lines
- Detection of card power supply failure
- Surge withstands capability as per IEEE standards
- Self-Checking features for detecting faulty operation
- Status indicating LEDs for each input
- On-line replacement of individual modules in case of failure
- Simulation facility
- Digital inputs with interrupt-controlled updating
- Provision for isolating failed channels and for ensuring that such partial failure does not affect remaining healthy channels
- The digital input can be inverted so the value is 1 when the electrical signal is off, and 0 when it is on
- Rated Voltage – 48 V DC
- Input Voltage Range "1" – 36 – 72 V
- Input Voltage Range "0" – (-) 28 – 20V
- Input Resolution – 1 msec
- Time Stamping – at Card level
- Event Detection – Yes
- Current consumption (+5V) – 460 mA
- Number of channels per module / card – 16 (max)

c. **Digital Output Sub System**

a. **Digital Output Signal Conditioning**

- Galvanic isolation of output signals

b. **Digital Output Signal Monitoring**

- Contact monitoring
- Contact bounce protection
- Power Supply failure
- Fail safe condition on failure of card / channel

- On-line simulation / blocking
- Fuse protection and fuse failure detection
- Communication monitoring
- Cable monitoring

c. **Design and Performance requirement of Digital Output modules**

The digital output module shall provide contact closure outputs by driving relays. The features to be provided are as follows:

- On-line replacement of individual modules in case of failure
- Long life, bounce free, high-speed mercury wetted or dry reed relays
- Surge withstands capability as per IEEE standards
- Type of Output – up to isolated short circuit protected transistor output
- Number of channels per module / card – 8 (max)
- Voltage rating – 48 V DC
- Load Supply – 38 V (minimum), 112 V (maximum)

1.36 **Algorithm and Logic**

a. The RTU shall be based on advanced and proven algorithms and an easy and efficient upgrade of the RTU functionality shall be possible.

b. The RTU shall support IEC61131 for constructing the interlock logic functions.

c. The RTU shall facilitate user defined logic functions such as automatic control sequences by means of available logic elements. e.g., with one command perform a safe change of the connection of a selected line from one bus-bar to another bus-bar in double bus-bar switchgear.

d. Command is always to be given in two stages: selection of the object and command for operation under all mode of operation. Final execution shall take place only when selection and command are actuated (Select-before-execute).

e. It shall also be possible to interconnect and derive input and output signals, logic functions, using built-In functions, complex voltage and currents, additional logics (AND-gates, OR gates and timers).

f. A delay/integrator shall allow the pick-up and reset of binary signals of IEDs to be delayed before being displayed or used to control other functions.

1.37 **Self-Supervision**

a. The RTU shall have extensive self-supervision including all functional module and communication channel.

b. The RTU shall have LEDs for healthiness / error indication

c. RTU shall have the facility to generate & download the log files for maintenance and troubleshooting.

d. Each RTU shall be independent from each other and its functioning shall not be affected by any fault occurring in any of the equipment of the station.

e. Command execution timer (configurable) must be available for each control point. If the control action is not completed within a specified time, the command should get cancelled (Run Time Command cancellation). The timer for time-out feature shall also be user configurable.

f. In case of restoration of communication links, power supply after failure, the software along with hardware shall be capable of automatically synchronizing with the remaining system without any manual intervention.

g. It shall be possible to re-boot the RTU through the LAN/WAN from a remote location.

1.38 **Event Recording pertaining to RTU**

a. The RTU shall support event recorder that can handle up to 2000 time tagged events. Events shall be stored in non-volatile memory. In case of failure of RTU or communication channel, the recorded events shall be communicated to the master as soon as communication is restored after failure.

b. The RTU shall have an internal clock with the stability of minimum 10 ppm or better. The RTU time shall be set from time synchronization messages received from GPS clock or Master station. SOE time resolution shall be 1ms or better.

c. The RTU shall maintain a clock and shall time-stamp the digital status data. Any digital input data in the RTU shall be assignable as an SOE point. Each time a SOE status indication point changes the state, the RTU shall time-tag the change and store in SOE buffer within the RTU. SOE shall be transferred to Master Station through RTU as per IEC 60870-5-104 protocol.

d. It shall be possible to retrieve the recorded event on the TPCODL SCADA system.

1.39 **Power Supply**

a. The RTU shall be powered from the 18-72 VDC (24/48 V DC) Power Supply . The RTU shall accept power from the DC system with the following characteristics:

b. Bidder shall consider Dual Input Source for energizing the RTU along with Diode-oring unit.

c. Nominal Voltage of 24V DC/ 48V DC with operation between 18 - 72 VDC. The voltage may vary during normal operation between these limits with a duration not less than 1 msec.

d. Reverse polarity protection.

e. The RTUs shall operate with grounded input power from TPCODL

f. The RTU shall have adequate protection against reversed polarity, over current and under voltage conditions.

g. Each Input / Output Supply within the panel shall be through power supply distribution module with MCBs with NO contacts (for supply monitoring).

1.40 **Time Synchronization**

a. RTU time synchronization shall be through GPS clock via communication ports on SNTP or over the Communication protocol from master (IEC 60870-5-104).

b. RTU in turn shall be capable of synchronizing all the slave IEDs

c. Timing Accuracy: The RTU shall time-tag event reports to an absolute accuracy of 1ms or better.

d. RTU shall generate an alarm if it gets drifted or loose the synchronization signal.

e. RTU shall have min 2 (two) source input for Time synchronization with priority provision

f. Bidder to propose the solution for time synchronization of the RTU, if the same drifts beyond specified limit (e.g. 30 minutes drift)

g. With each power cycle the RTU shall synchronize with GPS receiver or with Master.

1.41 **Environment requirements, Reliability & Cooling**

a. The Unit shall have high reliability in operation and shall not use cooling fans. The unit shall have vermin proof enclosure and shall insulate electronics, internal components and electronics from external environment in order to avoid failures due to dust, humidity, fungus etc.

b. The RTU Panel hardware installed in Switchyard shall comply to IP65/IP67 enclosure.

c. The RTU panel shall be installed in Substation control room buildings with no temperature or humidity control. RTUs shall be capable of operating in ambient temperature from 0 to +65-degree C with rate of temperature change of 20-degree C/hour and relative humidity 95%, non-condensing.

1.42 **Expansion in future**

Offered system shall be suitable for extension in future for additional BCPUs & other IEDs. During such requirement, all the drawings and configurations shall be designed in such a manner that its extension shall be easily performed by the TPCODL. During such event, normal operation of

the existing substation shall be unaffected, and system shall not require a shutdown. The Bidder shall provide all necessary hardware and complete set of software tools along to perform addition of bays in future and complete integration with TPCODL SCADA System**.** These hardware and software tools shall be able to configure IED, add additional analogue measurements, digital I/Os, modify interlocking logics etc. for additional bays/equipment which shall be added in future.

1.43 **Cybersecurity**

a. TPCODL reserves right to nominate any site limiting to 4 numbers for cyber security audit. Bidder to note that Gaps identified during the audit shall be rectified, closed and re-audited by the bidder. Bidder Shall submit and certify all the 11 Nos. sites are Cyber Security Compliant as per the NCIIPC, CERT-IN and other standard mentioned in the RFP. Bidder shall submit the List of Auditor (Certified by GoI for OT Technology) for selection of auditor for this project and Bidder to consider Audit Charges in the bill of the material as applicable.

b. Secure access- Level Wise enabling of settings with User Rights should be incorporated with Password protection in the RTU. Each User shall have his/her own User Id & Passwords.

c. User Credentials to access RTU shall be authenticated through TPCODL Active directory Server.

d. All actions/modifications/deletions shall be logged in the RTU. These logs shall be pushed to TPCODL Central Asset Management system/SOC.

e. It shall be possible to access the RTU through a web browser (Https Support) anywhere from the LAN for configuration, diagnosis, monitoring, file upload & download, simulation and log retrieval by using appropriate user account management viz. Role based access control & password complexity

f. The RTU should also supports Authentication and Authorization of individual users, Security logging.

g. RTU shall be NERC-CIP/NIST 7628, IEC62351, IEC 62443 and IEEE 1686 compliant.

h. RTU shall be enabled with System hardening viz. disabling/removal of unused ports and services.

i. RTU Should support System Audit Logs, SYS logs etc.

1.44 **Reliability**

Reliability of the equipment's offered shall be better than 99.9999% per year availability for overall end equipment. RTU relatability and availability calculation shall be provided with engineering document for approval.

All functional capability described herein shall be provided by the bidder even if a function is not initially implemented. As a minimum, the Interface module, communication interface along with other accessories shall be capable of performing the following functions:

a. Bidder to accommodate all RTU (Main and Stand-by), interface modules relays, Terminal Blocks in panel and shall judiciously optimize the space requirement. As described in the RFP, TPCODL is having a space constraint and prefer to accommodate all the hardware in a single panel.

b. Details of Digital Input, Output and Analog Input requirement are described in Item 1.34 of RTU specification.

c. The proposed Interface modules shall be suitable for decentralized and centralized architecture to address the requirement of present and future.

d. The proposed RTU, I/O and Interfacing modules shall be of the same family of RTU or Embedded, industrial grade system with high availability & reliability. Interface modules hardware shall be easily scalable for expansion.

e. All the interface modules shall be directly connected to the I/O modules of the RTU. In case bidder is proposing the use of remote I/O architecture, then proposed Remote I/O shall be of the same RTU family and communicate with Main and Redundant RTU seamlessly.

f. Auto Changeover of Main and Standby RTU shall also ensure the switching of non-redundant I/O system as envisaged in the RFP. This changeover from Main to Standby and vice-versa shall be bump less with no loss of data.

g. Remote I/O rack or individual interface module shall use the open protocol as of RTU. No proprietary protocol between Remote I/O and RTU is envisaged.

h. The proposed Remote I/O / Interface Modules shall provide the data to eight independent remote master (redundant) stations through RTU.

i. I/O interface System/Modules to the TPCODL SCADA Systems through RTU shall allow scanning & control of all defined points (Physical/Pseudo points) within the substation independently to each of the SCADA systems. Proposed system shall simultaneously respond to independent scans & commands from TPCODL SCADA/DMS/OMS Systems. It is envisaged that Proposed RTU system shall support the use of a different communication data exchange rate (bits per second), scanning cycle, and/or communication protocol for each remote control center. Also, each control center's data scan and control commands may be different for different data points within the proposed system's database, hence proposed I/O interface system shall also be supporting the required functionality.

j. The I/O Interface system can be 19" Rack mounted / Din Rail Mounted.

k. Bidder to note that, distributed configuration is not envisaged at RTU and at Interface System/Module level. The proposed Remote I/O or interface module configuration shall be part of the Main and Standby RTU, no separate configuration is envisaged at I/O interface System/Module level.

l. Web Server functionality to monitor and configure the RTU along with Substation IEDs by authorized users (AAA functionality) shall also be extended to monitor the I/O interface system.

m. Interface modules shall also be time synchronized through Main/Standby RTU for time stamping at I/O level.

n. SNMP protocol support required in RTU shall also be extended to I/O interface level.

o. Analog Input Interface module shall support resolution of 14 Bit + Sign.

p. Proposed I/O interface shall be completely aligned with resolution required for Digital I/Os and Analog Inputs.

q. User friendly on-line health and data monitoring facility shall be provided to maintenance engineer for monitoring/analyzing the real time status of the process, program logic from the engineering station (Configuration tool – Laptop) from local and Remote.

r. In case of power supply failure, auto start-up and restoration of the RTU along with I/O interface shall be possible without manual intervention.

s. All the Interface cards/modules must have conformal coating for protection against harsh environments.

t. The proposed I/O interface modules shall be certified by CPRI/ERDA/International Accredited Lab.

u. Continuous self-supervision function with self-diagnostic feature shall be included.

v. Remote I/O and RTU Communication Redundancy

- The Remote I/O interface system shall ensure the data to both Main and Standby RTU seamlessly, so that the RTU can send the entire data to Control Centre, even when one of the units fails.
- The failover process should cause the assignment of all the functions of the failed unit to the healthy unit. The changeover between the two redundant units shall be transparent and shall not require any manual intervention. The changeover process of the RTU/Remote I/O system shall be bump less and with no data loss.
- Main and Standby RTU shall support simultaneous communication with I/O interface system.

w. **Communication**

I/O interface system/modules shall communicate to Main and Standby RTU simultaneous and independently on open protocols. No Proprietary protocol is envisaged for communication between I/O interface system and RTU.

- Time synchronization over SNTP and Communication protocol from RTU/Master.
- SNMP (v1, v2c and v3) for Health monitoring of the Hardware

x. **Input / Output Requirement**

Input / Output interface system/module are envisaged to acquire the field information. Bidder to note that, the I/O requirement considered from hybrid architecture, i.e. Acquisition of I/O from IEDs and as well from proposed I/O module.

a. Analog input

b. Digital inputs

c. Digital outputs

1.44.24.1 **Analog Input Interface Module/System**

- Interface modules for Analog Input shall be in-line with proposed Analog Input modules.
- Analog Interface module shall be with knife edge fuse connector for each channel.
- The Interface module shall be with pluggable connector for field inputs, which can be removed without disturbing the filed cable during replacement of Interface module.
- Each interface module shall have common fuse and LED indication for Auxiliary Supply (48V DC +/- 20%). Same shall be monitored by RTU.
- Prefab cable of adequate length shall be used between Interface module and I/O module of the RTU. This cable shall also be with pluggable connector.

1.44.24.2 **Digital Input Interface Module/System**

- Interface modules for Digital Input shall be in-line with proposed Digital Input modules.
- Digital Input Interface module shall be with knife edge connector for each channel.
- The Interface module shall be with pluggable connector for field inputs, which can be removed without disturbing the filed cable during replacement of Interface module.
- Each interface module shall have common fuse and LED indication for Auxiliary Supply (48V DC +/- 20%). Same shall be monitored by RTU.

- Prefab cable of adequate length shall be used between Interface module and I/O module of the RTU. This cable shall also be with pluggable connector.

1.44.24.3 **Digital Output Interface Module/System**

- Interface modules for Digital Output shall be in-line with proposed Digital Output modules. For technical details please refer RTU Specification Item 1.34 (c)
- Each Digital Output shall be along with interposing relay for switchyard equipment Open/Close, device resetting commands.
- Bidder to shall also consider disconnecting type terminal blocks for field wiring of digital outputs.
- Digital Output Interface module shall be with knife edge connector for each channel.
- The Interface module shall be with pluggable connector for field outputs, which can be removed without disturbing the filed cable during replacement of Interface module.
- Each interface module shall have common fuse and LED indication for Auxiliary Supply (48V DC +/- 20%). Same shall be monitored by RTU.
- Prefab cable of adequate length shall be used between Interface module and I/O module of the RTU. This cable shall also be with pluggable connector.

y. **Self-Supervision**

a. The I/O interface system shall have extensive self-supervision including all functional module and communication channel.

b. The I/O interface system shall have LEDs for healthiness / error indication

c. Each I/O interface system/modules shall be independent from each other and its functioning shall not be affected by any fault occurring in any of the equipment of the station.

d. In case of restoration of communication links, power supply after failure, the software along with hardware shall be capable of automatically synchronizing with the remaining system without any manual intervention.

z. **Power Supply**

a. The I/O interface System/Modules shall be powered from the 18-72 VDC (24/48 V DC) Power. The I/O interface system/modules shall accept power from the DC system with the following characteristics:

b. Bidder shall consider Dual Input Source used for energizing the RTU along with Diode-Oring unit for I/O interface System/Modules.

c. The voltage may vary during normal operation between these limits with a duration not less than 1 msec.

d. Reverse polarity protection.

e. The I/O interface System/Modules shall operate with grounded input power from TPCODL

f. The I/O interface System/Modules shall have adequate protection against reversed polarity, over current and under voltage conditions.

g. Each Input / Output Supply within the panel shall be through power supply distribution module with MCBs with NO contacts (for supply monitoring).

aa. **Time Synchronization**

a. I/O interface System/Modules time synchronization shall be through RTU.

b. Timing Accuracy: The I/O interface System/Modules shall time-tag event reports to an absolute accuracy of 1 msec or better.

c. I/O interface System/Modules shall generate an alarm if it gets drifted or loose the synchronization signal.

d. With each power cycle the I/O interface System/Modules shall time synchronize with RTU.

bb. **Environment requirements, Reliability & Cooling**

a. The I/O interface System/Modules panel shall have high reliability in operation and shall not use cooling fans. The unit shall have vermin proof enclosure and shall insulate electronics, internal components and electronics from external environment in order to avoid failures due to dust, humidity, fungus etc.

b. The I/O interface System/Modules Panel hardware installed in Switchyard shall comply to IP54 enclosure.

c. The I/O interface System/Modules panel shall be installed in Substation control room buildings with no temperature or humidity control. RTUs shall be capable of operating in ambient temperature from 0 to +65-degree C with rate of temperature change of 20-degree C/hour and relative humidity 95%, non-condensing.

cc. **Expansion in future**

Offered system shall be suitable for extension in future for additional I/O requirement. During such event, normal operation of the existing substation shall be unaffected, and system shall not require a shutdown. The Bidder shall provide all necessary hardware and complete set of software tools along to perform addition of bays in future and complete integration with RTU

System**.** These hardware and software tools shall be able to add additional analogue measurements, digital I/Os etc. for additional bays/equipment which shall be added in future.

1.45 Engineering Station (Laptop)

Engineering LAPTOP shall be industrial grade LAPTOP system loaded with software for RTU configuration, diagnosis, simulation, Logic development in RTU Also, shall be loaded with configuration and management software of RTUs, BCUs on IEC 61850 LAN.

A tool for user friendly engineering and disturbance handling shall be available.

a. Engineering laptop shall have SSD hard disk (Minimum 1 TB). Refer BOM for the configuration.

b. Configuration of all input and output logical, communication interfaces and other built-in functions and signals shall be possible both locally and remotely from the Master Station for configuration & maintenance activity.

c. Configuration application shall have multilevel passwords to safeguard control, logic, and automation settings.

d. Data collection, data modelling, configuration and parameter setting

e. Engineering of process information for automation and control center systems

f. Engineering of process information for automation of non-bidder systems and their individual parameters.

g. User friendly on-line monitoring facility of real time data shall be provided to maintenance engineer for monitoring/analyzing the real time status of the process, program logic from the engineering station.

a. **Configuration Application**

a. SCL Tool shall be used to model the (IEDs) as stipulated in the standard IEC 61850. SCL Tool shall be capable of generating the configuration files for any IEC 61850 compliance IED.

b. The main functions that the application shall perform are:

c. Read and edit any type of configuration file compliant with the defined restrictions by the schema of the SCL language.

d. Model devices from the libraries of Logical Nodes (LNs), Common Data Class (CDCs) and Common Data Attributes (CDAs) defined in the norm.

e. Generation of the modelling and SCL configuration files for devices IEC 61850.

f. Capacity to manage projects with several devices, generating the files for the configured devices.

g. Visualization and edition of the components of the standard library of the norm. This can be customized with user additions or generate custom libraries for specific projects.

h. Export files of data templates (Data Type Templates) that can be reused to model new devices. This avoids the need to create all these sections in new models.

i. Compatible with IEC 61980-6 Ed:1, Ed:2, and other associated models like IEC 61850-7-410, IEC 61850-7-420

j. Create SCD / SSD / SED / ICD / IID SCL Files

k. Import & Export of SCD / SSD / SED / ICD / IID / CID SCL Files

l. Facilitate enhanced management of SCL files and its validation

m. Wizard for handling major process and work flow

- SLD Wizard: to draw and add Substation Configurations to the Project
- IED Configuration Wizard: to add and edit IED Configurations to the project
- SCD Wizard: to add external SCDs /SEDs to the Project

n. Library Support

- SLD library support for reusing substation drawings in multiple projects
- Data model library as per IEC 61850-6 Ed:1 and Ed:2
- Flexible design that enable user to create & edit data model library

b. **RTU/IED simulator & protocol analyzer software tool**

a. RTU simulator tool shall be provided to test the communication interfaces of Master station, RTU, RTU and IEDs.

b. The Master station simulator tool shall be capable of emulating the master station on open protocol such as IEC 60870-5-104, 101, 103, Modbus, & IEC61850 etc. The RTU simulator shall also be capable of emulating the slave protocols for all the applicable open protocols. Bidder shall submit the details of the offered simulator packages along with the bid.

c. The protocol analyzer shall be used to monitor all communication traffic on a channel (between Master station & RTU/RTU & between RTU/RTU & IEDs without interfering channels operation. Channel traffic captured in the active or passive modes of operation shall be displayed.

d. The Master station simulator and protocol analyzer tool shall be provided and shall have following features:

- Each received message shall be checked for validity, including the check sum.

- The tool shall maintain and display error counters so that the number of errors during a period of unattended testing can be determined.
- All fields of a message shall be displayed. A pass/fail indication for the message shall be included.

c. **HMI software tool**

- Two Numbers of HMI Configuration Licensed tool shall be provided for Monitoring and controlling of Substation from Laptop
- HMI Configuration tool and RTU shall be of same OEM.
- HMI shall support 5000 IOs.

1.46 Layer 2 Industrial Grade Managed Ethernet Switch

Technical specifications for the Managed Layer 2 Industrial grade, 61850-3 compliant Ethernet switch is given below:

a. The switch shall be of industrial grade type designed for continuous operation.

b. Switch shall have minimum 24 ports – RJ45 / Fibre ports of 10/100 Mbps

- No. of CU Ports : 24 CU Ports

c. Switch shall be 19-inch rack mountable with Power Socket and Ports at rear side

d. LED indicators for link establishment and data transfer for each port

e. Should support remote configuration

f. It should own separate maintenance/console port

g. Latency shall not be more than 10 µs.

h. Should support SNMP Server v1.0/v2.0/v3.0

i. Should be KEMA Certified or equivalent

j. All the cards/modules of the Switch must have conformal coating for protection against harsh environments.

k. Switch shall support IEEE802 series for VLAN, RSTP, MSTP and Suitable for ring configuration etc.

l. Switch shall be IEC 61850 EMC and operating conditions for Power Substations environment.

m. Switch shall be IEEE 1613 Environmental Standard for Electric Power Substations environment.

n. Switch shall have design for minimum Heat generation and high MTBF (minimum time between failure)

o. Switch shall Support Simple plug and play operation - automatic learning, negotiation, and crossover detection

p. Switch shall Support Quality of Service (802.1p) for real-time traffic

q. Switch shall Support SNTP time synchronization (client and server) for synchronization of networks

r. Switch shall Support Industrial automation features (e.g. Modbus, Ethernet/IP and IEC61850 protocols for transparent data transmission)

s. Switch shall be suitable for PRP/HSR configuration and devices.

t. Switch shall Support Management Tools like:

- Web-based, Telnet & Command Line Interface (CLI) for quickly configuring major managed functions
- SNMPv1/v2c/v3 for different levels of network management
- Remote Monitoring (RMON)
- Rich set of diagnostics with logging and alarms
- Bidder shall supply Console Cable along with each switch

a. **LAYER 2 features**

a. The Switch should support Layer 2 switch ports with Secure VTP or similar protocols to reduce administrative burden of configuring VLANs on multiple switches in turn eliminating the configuration errors & troubleshooting in secure manner.

b. The Switch should support Rapid Spanning Tree Protocol & Multiple Spanning Tree Protocol.

c. The Switch shall have IEEE compliance for 802.1Q VLAN, 801.2p, 802.1d STP, 802.3ad (Port aggregation), 802.1w RSTP, 802.1s MSTP, 802.3ad LACP, IEEE 802.1ab Link Layer Discovery Protocol.

d. The switch should have support for Port mirroring

e. The Switch should be able to discover the neighboring device of the same vendor giving the details about the platform, IP Address, Link connected through etc, thus helping in troubleshooting connectivity problems or equivalent

f. The Switch should support a mechanism to prevent edge devices not in the network administrator's control from becoming Spanning Tree Protocol root nodes

b. **Management features**

a. Switch Latency period: 7 Microsecond or better

b. Transfer Rate of the Switch: 50.4 Gbit/sec

c. The Switch should support SNMP v2c, V3

d. The Switch should support Configurable SNMP traps

e. The Switch should support Logging to syslog with time stamp

f. Java Run time version - Latest

g. The Switch should support NTP, SNTP support.

h. Full environmental monitoring of PSUs, Fans, temperature and internal voltages, with SNMP traps to alert network managers in case of any failure

c. **Power supply**

a. Redundant 18-72 V DC power supply module, with ±15% tolerance

b. Separate MCB with appropriate rating shall be used to power up the Switch

c. Provision for connecting redundant power supply option should be available.

d. **Environmental**

a. The switches should have IEEE 802.3az Energy efficient Ethernet and ROHS compliance

b. Switch should be capable of operating under normal room temperature without the requirement of Air conditioning.

c. Conformal Coating: Required

d. Operating Temperature: -5° to +85°C.

e.

IEC60068-2-1	-	Cold Temperature
IEC60068-2-2	-	Dry Heat
IEC60068-2-30	-	Humidity (Damp Heat, Cyclic)
IEC60068-21-1	-	Vibration
IEC60068-21-2	-	Shock, IEC61850-3- Environmental

e. **Product Conformity**

Product Conformity	TPCODL Requirement
IEEE 802.3-10BaseT	Yes
IEEE 802.3u-100BaseTX	Yes
IEEE 802.3u-100BaseFX	Yes
IEEE 802.3ab-1000BaseT	Yes
IEEE 802.3ad-Link Aggregation	Yes
IEEE 802.3x-Flow Control	Yes
IEEE 802.1d-MAC Bridges	Yes
IEEE 802.1d-STP	Yes
IEEE 802.1p-class of service	Yes
IEEE 802.1Q-VLAN tagging	Yes
IEEE 802.1Q-2005 (formerly IEEE 802.1s) MSTP	Yes
IEEE 802.1w-RRST	Yes
IEEE 802.1x-port based Network Access Control	Yes

1.47 Multi-Function Meter (MFM)

Bidder to consider Multifunction meter for each 33, 11 kV feeders and RMU which shall be mounted on the CRP panel for 33 kV , 11 kV feeders and RMU Panel. These meters shall be integrated to RTU on MODBUS. Separate MFM shall be considered for Bus PTs (Bus Voltages). In case these meters are required to put in daisy chain, no more than ten MFM shall be considered in each loop.

Sl. No.	Description	Functionality Expected
1	Sampling rate	128 samples per cycle for true RMS measurement
2	Voltage Input	0 to 690VAC
3	Voltage Burden	< 0.15VA
4	Current Input	1 A or 5A Site selectable
5	CT Burden	0.1VA
6	CT range	0.1% to 200%
7	Current over range	Three times continuously, eighty times for one sec
8	Accuracy kW / kWH	0.5S as per IEC62053:22
9	Real time & average parameters	Required
10	Four quadrant measurement	Required
11	LED Load Bar Indication	Optional

12	Self Diagnostic LED	Required
13	Real time clock	Required
14	Min./Max of parameters	Required
15	THD	Required
16	Individual Harmonics upto 39th	Required
17	Real time waveform monitoring	Standard software to monitor real-time waveform
18	RS485 communication	Min 1 port
19	Isolation	Galvanic
20	Communication protocols	MODBUS RTU, ASCII, selectable at site
21	User defined registers	Preferred
22	Energy pulse LED for calibration test	Required
23	Relay output	Optional
24	Aux. power supply	48 V DC +/- 20%
25	Ambient operating temperature	-20 to 60 ºC
26	Mounting Panel cutout	92 x 92 mm

1.48 Temperature & Humidity Sensor

a. **Functional Requirement**

Temperature & Humidity Sensor is required for measurement of climatic condition of (temperature and humidity) Switchyard / Switchgear / Control Room.

b. **General requirement**

a. Transmitter shall be Microcontroller based design

b. Isolated 4-20 mA proportional and linearized for both Temperature and % Humidity

c. RS 485 MODBUS RTU serial interface or Ethernet TCP/IP (optional)

d. Local display for temperature and humidity

e. Transmitter shall also be suitable for outdoor application (Switchyard); Bidder shall consider necessary protection for outdoor application

f. Mounting arrangement: Suitable for wall mounting, all necessary mounting accessories, cables etc. shall be included in the offer with the transmitter

g. Auto-diagnostic and Auto correction sensors

h. Analog output shall be selectable and scalable

i. Heat from the electronic components shall not affect the sensors.

j. Bidder shall specify the frequency of calibration required for the offered model for desirable accuracy. Bidder shall also mention that the calibration can be done at site by the TPCODL or required to be sent to the OEM

Sl. No.	Description	Functionality Expected	Bidder Response
1	Make		
2	Model		
3	Operating Range	-40.0 to + 85 °C (Temperature)	
		0.0 to 100.0% RH (RH)	
4	Measuring Range	-40.0 to + 65 °C (Temperature)	
		0.0 to 100.0% RH (RH)	
5	Accuracy	Temperature: +/- 0.1 °C	
		RH: +/- 0.1 % RH @ 24 °C	
6	Long term stability for humidity sensor	< 1% RH / Year	
7	Local Display	4 Digit (min), red, Seven Segment Display, Independent displays for T & % RH, Visible at least from 15 mtrs.	
8	Power Supply	. 18-72V DC	
9	Output for Temperature & % RH	1) Temperature – 4-20 mA proportional to temperature range as mentioned in item 2 (14-bit resolution) 2) % RH – 4-20 mA proportional to % RH range as mentioned in item 2 (14-bit resolution)	
10	Min / Max Load	. V-signal ≥ 1Kohms/V, mA-signal ≤ 500 ohms	
11	Serial Output	. Isolated 4 wire / 3 wire RS 485 electrical port with MODBUS protocol Or . Ethernet Port with RJ45 connector and on open protocol	

12	Front Keyboard	. Required for programming and calibration	
13	Enclosure (Size)	. Robust Industrial Housing, Suitable for Internal and External use	
14	Additional Enclosure for Outdoor Application	. Transmitter shall be mounted in the industrial grade weather proof Box	
15	Mounting Arrangement	. Wall mounted, necessary mounting arrangement shall be included in the offer for internal and external use	
16	Protection	. Necessary protection shall be provided for the sensors	
17	Protection Rating	. IP 65	

1.49 Networking Accessories

a. **Patch Panel**

All structured Ethernet copper cabling shall be terminated on of Cat 6 E type patch panels on L2 switch side.

Preferred make: Systemax

b. **I/O Box**

All the structured CAT6 cabling on the device side shall be terminated on I/O boxes.

Preferred make: Systemax

c. **Ethernet Patch cords**

All the terminations on the switches / devices shall be done using factory crimped, flexible Cat 6 E UTP Patch cords of suitable length.

Preferred make: Systemax

1.50 RTU Panel

a. **Panel and other Accessories**

a. All the panels shall be of IP54 class and industrial grade.

b. Control panel shall be suitable for bottom cable entry.

c. Interconnection between panels shall be by prefabricated cables.

d. The Bidder shall submit the GA drawing considering the maintenance and aesthetic requirements and submit the drawings along with bill of material for TPCODL review.

e. The bidder shall guarantee the satisfactory functioning of the system hardware mounted in the panels even in the event of failure of air-conditioning.

f. Proper size Cable trays shall be provided in the panel after reviewing the number of cables to be terminated in the panel.

g. Enough space (for easy termination, for easy viewing of cable tags) shall be provided between the terminal channels and cable trays.

h. Terminals shall be distributed functionally in the panel.

i. Panel door locks shall have the common key.

j. Acrylic glass sheet shall be provided, wherever the power cables & terminations are exposed and prone to be fatal.

k. Electrostatic strap shall be fitted with each panel.

b. **Sheet Metal Work**

The panel frame shall be fabricated using suitable mild steel structural sections or pressed and shaped cold rolled sheet steel of thickness not less than 2.5 mm.

Frames shall be enclosed by cold rolled sheet steel of thickness not less than 2 mm, smoothly finished, leveled and free from flaws. Stiffeners shall be provided wherever necessary. The Panels shall be provided with MS Base Channel of 75 x 50 mm

All panel edges and door edges shall be reinforced against distortion by rolling, bidding or by the addition of welded reinforcement member.

Cut-Outs shall be true in shape and devoid of sharp edges.

The complete structure shall be rigid, self- supporting, free from vibration, twists and bends.

c. **Constructional Features**

SAS cabinet shall be indoor type, floor mounted, with dimension (2315(H) x 800(W) x800(D)) and both sides opening with swing frame. Front glass door with 19” rack arrangement.

Anti-vibration pad of 15 mm thickness should be provided. Panel base frame should be of 100 mm height.

The panel shall be -

a. Panel shall be of the metal enclosed indoor, floor mounted.

b. Preferred make of panel shall be

- RTU – Rittal make

c. Made up of the requisite vertical sections.

d. of dust, moisture and vermin proof construction

e. It shall have lifting i-bolts for hooks of good capacity and even distributed lifting. Test certificates shall be available for the lifting bolts.

f. Suitable to provide a degree of protection of not less than IP 54 as per IS: 2147.

g. It is the responsibility of the bidder to ensure that the equipment specified, and such unspecified complementary equipment required for completeness of the SAS design shall be properly accommodated in the panel, in such a way that the maintenance, identification, isolation of any component or circuit shall be easy. Equipment shall be mounted such that removal and replacement can be carried out individually without affecting the services of the adjacent devices. No price increase at a later date on this account shall be allowed.

h. Of self-cooled design with adequate louvers on sides. The louvers shall have screens and filters on inner side of panel. The screens shall be of fine wire mesh made of brass or GI wire.

i. Shall have maintenance access to the hardware and wiring through lockable full height doors.

j. Shall have the provisions for bottom cable entry.

k. The safety ground shall be isolated from the signal ground and shall be connected to the ground network each ground shall be a copper bus bar. The grounding of the panels to the owner's grounding network shall be done by the contractor.

l. All panels shall be supplied with 230 V AC, 50 Hz, single-phase switch and socket arrangement for maintenance.

m. RTU and interface panels shall be provided with 2 Nos. (One front side and one rear side) internal maintenance lamps (CFL) and space heaters and gaskets.

n. All panels shall be indoor, dust-proof with rodent protection, and meet IP54 class of protection for indoor and IP6x for outdoor application.

o. There shall be no sharp corners or edges. All edges shall be rounded to prevent injury.

p. Document Holder shall be provided inside the cabinet to keep test report, drawing, maintenance register etc.

q. Provided with labels on the front and rear indicating the panel designation.

r. Proper provision must be provided for the entry of FO cables and Ethernet cables at the bottom. AC & DC incoming cable entry provision should also be there.

s. Provided with pocket on rear door for keeping A4 size copy of panel drawings.

t. Provided with 4 nos. of lifting hooks.

u. Provided with neoprene gaskets all-round the perimeter of covers, gland plates, removable covers and doors.

v. 150 sq.mm copper earth bar must be provided for equipment earthing.

w. All sheet steel work shall be degreased, pickled, phosphate and then applied with two coats of zinc chromate primer and two coats of finishing synthetic enamel paint, both inside and outside. The paint shade shall be Siemens Grey (RAL 7032). The final finished thickness of paint film on steel shall not be less than 100 microns and shall not be more than 150 microns.

x. For every distribution of AC and DC circuits MCB's must be provided. These MCB's must be rated according to the load on the distributed circuit.

y. Each RTU/Gateway, Switch panels shall be provided with 20% spare terminals.

z. If I/O interface boards are used for field input connection proper isolation facility shall be provided. Preferably disconnecting type of terminal blocks shall be used for all inputs.

aa. Interconnection between panels shall be by prefabricated cables.

bb. Terminal blocks shall be having provision for isolation, with full-depth insulating barriers made from moulded self-extinguishing material. Terminal blocks shall be appropriately sized and rated for the electrical capacity of the circuit and wire used. No more than two wires shall be connected to any terminal. Required number of TBs shall be provided for common shield termination for each cable.

cc. All materials used in the enclosures including cable insulation or sheathing, wire troughs, terminal blocks, and enclosure trim shall be made up of flame-retardant material and shall not produce toxic gasses under fire conditions

dd. Proper lighting arrangement shall be made on both sides of the panel if both sides of the panels are used.

ee. Space heater with thermostat shall be provided in the panel to maintain the required temperature.

ff. Disconnecting type terminal blocks shall be used for CT, PT and for all Digital Outputs.

gg. Enough space (for easy termination, for easy viewing of cable tags) shall be provided between the terminal channels and cable trays.

hh. Terminals shall be distributed functionally in the panel.

ii. The panel shall also have a document pocket.

jj. Horizontal and vertical Grounding bus shall be provided in the panel. Green coloured wires shall be used for grounding purpose. Cable gland plate fitted on the bottom of the panel shall be connected to earthing of the Panel/Station through a flexible braided copper conductor rigidly.

d. **Wiring /Cable Requirements**

The RTU panels shall gather all signals from and to the devices located in Control & Relay panels in the substation control room. Pre-wired and prefabricated cabling may be used. All wires that carry low-level signals shall be adequately protected and separated as far as possible from power wiring. All wires shall be identified either by using ferrules or by color coding. In addition, cables shall be provided with cable numbers at both ends, attached to the cable itself at the floor plate where it enters the cubicles. The cable distance shall be site surveyed by the bidder. The distance between RTU panels and Control & Relay panels in the substation control room is approximately 30 mtrs. These cable lengths mentioned are for indicative purpose only. The bidders are required to quote as per their site survey

The external Cabling between the RTU and CRP panels shall use shielded cables. The external cables (except communication cables) shall have the following characteristics:

a. All cables shall have stranded copper conductor

b. Minimum core cross-section of (3/20) 2.5 mm² for Control outputs and 0.5 mm² for Status inputs

c. Minimum core cross-section of (3/20) 2.5 mm² for PT cables and for CT cables.

d. Rated voltage Vo/V of 0.6 / 1.1kV

e. External sheathing of cable shall have oxygen index not less than 29 & temperature index not less than 250. Cable sheath shall meet fire resistance test as per IS 1554 Part- I.

f. Shielding, longitudinally laid with overlap.

g. Dielectric withstand 2.5 kV at 50 Hz for 5 minutes

h. External marking with manufacture's name, type, core quantity, cross-section, and year of manufacture.

i. The Communication cable shall be of shielded, twisted pairs and of 0.22sq mm² size with dielectric withstand of 1 kV at 50 Hz for 1 minute.

RTU cabinet shall be wired with all the DC distribution wiring and AC wiring for the Illumination and fans. Following sizes of wires shall be

Color Codes

DC wiring	**1.5 sq.mm**	**Red/Black**
AC wiring	**1.5 sq.mm**	**Red/ Black**

Engraved identification ferrules marked to correspond with the wiring diagram shall be fitted at both ends of each wire. These ferrules shall fit tightly on the wires and should not fall off when the wire is removed. The wires should be terminated on terminal blocks using soldering crimping type of tinned copper lugs. Insulated sleeves shall be neatly punched and cleaned without affecting access to equipment mounted within the cabinet. Wiring troughs shall be provided for cable routing inside the cabinet. One piece molded, 650 V grade terminal blocks complete with insulated barriers, screws, identification strips shall be used. Terminals links shall be of Elmex or Connect well make. Terminals for power connections shall be adequately rated for the circuit current and the rating of other terminal blocks for central indication etc. shall not be less than 15 amps. At least twenty percent spare terminal blocks shall be provided. All the terminal blocks should be provided with proper identification strips. Terminal blocks shall be provided with transparent acrylic covers.

All internal wiring shall be securely supported, neatly arranged, readily accessible and connected to equipment terminals and terminal blocks. Cable ways & troughs shall be used for this purpose.

Wire termination shall be made with solderless crimping type and tinned copper lugs, which firmly grip the conductor. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wire and shall not fall off when the wire is disconnected from terminal blocks.

e. **Labels**

All equipment shall be provided with individual labels with equipment designation engraved. Also, the control cabinet shall be provided on the front with a label engraved with designation of the cabinet as furnished by TPCODL. Labels shall be made up of non-rusting metal or 3 ply lamicoid. Labels shall have white letters on black or dark blue background. Sizes of labels and lettering are subject to TPCODL approval.

Manufacturer's label should be provided at the rear door, which should mention the project ref, substation, P.O ref, circuit details, drawing ref.

f. **Earthing Terminals**

Control cabinet shall be provided with two separate earthing terminals suitable to receive TPCODL earthing conductors of size specified.

Positive connection between all the frames of equipment mounted in the switchboard and earth bus bar shall be provided by using insulated copper wire/bars bus bars of cross section equal to that of the bus bar or equal to half the size of circuit load current carrying conductor, whichever is smaller.

All equipment shall be connected to the earth busbar using 1100/650V grade PVC insulated 2.5 sq.mm stranded tinned copper earthing conductor.All hinged doors shall be positively connected to the earthing bus terminals, with the help of braided copper conductors of adequate size.

An electrostatic discharge arrangement shall be provided in each panel so as to discharge human body before he handles the equipment inside the panels

g. **Terminal Blocks**

Terminal blocks shall be having provision for disconnection (isolation), with full-depth insulating barriers made from mounded self-extinguishing material. Terminal blocks shall be appropriately sized and rated for the electrical capacity of the circuit and wire used. No more than two wires shall be connected to any terminal. Each analog input signal, digital status input and digital output signals shall require two terminals per point plus a common shield termination for each cable. All terminal blocks shall be suitably arranged for easy identification of its usages such as CT circuits, PT circuits, analog inputs, status inputs, control outputs, auxiliary power supply circuits, communication signals etc.

1.51 RTU Test

The contractor shall supply type tested RTU. The bidder shall submit RTU type test reports along with the bid for the same and model of RTU. The type test reports minimum shall include the tests indicated in Table 1 and 2. Type test reports as per other equivalent standards are also accepted provided, they meet or exceed minimum requirements specified in this specification. In case the RTU type test report do not meet specification requirements, the relevant type tests shall be performed without extra cost to TPCODL. The vendor should submit proof of RTU certificate (As conforming to IEC 61850, IEC 60870-5-104/101) BY KEMA.

Routine test to be performed in the factory and the field test to be performed in the site on the RTU panels are indicated in Table – 1.

Test No.	DESCRIPTION OF THE TEST	Type test	Routine test	Field test
1.**0**	**Functional Tests for RTU**			
1.1	Check for BOQ, Technical details, Construction & Wiring as per RTU drawings		√	√
1.2	Check for RTU database & configuration settings		√	√

1.3	Check the operation of all Analog inputs, Status input & Control output points of RTU		√	√
1.4	Check operation of all communication ports of RTU		√	√
1.5	Check for communication with multiple master stations using partitioned databases		√	√
1.6	Check for auto restoration of RTU on DC power recovery after its failure		√	√
1.7	Test for RTU self-diagnostic feature		√	√
1.8	Test for RTU time synchronization from Master and GPS		√	√
1.9	Test for RTU SOE feature		√	√
1.10	Test for down loading of RTU data base from master station		√	√
1.11	End to end test (between RTU & Master station) for all I/O points			√
1.12	RTU Analog accuracy test for Analog inputs		√	
1.13	Test for RTU operation with DC power supply voltage variation		√	
1.14	Test for RTU internal Clock stability		√	
1.15	Test for RTU Noise level measurement		√	
1.16	Test for IEC 60870-5 -104 & IEC 61850 protocol implemented and matching with protocol profile of existing RTU		√	
1.17	Test for Control Security and Safety for Control outputs		√	√
1.18	Other functional tests as per technical specification requirements		√	
1.19	Test for RTU as Data concentrator for IEC 60870-5-104 and MODBUS, IEC60870-5-103 protocol		√	√
1.20	Test for operation of redundant CPU and Power supply unit		√	√
1.21	Test for Modems		√	√
2.0	**EMI/EMC Immunity Tests for RTU**			
2.1	Surge Immunity Test as per IEC 60870-2-1	√		
2.2	Electrical Fast Transient Burst Test as per IEC-60870-2-1	√		
2.3	Damped Oscillatory Wave Test as per IEC 60870-2-1	√		
2.4	Electrostatic Discharge test as per IEC 60870-2-1	√		
2.5	Radiated Electromagnetic Field Test as per IEC 60870-2-1	√		
2.6	Damped Oscillatory magnetic Field Test as per IEC-60870-2-1	√		
2.7	Power Frequency magnetic Field Test as per IEC-60870-2-1	√		
3.0	**Insulation Test for RTU**			
3.1	Power frequency voltage withstand Test as per IEC 60870-2-1	√		
3.2	1.2/50 µs Impulse voltage withstand Test as per IEC 60870-2-1	√		
3.3	Insulation resistance test	√		
4.0	**Environmental Test for RTU**			
4.1	Dry heat test as per IEC60068-2-2	√		
4.2	Damp heat test as per IEC60068-2-3	√		

End of Section-B

Section – C

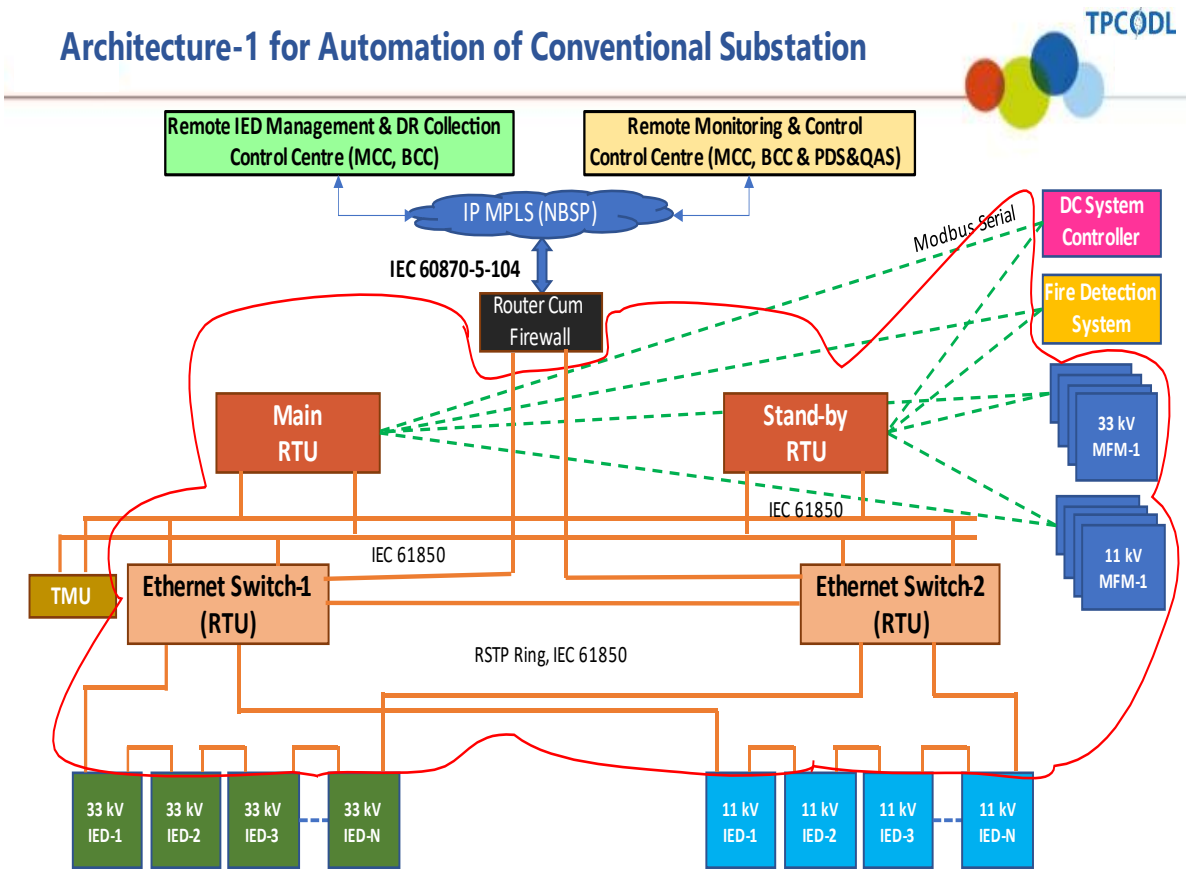
Annexures

CONTENTS:

The schematics, layouts, drawings in this section are indicative, bidder shall submit their best architecture, layout, drawings proposed as per specifications.

Annexure – 1 Indicative Proposed Sub-Station Automation System Architecture

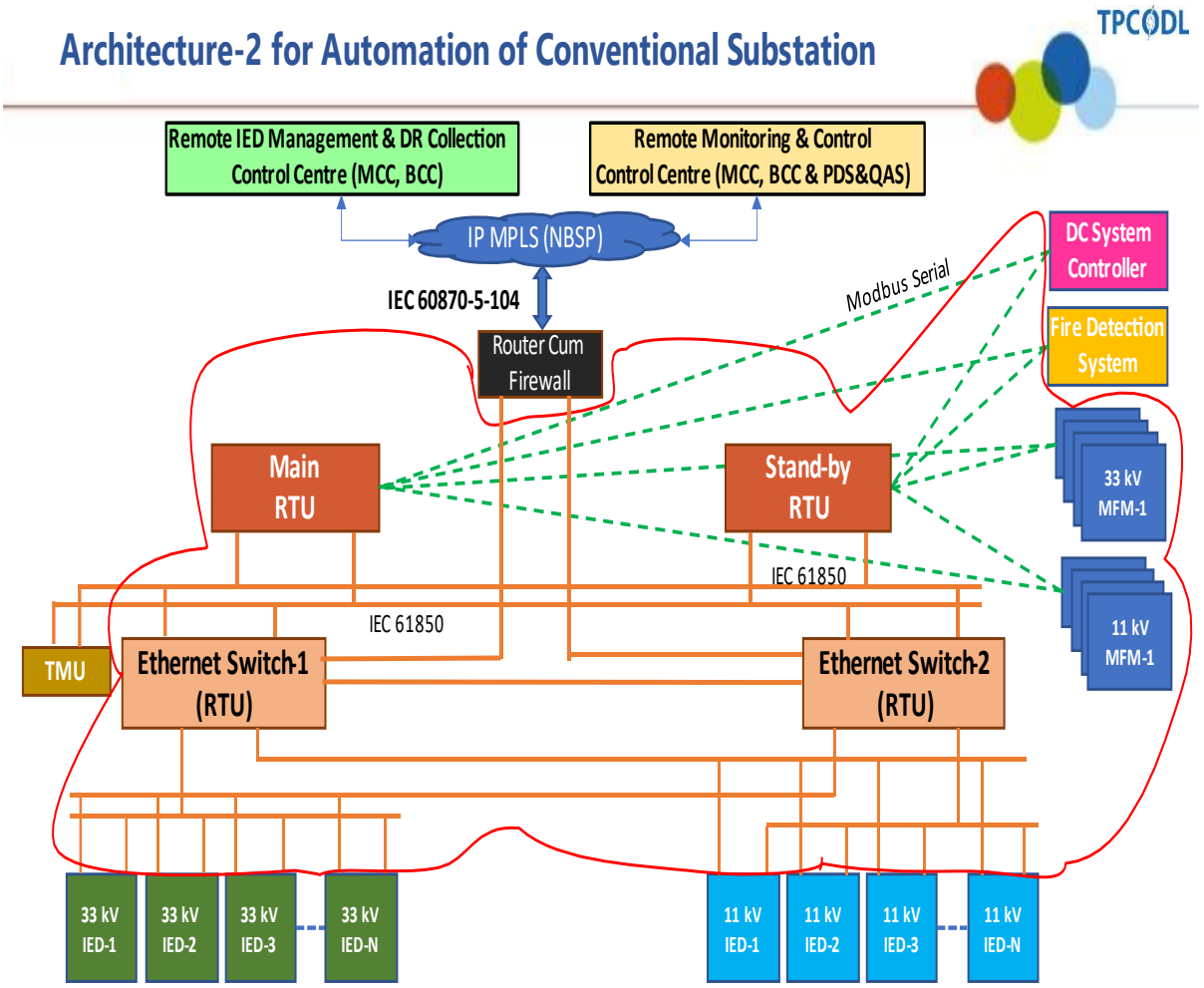
Proposed SAS Architecture Type # 1



Note for Bidder: Bidder shall give more emphasis on the following aspects in the proposed architecture

- Reliability Centric
- High Availability
- Cyber Security Resilience

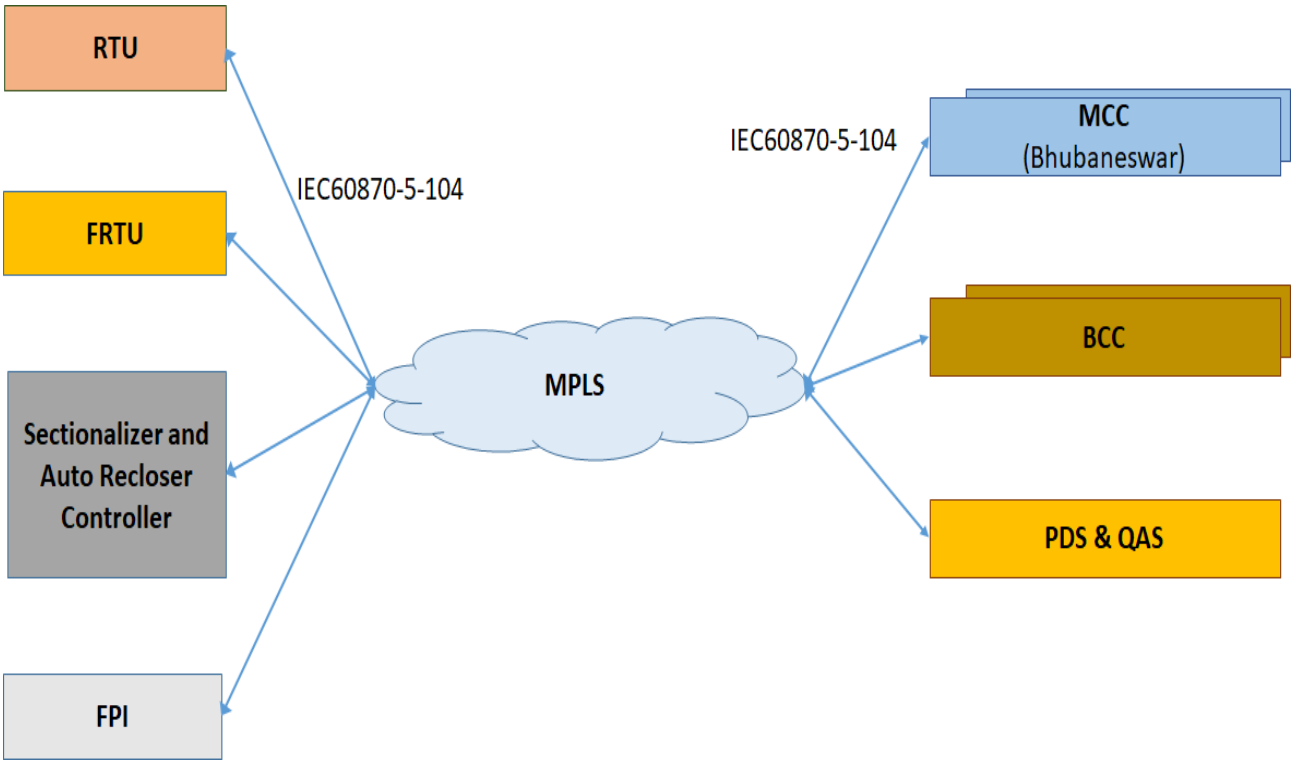
Proposed SAS Architecture Type # 2



Note for Bidder: Bidder shall give more emphasis on the following aspects in the proposed architecture

- Reliability Centric
- High Availability
- Cyber Security Resilience

Annexure – 2: Communication Architecture with Field Devices



Note for Bidder: Bidder shall give more emphasis on the following aspects in the proposed architecture

- Reliability Centric
- High Availability
- Cyber Security Resilience

Annexure – 3: Indicative Signal List

Feeder Name	Description	I/O LIST FOR RTU CONFIGURATION				I/O List for As-Is Integration of Conventional Substation (With Reference to RFP)			
		DPI / SPI DPC / SPC	Type (Hardwired / Soft - IEC61850)	*STATE 0*	*STATE 1*	DPI/SPI DPC/SPC	Type (Hardwired / Soft - IEC61850)	*STATE 0*	*STATE 1*
33 kV INC Feeder	**Digital Inputs**								
	Equipment and Protection Status								
	Circuit Breaker	DPI	Soft	OPEN	CLOSE	DPI	Hardwired	OPEN	CLOSE
	Bus Side Isolator	DPI	Soft	OPEN	CLOSE	DPI	Hardwired	OPEN	CLOSE
	Line Side (Outdoor) Isolator	DPI	Soft	OPEN	CLOSE	DPI	Hardwired	OPEN	CLOSE
	Line Side (Indoor) Isolator	DPI	Soft	OPEN	CLOSE	DPI	Hardwired	OPEN	CLOSE
	Line Side (Outdoor) Earth Switch	DPI	Soft	OPEN	CLOSE	DPI	Hardwired	OPEN	CLOSE
	Line Side (Indoor) Earth Switch	DPI	Soft	OPEN	CLOSE	DPI	Hardwired	OPEN	CLOSE
	Circuit Breaker Spring	SPI	Soft	DISCHARGED	CHARGED	SPI	Hardwired	DISCHARGED	CHARGED
	Local / Remote Switch Position	SPI	Soft	ON LOCAL	ON REMOTE	SPI	-	ON LOCAL	ON REMOTE
	Circuit Breaker Position	SPI	Soft	IN TEST	IN SERVICE	SPI	Hardwired	IN TEST	IN SERVICE
	Master Trip Relay (86 L/O)	SPI	Soft	RESET	OPERATED	SPI	Hardwired	RESET	OPERATED
	Trip Circuit-1	SPI	Soft	FAILED	HEALTHY	SPI	Hardwired	FAILED	HEALTHY
	Trip Circuit-2	SPI	Soft	FAILED	HEALTHY	SPI	Hardwired	FAILED	HEALTHY
	Earth Fault Protection	SPI	Soft	RESET	OPERATED	SPI	Soft	RESET	OPERATED
	Over Current Protection R Ph	SPI	Soft	RESET	OPERATED	SPI	Soft	RESET	OPERATED
	Over Current Protection Y Ph	SPI	Soft	RESET	OPERATED	SPI	Soft	RESET	OPERATED
	Over Current Protection B Ph	SPI	Soft	RESET	OPERATED	SPI	Soft	RESET	OPERATED
	Breaker Closed from TNC Switch	SPI	Soft	-	Alarm	SPI	-	-	Alarm
	PT Fuse	SPI	Hardwired	NORMAL	FAILED	SPI	Hardwired	NORMAL	FAILED
	Bus PT MCB	SPI	Soft	OFF	ON	SPI	-	OFF	ON
	Gas Pressure (CB Compartment)	SPI	Soft	NORMAL	LOW	SPI	-	NORMAL	LOW
	Gas Pressure (CB Compartment)	SPI	Soft	RESET	TRIP	SPI	-	RESET	TRIP
	Digital Outputs								
	Equipment Control								
	Circuit Breaker	DPC	Soft	OPEN	CLOSE	DPC	Hardwired	OPEN	CLOSE
	Bus Side Isolator	DPC	Soft	OPEN	CLOSE	DPC	-	OPEN	CLOSE

Feeder Name	Description	I/O LIST FOR RTU CONFIGURATION				I/O List for As-Is Integration of Conventional Substation (With Reference to RFP)			
		DPI / SPI DPC / SPC	Type (Hardwired / Soft - IEC61850)	*STATE 0*	*STATE 1*	DPI/SPI DPC/SPC	Type (Hardwired / Soft - IEC61850)	*STATE 0*	*STATE 1*
	Line Side (Outdoor) Isolator	DPC	Soft	OPEN	CLOSE	DPC	-	OPEN	CLOSE
	Line Side (Indoor) Isolator	DPC	Soft	OPEN	CLOSE	DPC	-	OPEN	CLOSE
	Master Trip Relay (86 L/O)	SPC	Soft		RESET	SPC	Hardwired		RESET
	Analog Inputs								
	Equipment Analog Signals								
	R Phase Current (Ampere)		Modbus RS485				Modbus RS485		
	Y Phase Current (Ampere)		Modbus RS485				Modbus RS485		
	B Phase Current (Ampere)		Modbus RS485				Modbus RS485		
	TOTAL Active Power (kW)		Modbus RS485				Modbus RS485		
	TOTAL Reactive Power (kVAR)		Modbus RS485				Modbus RS485		
	RY Phase Voltage (kV)		Modbus RS485				Modbus RS485		
	YB Phase Voltage (kV)		Modbus RS485				Modbus RS485		
	BR Phase Voltage (kV)		Modbus RS485				Modbus RS485		
	Frequency (Hz)		Modbus RS485				Modbus RS485		
	Power Factor (Pf)		Modbus RS485				Modbus RS485		
	Apparent Power		Modbus RS485				Modbus RS485		
	Kwh Export	Accumulator	COUNTER RS485			Accumulator	COUNTER RS485		
	Kwh Import	Accumulator	COUNTER RS485			Accumulator	COUNTER RS485		
	KVarh Export	Accumulator	COUNTER RS485			Accumulator	COUNTER RS485		
	KVarh Import	Accumulator	COUNTER RS485			Accumulator	COUNTER RS485		
33 kV TRF Feeder	**Digital Inputs**								
	Equipment and Protection Status								
	Circuit Breaker	DPI	Soft	OPEN	CLOSE	DPI	Hardwired	OPEN	CLOSE
	Bus Side Isolator	DPI	Soft	OPEN	CLOSE	DPI	Hardwired	OPEN	CLOSE
	Bus Side Earth Switch	DPI	Soft	OPEN	CLOSE	DPI	Hardwired	OPEN	CLOSE
	Circuit Breaker Spring	SPI	Soft	DISCHARGED	CHARGED	SPI	Hardwired	DISCHARGED	CHARGED
	Local / Remote Switch Position	SPI	Soft	ON LOCAL	ON REMOTE	SPI	-	ON LOCAL	ON REMOTE
	Circuit Breaker Position	SPI	Soft	IN TEST	IN SERVICE	SPI	Hardwired	IN TEST	IN SERVICE

Feeder Name	Description	I/O LIST FOR RTU CONFIGURATION				I/O List for As-Is Integration of Conventional Substation (With Reference to RFP)			
		DPI / SPI DPC / SPC	Type (Hardwired / Soft - IEC61850)	*STATE 0*	*STATE 1*	DPI/SPI DPC/SPC	Type (Hardwired / Soft - IEC61850)	*STATE 0*	*STATE 1*
	Master Trip Relay (86 L/O)	SPI	Soft	RESET	OPERATED	SPI	Hardwired	RESET	OPERATED
	Trip Circuit-1	SPI	Soft	FAILED	HEALTHY	SPI	Hardwired	FAILED	HEALTHY
	Trip Circuit-2	SPI	Soft	FAILED	HEALTHY	SPI	Hardwired	FAILED	HEALTHY
	Earth Fault Protection	SPI	Soft	RESET	OPERATED	SPI	Soft	RESET	OPERATED
	Over Current Protection R Ph	SPI	Soft	RESET	OPERATED	SPI	Soft	RESET	OPERATED
	Over Current Protection Y Ph	SPI	Soft	RESET	OPERATED	SPI	Soft	RESET	OPERATED
	Over Current Protection B Ph	SPI	Soft	RESET	OPERATED	SPI	Soft	RESET	OPERATED
	Oil Level (MOG)	SPI	Soft	NORMAL	LOW ALARM	SPI	-	NORMAL	LOW ALARM
	HV Winding Temperature	SPI	Soft	NORMAL	HIGH ALARM	SPI	-	NORMAL	HIGH ALARM
	LV Winding Temperature	SPI	Soft	NORMAL	HIGH ALARM	SPI	-	NORMAL	HIGH ALARM
	Oil Temperature	SPI	Soft	NORMAL	HIGH ALARM	SPI	-	NORMAL	HIGH ALARM
	Buchholz Relay	SPI	Soft	NORMAL	ALARM	SPI	-	NORMAL	ALARM
	Bus PT MCB	SPI	Soft	OFF	ON	SPI	-	OFF	ON
	RTCC SCADA Mode	SPI	Soft	OFF	ON	SPI	-	OFF	ON
	RTCC AUTO Mode	SPI	Soft	OFF	ON	SPI	-	OFF	ON
	RTCC MANUAL Mode	SPI	Soft	OFF	ON	SPI	-	OFF	ON
	RTCC IN OFF Mode	SPI	Soft	OFF	ON	SPI	-	OFF	ON
	RTCC Mode In	SPI	Soft	-	FOLLOWER	SPI	-	-	FOLLOWER
	RTCC Mode In	SPI	Soft	-	MASTER	SPI	-	-	MASTER
	RTCC Mode In	SPI	Soft	-	INDEPENDENT	SPI	-	-	INDEPENDENT
	RTCC Mode	SPI	Soft	OFF	ON	SPI	-	OFF	ON
	Over Fluxing Relay	SPI	Soft	NORMAL	OPERATED	SPI	-	NORMAL	OPERATED
	Differential Relay	SPI	Soft	NORMAL	OPERATED	SPI	Soft	NORMAL	OPERATED
	Restricted Earth Fault Relay	SPI	Soft	NORMAL	OPERATED	SPI	-	NORMAL	OPERATED
	HV Winding Temperature	SPI	Soft	NORMAL	HIGH-HIGH ALARM	SPI	-	NORMAL	HIGH-HIGH ALARM
	LV Winding Temperature	SPI	Soft	NORMAL	HIGH-HIGH ALARM	SPI	-	NORMAL	HIGH-HIGH ALARM
	Oil Temperature	SPI	Soft	NORMAL	HIGH-HIGH ALARM	SPI	-	NORMAL	HIGH-HIGH ALARM
	Buchholz Relay	SPI	Soft	NORMAL	OPERATED	SPI	-	NORMAL	OPERATED
	Oil Surge Relay	SPI	Soft	NORMAL	OPERATED	SPI	-	NORMAL	OPERATED

Feeder Name	Description	I/O LIST FOR RTU CONFIGURATION				I/O List for As-Is Integration of Conventional Substation (With Reference to RFP)			
		DPI / SPI DPC / SPC	Type (Hardwired / Soft - IEC61850)	*STATE 0*	*STATE 1*	DPI/SPI DPC/SPC	Type (Hardwired / Soft - IEC61850)	*STATE 0*	*STATE 1*
	Pressure Relief Valve	SPI	Soft	NORMAL	OPERATED	SPI	-	NORMAL	OPERATED
	OLTC Mode	SPI	Soft	ON LOCAL	ON REMOTE	SPI	-	ON LOCAL	ON REMOTE
	Transformer TAP Position	SPI	Soft	NORMAL	OUT OF STEP	SPI	-	NORMAL	OUT OF STEP
	Breaker Closed from TNC Switch	SPI	Soft	-	Alarm	SPI	-	-	Alarm
	Gas Pressure (CB Compartment)	SPI	Soft	NORMAL	LOW	SPI	-	NORMAL	LOW
	Gas Pressure (CB Compartment)	SPI	Soft	RESET	TRIP	SPI	-	RESET	TRIP
	Digital Outputs								
	Equipment Control								
	Circuit Breaker	DPI	Soft	OPEN	CLOSE	DPI	Hardwired	OPEN	CLOSE
	Bus Side Isolator	DPI	Soft	OPEN	CLOSE	DPI	-	OPEN	CLOSE
	Master Trip Relay (86 L/O) / Over Current	SPC	Soft	-	RESET	SPC	Hardwired	-	RESET
	Master Trip Relay (86 L/O) / Differential Relay	SPC	Soft	-	RESET	SPC	Hardwired	-	RESET
	Transformer TAP Raise Command	SPC	Soft	-	RAISE	SPC	-	-	RAISE
	Transformer TAP Lower Command	SPC	Soft	-	LOWER	SPC	-	-	LOWER
	Analog Inputs								
	Equipment Analog Signals								
	R Phase Current (Ampere)		Modbus RS485				Modbus RS485		
	Y Phase Current (Ampere)		Modbus RS485				Modbus RS485		
	B Phase Current (Ampere)		Modbus RS485				Modbus RS485		
	TOTAL Active Power (kW)		Modbus RS485				Modbus RS485		
	TOTAL Reactive Power (kVAR)		Modbus RS485				Modbus RS485		
	RY Phase Voltage (kV)		Modbus RS485				Modbus RS485		
	YB Phase Voltage (kV)		Modbus RS485				Modbus RS485		
	BR Phase Voltage (kV)		Modbus RS485				Modbus RS485		
	Frequency (Hz)		Modbus RS485				Modbus RS485		
	Power Factor (Pf)		Modbus RS485				Modbus RS485		
	Apparent Power		Modbus RS485				Modbus RS485		
	Kwh Export	Accumulator	COUNTER RS485			Accumulator	COUNTER RS485		

Feeder Name	Description	I/O LIST FOR RTU CONFIGURATION				I/O List for As-Is Integration of Conventional Substation (With Reference to RFP)			
		DPI / SPI DPC / SPC	Type (Hardwired / Soft - IEC61850)	*STATE 0*	*STATE 1*	DPI/SPI DPC/SPC	Type (Hardwired / Soft - IEC61850)	*STATE 0*	*STATE 1*
	Kwh Import	Accumulator	COUNTER RS485			Accumulator	COUNTER RS485		
	KVarh Export	Accumulator	COUNTER RS485			Accumulator	COUNTER RS485		
	KVarh Import	Accumulator	COUNTER RS485			Accumulator	COUNTER RS485		
	HV Winding Temperature Indication		HARD WIRING				-		
	LV Winding Temperature Indication		HARD WIRING				-		
	Oil Temp Indication		HARD WIRING				-		
	Transformer TAP Position		HARD WIRING				-		
11 kV INC Feeder	**Digital Inputs**								
	Equipment and Protection Status								
	Circuit Breaker	DPI	Soft	OPEN	CLOSE	DPI	Hardwired	OPEN	CLOSE
	Circuit Breaker Spring	SPI	Soft	DISCHARGED	CHARGED	SPI	Hardwired	DISCHARGED	CHARGED
	Local / Remote Switch Position	SPI	Soft	ON LOCAL	ON REMOTE	SPI	-	ON LOCAL	ON REMOTE
	Circuit Breaker Position	SPI	Soft	IN TEST	IN SERVICE	SPI	Hardwired	IN TEST	IN SERVICE
	Master Trip Relay (86 L/O)	SPI	Soft	RESET	OPERATED	SPI	Hardwired	RESET	OPERATED
	Trip Circuit-1	SPI	Soft	FAILED	HEALTHY	SPI	Hardwired	FAILED	HEALTHY
	Trip Circuit-2	SPI	Soft	FAILED	HEALTHY	SPI	Hardwired	FAILED	HEALTHY
	Earth Fault Protection	SPI	Soft	RESET	OPERATED	SPI	Soft	RESET	OPERATED
	Over Current Protection R Ph	SPI	Soft	RESET	OPERATED	SPI	Soft	RESET	OPERATED
	Over Current Protection Y Ph	SPI	Soft	RESET	OPERATED	SPI	Soft	RESET	OPERATED
	Over Current Protection B Ph	SPI	Soft	RESET	OPERATED	SPI	Soft	RESET	OPERATED
	Breaker Closed from TNC Switch	SPI	Soft	-	Alarm	SPI	-	-	Alarm
	Bus PT MCB	SPI	Soft	OFF	ON	SPI	-	OFF	ON
	Digital Outputs								
	Equipment Control								
	Circuit Breaker	DPC	Soft	OPEN	CLOSE	DPC	Hardwired	OPEN	CLOSE
	Master Trip Relay (86 L/O)	SPC	Soft	-	RESET	SPC	Hardwired	-	RESET
	Analog Inputs								
	Equipment Analog Signals								
	R Phase Current (Ampere)		Modbus RS485				Modbus RS485		

Feeder Name	Description	I/O LIST FOR RTU CONFIGURATION				I/O List for As-Is Integration of Conventional Substation (With Reference to RFP)			
		DPI / SPI DPC / SPC	Type (Hardwired / Soft - IEC61850)	*STATE 0*	*STATE 1*	DPI/SPI DPC/SPC	Type (Hardwired / Soft - IEC61850)	*STATE 0*	*STATE 1*
	Y Phase Current (Ampere)		Modbus RS485				Modbus RS485		
	B Phase Current (Ampere)		Modbus RS485				Modbus RS485		
	TOTAL Active Power (kW)		Modbus RS485				Modbus RS485		
	TOTAL Reactive Power (kVAR)		Modbus RS485				Modbus RS485		
	RY Phase Voltage (kV)		Modbus RS485				Modbus RS485		
	YB Phase Voltage (kV)		Modbus RS485				Modbus RS485		
	BR Phase Voltage (kV)		Modbus RS485				Modbus RS485		
	Frequency (Hz)		Modbus RS485				Modbus RS485		
	Power Factor (Pf)		Modbus RS485				Modbus RS485		
	Apparent Power		Modbus RS485				Modbus RS485		
	Kwh Export	Accumulator	COUNTER RS485			Accumulator	COUNTER RS485		
	Kwh Import	Accumulator	COUNTER RS485			Accumulator	COUNTER RS485		
	KVarh Export	Accumulator	COUNTER RS485			Accumulator	COUNTER RS485		
	KVarh Import	Accumulator	COUNTER RS485			Accumulator	COUNTER RS485		
11kV Bus Coupler	**Digital Inputs**								
	Equipment Status								
	Circuit Breaker	DPI	Soft	OPEN	CLOSE	DPI	Hardwired	OPEN	CLOSE
	Circuit Breaker Spring	SPI	Soft	DISCHARGED	CHARGED	SPI	Hardwired	DISCHARGED	CHARGED
	Local / Remote Switch Position	SPI	Soft	ON LOCAL	ON REMOTE	SPI	-	ON LOCAL	ON REMOTE
	Circuit Breaker Position	SPI	Soft	IN TEST	IN SERVICE	SPI	Hardwired	IN TEST	IN SERVICE
	Trip Circuit-1	SPI	Soft	FAILED	HEALTHY	SPI	Hardwired	FAILED	HEALTHY
	Trip Circuit-2	SPI	Soft	FAILED	HEALTHY	SPI	Hardwired	FAILED	HEALTHY
	Earth Fault Protection	SPI	Soft	RESET	OPERATED	SPI	Soft	RESET	OPERATED
	Over Current Protection R Ph	SPI	Soft	RESET	OPERATED	SPI	Soft	RESET	OPERATED
	Over Current Protection Y Ph	SPI	Soft	RESET	OPERATED	SPI	Soft	RESET	OPERATED
	Over Current Protection B Ph	SPI	Soft	RESET	OPERATED	SPI	Soft	RESET	OPERATED
	Breaker Closed from TNC Switch	SPI	Soft	-	Alarm	SPI	-	-	Alarm
	Bus PT MCB	SPI	Soft	OFF	ON	SPI	-	OFF	ON

Feeder Name	Description	I/O LIST FOR RTU CONFIGURATION				I/O List for As-Is Integration of Conventional Substation (With Reference to RFP)			
		DPI / SPI DPC / SPC	Type (Hardwired / Soft - IEC61850)	*STATE 0*	*STATE 1*	DPI/SPI DPC/SPC	Type (Hardwired / Soft - IEC61850)	*STATE 0*	*STATE 1*
	Digital Outputs								
	Equipment Control								
	Circuit Breaker	DPC	Soft	OPEN	CLOSE	DPC	Hardwired	OPEN	CLOSE
	Analog Inputs								
	Equipment Analog Signals								
	R Phase Current (Ampere)		Modbus RS485				Modbus RS485		
	Y Phase Current (Ampere)		Modbus RS485				Modbus RS485		
	B Phase Current (Ampere)		Modbus RS485				Modbus RS485		
	TOTAL Active Power (kW)		Modbus RS485				Modbus RS485		
	TOTAL Reactive Power (kVAR)		Modbus RS485				Modbus RS485		
	RY Phase Voltage (kV)		Modbus RS485				Modbus RS485		
	YB Phase Voltage (kV)		Modbus RS485				Modbus RS485		
	BR Phase Voltage (kV)		Modbus RS485				Modbus RS485		
	Frequency (Hz)		Modbus RS485				Modbus RS485		
	Power Factor (Pf)		Modbus RS485				Modbus RS485		
	Apparent Power		Modbus RS485				Modbus RS485		
	Kwh Export	Accumulator	COUNTER RS485			Accumulator	COUNTER RS485		
	Kwh Import	Accumulator	COUNTER RS485			Accumulator	COUNTER RS485		
	KVarh Export	Accumulator	COUNTER RS485			Accumulator	COUNTER RS485		
	KVarh Import	Accumulator	COUNTER RS485			Accumulator	COUNTER RS485		
11kV O/G Feeder	**Digital Inputs**								
	Equipment and Protection Status								
	Circuit Breaker	DPI	Soft	OPEN	CLOSE	DPI	Hardwired	OPEN	CLOSE
	Bus Side Isolator	DPI	Soft	OPEN	CLOSE	DPI	Hardwired	OPEN	CLOSE
	Line Side Isolator	DPI	Soft	OPEN	CLOSE	DPI	Hardwired	OPEN	CLOSE
	Outdoor Isolator	DPI	Soft	OPEN	CLOSE	DPI	Hardwired	OPEN	CLOSE
	Outdoor Earth Switch	DPI	Soft	OPEN	CLOSE	DPI	Hardwired	OPEN	CLOSE
	Circuit Breaker Spring	SPI	Soft	DISCHARGED	CHARGED	SPI	Hardwired	DISCHARGED	CHARGED

Feeder Name	Description	I/O LIST FOR RTU CONFIGURATION				I/O List for As-Is Integration of Conventional Substation (With Reference to RFP)			
		DPI / SPI DPC / SPC	Type (Hardwired / Soft - IEC61850)	*STATE 0*	*STATE 1*	DPI/SPI DPC/SPC	Type (Hardwired / Soft - IEC61850)	*STATE 0*	*STATE 1*
	Local / Remote Switch Position	SPI	Soft	ON LOCAL	ON REMOTE	SPI	-	ON LOCAL	ON REMOTE
	Circuit Breaker Position	SPI	Soft	IN TEST	IN SERVICE	SPI	Hardwired	IN TEST	IN SERVICE
	Master Trip Relay (86 L/O)	SPI	Soft	RESET	OPERATED	SPI	Hardwired	RESET	OPERATED
	Trip Circuit-1	SPI	Soft	FAILED	HEALTHY	SPI	Hardwired	FAILED	HEALTHY
	Trip Circuit-2	SPI	Soft	FAILED	HEALTHY	SPI	Hardwired	FAILED	HEALTHY
	Earth Fault Protection	SPI	Soft	RESET	OPERATED	SPI	Soft	RESET	OPERATED
	Over Current Protection R Ph	SPI	Soft	RESET	OPERATED	SPI	Soft	RESET	OPERATED
	Over Current Protection Y Ph	SPI	Soft	RESET	OPERATED	SPI	Soft	RESET	OPERATED
	Over Current Protection B Ph	SPI	Soft	RESET	OPERATED	SPI	Soft	RESET	OPERATED
	Breaker Closed from TNC Switch	SPI	Soft	-	Alarm	SPI	-	-	Alarm
	Bus PT MCB	SPI	Soft	OFF	ON	SPI	-	OFF	ON
	Digital Outputs								
	Equipment Control								
	Circuit Breaker	DPC	Soft	OPEN	CLOSE	DPC	Hardwired	OPEN	CLOSE
	Bus Side Isolator	DPC	Soft	OPEN	CLOSE	DPC	-	OPEN	CLOSE
	Line Side Isolator	DPC	Soft	OPEN	CLOSE	DPC	-	OPEN	CLOSE
	Outdoor Isolator	DPC	Soft	OPEN	CLOSE	DPC	-	OPEN	CLOSE
	Master Trip Relay (86 L/O)	SPC	Soft		RESET	SPC	Hardwired		RESET
	Analog Inputs								
	Equipment Analog Signals								
	R Phase Current (Ampere)		Modbus RS485				Modbus RS485		
	Y Phase Current (Ampere)		Modbus RS485				Modbus RS485		
	B Phase Current (Ampere)		Modbus RS485				Modbus RS485		
	TOTAL Active Power (kW)		Modbus RS485				Modbus RS485		
	TOTAL Reactive Power (kVAR)		Modbus RS485				Modbus RS485		
	RY Phase Voltage (kV)		Modbus RS485				Modbus RS485		
	YB Phase Voltage (kV)		Modbus RS485				Modbus RS485		
	BR Phase Voltage (kV)		Modbus RS485				Modbus RS485		
	Frequency (Hz)		Modbus RS485				Modbus RS485		

Feeder Name	Description	I/O LIST FOR RTU CONFIGURATION				I/O List for As-Is Integration of Conventional Substation (With Reference to RFP)			
		DPI / SPI DPC / SPC	Type (Hardwired / Soft - IEC61850)	*STATE 0*	*STATE 1*	DPI/SPI DPC/SPC	Type (Hardwired / Soft - IEC61850)	*STATE 0*	*STATE 1*
	Power Factor (Pf)		Modbus RS485				Modbus RS485		
	Apparent Power		Modbus RS485				Modbus RS485		
	Kwh Export	Accumulator	COUNTER RS485			Accumulator	COUNTER RS485		
	Kwh Import	Accumulator	COUNTER RS485			Accumulator	COUNTER RS485		
	KVarh Export	Accumulator	COUNTER RS485			Accumulator	COUNTER RS485		
	KVarh Import	Accumulator	COUNTER RS485			Accumulator	COUNTER RS485		
Misc Alarms, Control & Analog	**Digital Inputs**								
	Miscellaneous Station Alarms								
	Dummy Breaker Status	DPI	HARDWIRED	OPEN	CLOSE	DPI	Soft	OPEN	CLOSE
	Battery Charger Input AC Supply	SPI	HARDWIRED	NORMAL	FAILED	SPI	Soft	NORMAL	FAILED
	Battery Charger Failure	SPI	HARDWIRED	NORMAL	ALARM	SPI	Soft	NORMAL	ALARM
	DC System Earth Fault	SPI	HARDWIRED	NORMAL	OPERATED	SPI	Soft	NORMAL	OPERATED
	Battery Charger Group	SPI	HARDWIRED	NORMAL	ALARM	SPI	Soft	NORMAL	ALARM
	RTU Local / Remote Switch Position	SPI	HARDWIRED	ON LOCAL	ON REMOTE	SPI	HARDWIRED	ON LOCAL	ON REMOTE
	RTU - Power Supply	SPI	Soft	NORMAL	FAILED	SPI	Hardwired	NORMAL	FAILED
	Main RTU CPU Module	SPI	Soft	NORMAL	FAILED	SPI	Soft	NORMAL	FAILED
	Slave RTU CPU Module	SPI	Soft	NORMAL	FAILED	SPI	Soft	NORMAL	FAILED
	RIO RTU Rack	SPI	Soft	NORMAL	FAILED	SPI	Soft	NORMAL	FAILED
	RTU Managed Ethernet Switch	SPI	Soft	UNHEALTHY	HEALTHY	SPI	Soft	UNHEALTHY	HEALTHY
	Time Synchronization of RTU	SPI	Soft	UNHEALTHY	HEALTHY	SPI	Soft	UNHEALTHY	HEALTHY
	Time Synchronization of IEDs	SPI	Soft	UNHEALTHY	HEALTHY	SPI	Soft	UNHEALTHY	HEALTHY
	RTU - DI Module-1	SPI	Soft	NORMAL	FAILED	SPI	Soft	NORMAL	FAILED
	RTU - DI Module-2	SPI	Soft	NORMAL	FAILED	SPI	Soft	NORMAL	FAILED
	RTU - DI Module-3	SPI	Soft	NORMAL	FAILED	SPI	Soft	NORMAL	FAILED
	RTU - DO Module-1	SPI	Soft	NORMAL	FAILED	SPI	Soft	NORMAL	FAILED
	RTU - DO Module-2	SPI	Soft	NORMAL	FAILED	SPI	Soft	NORMAL	FAILED
	RTU - AI Module-1	SPI	Soft	NORMAL	FAILED	SPI	Soft	NORMAL	FAILED

Feeder Name	Description	I/O LIST FOR RTU CONFIGURATION				I/O List for As-Is Integration of Conventional Substation (With Reference to RFP)			
		DPI / SPI DPC / SPC	Type (Hardwired / Soft - IEC61850)	*STATE 0*	*STATE 1*	DPI/SPI DPC/SPC	Type (Hardwired / Soft - IEC61850)	*STATE 0*	*STATE 1*
	RTU - AI Module-2	SPI	Soft	NORMAL	FAILED	SPI	Soft	NORMAL	FAILED
	33 kV Incomer-1 MFM Communication	SPI	Soft	NORMAL	FAILED	SPI	Soft	NORMAL	FAILED
	33 kV Incomer-2 MFM Communication	SPI	Soft	NORMAL	FAILED	SPI	Soft	NORMAL	FAILED
	33 kV Trf-1 MFM Communication	SPI	Soft	NORMAL	FAILED	SPI	Soft	NORMAL	FAILED
	33 kV Trf-2 MFM Communication	SPI	Soft	NORMAL	FAILED	SPI	Soft	NORMAL	FAILED
	11 kV Incomer-1 MFM Communication	SPI	Soft	NORMAL	FAILED	SPI	Soft	NORMAL	FAILED
	11 kV Incomer-2 MFM Communication	SPI	Soft	NORMAL	FAILED	SPI	Soft	NORMAL	FAILED
	11 kV Bus Coupler MFM Communication	SPI	Soft	NORMAL	FAILED	SPI	Soft	NORMAL	FAILED
	11 kV Outgoing FDR-1 MFM Communication	SPI	Soft	NORMAL	FAILED	SPI	Soft	NORMAL	FAILED
	11 kV Outgoing FDR-2 MFM Communication	SPI	Soft	NORMAL	FAILED	SPI	Soft	NORMAL	FAILED
	11 kV Outgoing FDR-3 MFM Communication	SPI	Soft	NORMAL	FAILED	SPI	Soft	NORMAL	FAILED
	11 kV Outgoing FDR-4 MFM Communication	SPI	Soft	NORMAL	FAILED	SPI	Soft	NORMAL	FAILED
	33 kV Incomer-1 BCPU	SPI	Soft	NORMAL	FAILED	SPI	-	NORMAL	FAILED
	33 kV Incomer-2 BCPU	SPI	Soft	NORMAL	FAILED	SPI	-	NORMAL	FAILED
	33 kV Trf-1 BCPU-1	SPI	Soft	NORMAL	FAILED	SPI	-	NORMAL	FAILED
	33 kV Trf-1 BCPU-2	SPI	Soft	NORMAL	FAILED	SPI	-	NORMAL	FAILED
	33 kV Trf-2 BCPU-1	SPI	Soft	NORMAL	FAILED	SPI	-	NORMAL	FAILED
	33 kV Trf-2 BCPU-2	SPI	Soft	NORMAL	FAILED	SPI	-	NORMAL	FAILED
	11 kV Incomer-1 BCPU	SPI	Soft	NORMAL	FAILED	SPI	-	NORMAL	FAILED
	11 kV Incomer-2 BCPU	SPI	Soft	NORMAL	FAILED	SPI	-	NORMAL	FAILED
	11 kV Outgoing FDR-1 BCPU	SPI	Soft	NORMAL	FAILED	SPI	-	NORMAL	FAILED
	11 kV Outgoing FDR-2 BCPU	SPI	Soft	NORMAL	FAILED	SPI	-	NORMAL	FAILED
	11 kV Outgoing FDR-3 BCPU	SPI	Soft	NORMAL	FAILED	SPI	-	NORMAL	FAILED
	11 kV Outgoing FDR-4 BCPU	SPI	Soft	NORMAL	FAILED	SPI	-	NORMAL	FAILED
	Fire Protection System	SPI	Soft	NORMAL	OPERATED	SPI	Hardwired	NORMAL	OPERATED
	Fire Protection System	SPI	Soft	NORMAL	OPERATED	SPI	Soft	NORMAL	OPERATED
	Digital Outputs								
	Equipment Control								

Feeder Name	Description	I/O LIST FOR RTU CONFIGURATION				I/O List for As-Is Integration of Conventional Substation (With Reference to RFP)			
		DPI / SPI DPC / SPC	Type (Hardwired / Soft - IEC61850)	*STATE 0*	*STATE 1*	DPI/SPI DPC/SPC	Type (Hardwired / Soft - IEC61850)	*STATE 0*	*STATE 1*
	Dummy Breaker Control	DPC	HARDWIRED	OFF	ON	DPC	HARDWIRED	OFF	ON
	Fire Protection Alarm Hooter	SPC	HARDWIRED		Reset	SPC	HARDWIRED		Reset
	Fire Protection Alarm Hooter	SPC	Soft		Reset	SPC	Soft		Reset
	Analog Inputs								
	Equipment Analog Signals								
	Battery Charger Voltage (Volt)	Analog	HARDWIRED			Analog	HARDWIRED		
	Battery Charger Current (Ampere)	Analog	HARDWIRED			Analog	HARDWIRED		
	Substation Temperature	Analog	Soft			Analog	Soft		
	Substation Humidity	Analog	Soft			Analog	Soft		

Annexure – 4: Approved Make of Equipment/System

Sl. No.	Item Description	Approved Make / Model
1	RTU	ABB / SIEMENS / SCHNEIDER / GE
2	Engineering / Configuration Laptop	DELL / HP / LENOVO
3	Industrial Grade RTU Panels (42U)	RITTAL / SIEMENS / PYROTECH / PRESIDENT
4	Layer 2 Managed Ethernet Switch	RUGGEDCOM / HIRSCHMAN / MOXA
5	GPS Clock with SNTP Server	SERTEL / MASIBUS / SANDS / MEINBERG
6	LIU (Fiber Optic)	RAYCHEM / AFS / 3M
7	I/O Boxes	SYSTEMAX / COMMSCOPE / TYCO
8	Armored UTP CAT6 Cable	SYSTEMAX / COMMSCOPE / TYCO
9	Armored Fiber Optic Cable	FINOLEX / KEC / APAR
10	Unarmored UTP CAT6 Cable	SYSTEMAX / COMMSCOPE / TYCO
11	Patch Panel (RJ45) with Connectors, I/O boxes	SYSTEMAX / COMMSCOPE / TYCO
12	Fiber Optic Patch Chords	AFS / RAYCHEM / TYCO / 3M / PRESTON
13	CAT6 UTP Patch Chords	SYSTEMAX / COMMSCOPE / TYCO
14	4P X 0.36 Sq.mm. Armored Communication Cable (Multistrand, individual pair and overall shielded)	BELDEN / LAPP / SATYAM
15	4P X 0.36 Sq.mm. Unarmored Communication Cable (Multistrand, individual pair & overall shielded)	BELDEN / LAPP / SATYAM
16	Fiber Optic Transceiver	CTC UNION / MRO TEK / ALLIED TELESIS / MOXA
17	RS 232 / RS 485 converter	MOXA / ADVANTECH
18	DC-DC Converter	COSSEL / PHOENIX / PARAMOUNT
19	Diode-Oring Unit	PARAMOUNT / PHOENIX
20	Droppable type Terminal Block for Digital Output, CT & PT	CONNECT WELL – CBT4U
21	Disconnecting type (Knife edge) Terminal Block for Digital Input	CONNECT WELL – CKT4U
22	Modbus TCP/IP converter	MOXA, ADVANTECH, RUGGEDCOM
23	Temperature & Humidity Sensor	KIMO / HONEYWELL / SUNPRO
24	Multi-mode, 12 core armored FO-cable	FINOLEX / KEC / APAR / BIRLA CABLES
25	Multifunction Meter	SATEC, PM130EH+
26	Auxiliary Relays	OMRON / ABB / SULZER / OEN / PARAMOUNT
27	Control Cable	FINOLEX / POLYCAB / MESCAB
28	MCB	SIEMENS / SCHNEIDER / ANCHOR / HAVELLS
29	Instrumentation Cable (Status, Indications, Control and Analog Measurement)	CCI / FINOLEX / HAVELLS / UNIVERSAL CABLES / INCAB / ASIAN CABLE / KEI / POLYCAB / RUCHIKA

Bidder proposing system/equipment not in the above list of approved make, shall be specified in the technical offer along with technical details for TPCODL review, approval and acceptance. The decision of TPCODL will be final.

Annexure – 5: Indicative Bill of Material for Proposed Substation Automation System

Information to Bidder:

1	2
Sl. No.	**Information to Bidder**
1	Bill of Quantity mentioned in the tables are indicative, this may vary to meet the functional or site requirement. It is the responsibility of the Bidder to include all Hardware, Software, Configuration tools and Services as per functional requirement specified in the RFP and as per the phases mentioned.
2	Bidder to refer Approved make and model of the equipment to be considered for this project. All bidder's own and bought out items shall be subject to Purchaser's prior approval. Lead Bidder to submit all the Purchase orders released to Sub-vendors for TPCODL Review and Records.
3	The bidder shall propose and design the solution considering all the functional requirement stated in the RFP and shall submit the overall System Architecture considering current and phase wise implementation.
4	System shall be modular in such a way that it shall allow flexible configuration of the system, adding modules as and when required. The system shall facilitate a gradual growth of the system through phased implementation as the Power System Network operating requirements expand or change.
5	Bidder shall include license for redundant applications as applicable. Bidder shall also consider the enterprise version of software as feasible to meet the required functionality and to reduce the overall cost.
6	All the offered system will be with Operating System and shall be of latest version at the time of delivery and phase wise commissioning
7	All Systems Application, OS and configuration tools shall be kept current with latest OS version, Application Software, Configuration tools as and when the new system will be implemented/added in a phased manner.
8	Configuration of all RTU and other system shall be identical except IP Schema and specific requirement of the site.
9	The RTU should be modular to enhance the capacity and expected communication response speed are achieved with distributed system and final architecture frozen during detailed engineering.
10	The offered solution shall meet all the Cyber Security Requirement as per the standards such as NERC_CIP, NISTR, ISO 27001 and NCIIPC guidelines. All the Cyber Security measures shall address Operational Technology requirement. Bidder shall ensure the proposed architecture at Substation are certified by Cyber Security auditor for the compliance as per Industry standards. Bidder to demonstrate all the cyber security measures considered and implemented during FAT and SAT. Bidder to ensure that all the product own and sub-vendor product offered are tested at CPRI Lab for cyber security as per the Guidelines of MoP Order No.25-L7 /6/2O18-PG dated 2nd July, 2O2O
11	The proposed system will be integrated with other external systems and the required interfaces shall be considered accordingly. Since all external systems are different, special studies for interfaces shall be conducted for seamless integration.
12	The platform services shall be common to the whole family of products (Main & Standby RTU etc.); thus, integrated control of power system network is possible from one base platform. Allows data to be distributed across a number of sites and systems.
13	The bid shall include Unified data engineering environment for data take-on and data maintenance, facilitating a single point of entry for both data configuration and use for multiple application/calculation and data management.
14	Bidder to indicate clearly the no. of Software licenses (proprietary & third party) included taking into account no. of RTUs, Communication Equipment, Controller, redundant equipment, I/O Tags etc. Bidder shall also indicate the (slab-wise) incremental price for each of these licenses as applicable. It will be deemed to be nil if not indicated separately. Bidder shall consider enterprise license for common applications for proposed system.

1	2
Sl. No.	**Information to Bidder**
15	Each selected application shall include necessary prerequisites, if any.
16	All cabling (Communication, Power Supply, Field, Interfaces) is in Bidder's scope. This includes supply, laying, termination and connection to equipment.
17	All Networking accessories and all types of Cables required for integration of other systems shall be considered by the bidder.
18	Necessary Communication equipment (Industrial grade) such as Layer2 switches, Router, Networking cables, patch cords etc. for integrating the Substation Automation System with Purchaser's SCADA System through NBSP Communication network shall be in the scope of the Bidder. All structure cabling at Sub-Stations (if any) is in Bidder scope. All the Communication equipment shall be DC Powered.
19	Bidder to ensure the deployment of the resources and service requirement during Warranty Support for all the supplied equipment (Bidder's Own and bought out items). SLA will be prepared with the successful bidder to achieve the 24X7 availability and reliability of the installed system
20	It is the responsibility of the bidder to provide Patch Management, Software upgradation, Firmware Upgradation for Bidder's Owned items, Sub-vendor items, and Communication and Networking items during Warranty period as per the SLA.
21	Purchaser may procure any item from elsewhere. Integration of those with supplied system is in Bidder's scope.
22	All annual maintenance charges of supplied Hardware, OS & Software are inclusive in the Warranty of Bidder's Owned items, Sub-vendor items, Communication and Networking items, software licenses their renewal, upgrades etc.
23	All the materials to be delivered should be F.O.R at TPCODL sites.
24	The bidders are advised to quote prices strictly in the format attached.
25	The bidder must fill each column of the format attached. Mentioning “extra/inclusive” in any of the column may lead for rejection of the price bid.
26	No cutting/ overwriting in the prices is permissible.
27	The unit price to be indicated in col. No. 8 should be exclusive of taxes & duties which are to be indicated in separate columns meant for the purpose.
28	The bids will be evaluated commercially on the overall all-inclusive lowest cost lowest for the individual LOT as defined in the tender BOQ as calculated in Schedule of Items TPCODL however, reserves right to split the order line item wise and/or quantity wise among more than one Bidder. Hence, all bidders are advised to quote their most competitive rates against each line item.
29	In case of increase in quantity for any item, the unit rate mentioned above shall be considered for the same.
30	HSN/SAC codes for respective line item must be mandatorily provided wherever applicable.
31	TPCODL reserve the right to split the order quantity to any extent amongst the bidders.

1	2	3	4	5	6	7
Sl. No.	Item	Description	UOM	Qty	Total	Remarks
				1		
A	**Pre-Wired RTU Panel**					
1	**Pre-Wired RTU Panel**	**Pre-Wired RTU Panel** RTU Redundancy : Mandatory I/O Requirement: with 32 DI, 16 DO, 8 AI with Auxiliary relay for each Digital Input & Output Communication Ports per RTU: 2 Nos. Ethernet ports/CPU (one Ethernet Port for Master and another for IED Communication), 4 Nos. RS 485 electrical ports for communication with serial devices over IEC60870-5-103, MODBUS (Serial) and IEC 60870-5-101 protocol in the RTU. To meet the additional RS485 ports requirement, Bidder shall propose Industrial grade Serial Server of 8 Ports as a optional item. This server shall communicate with RTU on Modbus TCP/IP protocol or Open Protocol as considered in the RTU. Power supply: Redundant 18-72 VDC Supply with MCBs with add-on NO contact Protocols : IEC 60870-5-101, IEC60870-5-103, IEC 60870-5-104, IEC 61850 (ED1, ED2), RSTP, MODBUS (Serial & TCP/IP), SNMP (V1.0, V2.0, V3.0), NTP & SNTP, Software Licenses: RTU OS, Application Software, Configuration tools, Diagnostic tools. Logic building Application-Interlock logic, Calculation Package, SMS Utility Software for Main & Standby Application Software Licenses with 5000 Physical I/O tags, 40 IEDs - IEC61850 (ED1, ED2), 25 IEDs - Serial Protocol, RTU shall Communicate to Eight Independent Remote SCADA Master on IEC 60870-5-104 Mounting: To be supplied with prewired panel (Rittal/Siemens or equivalent, size : 2300 mm x 800 mm x 800 mm, both side opening), IP Class : IP54/55. Other Accessories: Interface Modules, Pre-fabricated cables for I/O modules, Auxiliaries Relays for Power Supply monitoring, MCBs for all type of Power Supplies	Set / Substation	1	11	
	Managed Layer2 Ethernet Switch	**Managed L2 Ethernet Switch for IED Communication with RTU.** **Communication Ports: 24** PORT L2 10/100 MBPS, Copper Ports (12 Nos.) or as per type of ports proposed for BCPUs **Power Supply:** Redundant Input power supply 18-72V DC Supply with Diode Oring unit and MCBs with add-on NO contact **Mounting Arrangement:** To be mounted in SWGR (33 & 11 kV) Panel **Software:** Software for Local and Remote configuration of Ethernet Switches - Enabling Monitoring, Configuration, Maintenance and backup of configuration files **Preferred/Approved Make:** RUGGEDCOM/HIRSCHMAN/MOXA	Set / Substation	2	22	

1	2	3	4	5	6	7
Sl. No.	Item	Description	UOM	Qty	Total	Remarks
	Networking Rack	Networking **6U Rack (Cabinet Box) Mounting Arrangement:** Wall Mounted **Accessories**: 2 Pole 6A DC MCB, 6 Port PDU with Cable suitable for 48V DC, Lock, Mounting accessories for Router cum Firewall	Nos. / Substation	1	11	
	Surge Protection Device	**Surge Protection for Serial Communication Ports (4 Nos. Per RTU Panel)** Compliance: IEC 61643-21C2 20 kV. Shall Supports RS422/485 and RS232, Plug and play Mounting Arrangement: To be mounted in RTU Panel Temperature -40 to 85°C	Nos. / RTU Panel	4	44	
	Industrial Grade Serial Server	Industrial grade Serial Server: Communication Ports: 2 Nos. Ethernet ports, 8 Nos. RS485 ports This server shall communicate with RTU on Modbus TCP/IP protocol or Open Protocol as considered in the RTU. Power supply: Input DC supply of 18-72 VDC (24/48 V DC) with Diode Oring unit and MCBs with add-on NO contact Protocols : IEC 60870-5-101, IEC60870-5-103, MODBUS (Serial & TCP/IP), IEC 60870-5-104, SNMP (V1.0, V2.0, V3.0), NTP & SNTP Software Licenses: Serial Server OS, Application Software, Configuration tools, Diagnostic tools. Mounting: Din-rail mountable/19" Rack Mountable Serial Server Managed Switch IP Class : IP54/55.	Nos. / RTU Panel	1	1	
	Networking Accessories	Networking Accessories for Integration of IEDs, Ethernet Switches & RTU All required networking accessories like Patch Panel (for each ethernet switch), Patch cords (UTP as per the Ethernet Switch Configuration) of suitable length, Conduits for all non-armored cables, RJ45 connectors, I/O boxes with Quad face plate and connectors etc.	Lot/ Substation	1	11	
B	**Interposing Relay with Mounting Base for Digital Input**					
2	**CMR with Mounting Base for Digital Inputs**	**Contact Multiplier Relay with Mounting Base:** 1. Contact Material : Silver Alloy 2. Contact Rating : 5 Amps. @ 24 V/48 V DC 3. Contact Resistance : 50 M ohms max. (Initial) 4. Dielectric Strength : i) Between open contacts : 500 V RMS ii) Between Contact and Coil: 2000 V RMS 5. Insulation Resistance : 500 M ohms @ 500 V DC, 250 C 6. Operate time at Nominal Voltage: 20 milli seconds 7. Release time at nominal Voltage: 10 milli seconds 8. Ambient temperature : -40ºC to +70ºC 9. Life expectancy : i) Mechanical : 20 million DC Relay ii) Electrical : More than 100,000 Operations 10. Coil Resistance at Nominal Voltage (DC): 30,000 Ohms +10% at 250ºC 11. Type of Contact Multiplier : 2 NO + 2 NC with LED Indicator + Freewheeling 12. Type of mounting : DIN RAIL MOUNTING WITH SOCKET 13. No. of Poles : 2 NO + 2 NC 14. Other Accessories: Necessary TB, Din rail channel and other accessories to mount in CRP	Nos. / DI Module	32	352	

	2	3	4	5	6	7
Sl. No.	Item	Description	UOM	Qty	Total Required Quantit	Remarks
C	**Interposing Relay with Mounting Base for Digital Output**					
3	**Interposing Relay with Mounting Base for Digital Output**	1. **Interposing Relay with Mounting Base for Digital Output** **Interposing Relay with Mounting Base for Digital Output** 1. Auxiliary Power. : 24 V / 48 V DC 2. Input signal from field : 24 V / 48 V DC 3. Input impedance : More than 50 Kohms 4. Output signal of the RTU : 24 V / 48 V DC 5. Contact mechanism : Self Reset 6. Contact Make & Carry : 30 A for 3 Sec. & 5A continuously at 660V 7. Number of Contacts : 2 NO + 2 NC with LED Indicator + Free wheeling 8. Operating time : Less than 15 msec. 9. Other Accessories: Necessary TB, Din rail channel and other accessories to mount in RTU/CRP Panel	Nos. / DO Module	16	176	
D	**Instrumentation Cable for Status, Control & Power Supply**					
4	**Twisted Pair Shielded & Over all shielded Instrumentation Cable 5 Pair Armored 1.0 mm2 for Analog Input**	**Twisted paired Shielded & Overall Shielded Cable for AnalogInputs** 5 P X 1.0 mm2, Armored, Copper twisted paired and Overall shielded cable for Analog inputs from CRP/Field panel to the RTU panel **Preferred Make:** CCI / FORT GLOSTER / FINOLEX / HAVELLS / Indian aluminum Cables / Universal Cables / Incab / Asian Cable / KEI / Polycab / Ruchika	Meters/ Substation	50	550	
E	**Communication Cable for MFM, IEDs Integration**					
5	**4P X 0.36 mm2 Armored Communication Cable for MFM**	**Communication Cable**: 4P X 0.36 Sq.mm Armored multistrand Pair and Overall shielded, for Multifunction Meter looping. **Preferred/Approved Make:** Belden/LAPP/SATYAM/KEC/DIGISOL/POLYCAB	Meters/ Substation	100	1100	
6	**Armored CAT6 UTP Cable**	Armored CAT6 UTP Cable **Preferred/Approved Make:** SYSTEMAX / COMMSCOPE / TYCO / POLYCAB / DIGISOL	Meters/ Substation	100	1100	
7	**Un-Armored CAT6 SFTP Cable**	Un-Armored CAT6 SFTP Cable **Preferred/Approved Make:** SYSTEMAX / COMMSCOPE / TYCO / POLYCAB / DIGISOL	Meters/ Substation	200	2200	
8	**T&H Sensor**	Temperature & Humidity Transmitter : for integration with RTU on RS485 MODBUS **Preferred/Approved Make** – KIMO/HONEYWELL/SUNPRO	Nos. / Substation	2	22	

1	2	3	4	5	6	7
Sl. No.	**Item**	**Description**	**UOM**	**Qty**	**Total**	**Remarks**
9	**Multifunction Meter**	**Multi Function Meter:** **Requirement :** For all 33 & 11 KV Feeders, Bus Voltages (33 & 11 kV), Station Trf, ACDB Multifunctional 3-phase Power meter, four quadrant active and reactive energy polyphase static meter **CT Type:** Ring CT **Form Factor:** 96 X 96 mm **Accuracy Class:** 0.2 S as per IEC62053:22 **Voltage Inputs:** Operating range : 690 V AC line-to-line, 460 V AC line-to-neutral **Current Inputs:** 1A / 5A (User selectable CT secondary 1A / 5A, PT Secondary) **Wiring configurations:** 3OP2, 4LN3, 3DIR2, 4LL3, 3OP3, 3LN3, 3LL3, 3BLN3, 3BLL3 (All wiring configurations selected via the front panel) **Communication Port:** RS 485 Serial Port with removable connector **Protocols:** MODBUS RTU, Assignable Register map, Device Address (User Configurable - (1-247)) **Auxiliary Supply:** 24 V / 48 V DC **Other Accessories:** Necessary TB, Din rail channel and other accessories for flash mounting in CRP **Preferred Make:** SATEC PM130EH+ or equivalent **Services for MFM:** Installation and Commissioning of Multifunction Meters in CRP Panel and its integration with RTU with required configuration for Control Centre communication over IEC-104	Nos./ Substation			As per SLD.
10	**Engineering Configuration Laptop**	**Configuration Laptop** **Hardware:** Laptop with latest processor, 1 TB SSD, 8 GB RAM, DVD RW, Ethernet Port, 4 USB Ports, 1 HDMI Port, 15" Display with 1 No. Serial to USB converter **Software License:** Microsoft Windows compatible with latest version of configuration software, Microsoft Office License pack, Antivirus Symantec Endpoint protection small business edition with three year subscription, Configuration & Maintenance Software tools, and Diagnostic tools. Logic building Application of RTU and Protection IEDs, Simulation Software, Applicable Software licenses for Local SCADA HMI and shall be in-line with RTU Software. Proposed Licenses shall be independent of Engineering Configuration Laptop Hardware.	Nos.	-	2	

1	2	3	4	5	6	7
Sl. No.	Item	Description	UOM	Qty	Total	Remarks
F	Services					
F.1	Services for Erection, Installation on, testing, Commissioning and Integration.	**Erection, Installation, testing, Commissioning and Integration.** a) Design, Engineering, FDS b) Transportation, Delivery, Unloading and Storage. c) Installation and commissioning of Pre-wired RTU and Networking equipment and accessories e) Cable laying, termination and continuity check of all cables f) Integration of all Protection, MFM, Condition monitoring devices etc. g) Powering up of all supplied materials h) Configuration of RTU and its accessories i) Integrated testing with TPCODL SCADA System j) I/O testing, Pre-SAT testing of Hardware and Software functionality k) Integrated FAT & SAT for Hardware and Software l) Demonstration of System Capacity and Performance Guarantee Test m) Submission of As-Built Drawings, RTU Backup	Lumpsum	1	11	
F.2	Standard Warranty	Standard Warranty for Hardware & Software inclusive of patch management and software upgradation for the period of 5 Years.	Lumpsum	1	1	
F.3	Training	Training (10 Man-days of Trainer) : On-site training at TPCODL works on supplied equipment and application software (Own & Sub vendor)	Lumpsum	1	1	
F.4	Mandatory Spares	As per the attached Sheet (worksheet 2)	Lumpsum	1	1	

Mandatory Spares:

SL. No.	System	UoM	Qty
1	CPU Module of the RTU	Nos.	2
2	Power Supply module of the RTU	Nos.	2
3	Memory Module of the RTU	Nos.	2
4	Communication Module (Ethernet) - As per the proposed Solution	Nos.	2
5	Communication Module (Serial) - As per the proposed Solution	Nos.	2
6	DI Cards for Digital Inputs (DI Channels/Module = 16 DI)	Nos.	4
7	DO Cards for Digital Output (DO Channels/Module = 8 DO)	Nos.	4
8	AI Cards for Analog Inputs (AI Channels/Module = 4 AI)	Nos.	4
9	Contact Multiplier Relay with Base	Nos.	64
10	Interposing Relay with Base	Sets	32
11	Multifunction Meter	Nos.	5
12	IEC 61850 complied L2 Managed Ethernet Switch	Nos.	2
13	Surge Arrestors	Nos.	5
14	CAT 6 SFTP Patch Cord (2 Mtrs, 5 Mtrs)	Nos.	5 each

Annexure – 6: GTP for Proposed Substation Automation System

Remote Terminal Unit (RTU)			
SL. NO.	**TECHNICAL PARTICULARS**	**TPCODL REQUIREMENT**	**BIDDER RESPONSE**
1	Remote Terminal Units (RTU)	19" Modular / Din Rail Mounted It shall have capability to be part of a larger BCU/RTU family for T&D function	
2.1	Make		
2.2	Model		
3	RTU Rendundancy	Mandatory (CPU, Power, Communication & Memory)	
4	Digital Inputs (Physical)	As specified in the I/O Requirement	
5	Digital Outputs (Physical)	As specified in the I/O Requirement	
	Close / Open	Required	
	Raise / Lower	Required	
6	Analog Inputs (Physical)	As specified in the I/O Requirement	
7	Energy Meters / Numerical Relays Integration	Facility to interface Multifunction Meters and Numerical Relays	
7.1	Accumulator Data from Multi-Function Meter	Capable of Acquiring 32 bit Analog and Accumulator Data from Multifunction Meters	
8	Distributed I/O modules	Required	
9	Ports Requirement and Type	All ports shall be galvanically isolated	
		4 Nos. RS 485 electrical ports for communication with serial devices over IEC60870-5-103, Modbus and IEC 60870-5-101 protocol in the RTU. To meet the additional RS485 ports requirement, Bidder shall propose Industrial grade Serial Server of 8 Ports as an optional item. This server shall communicate with RTU on Modbus TCP/IP protocol or Open Protocol as considered in the RTU.	
		2 Nos. Ethernet Ports / CPU (One port for IEC 104 & other for port for Communicaiton with substation IEDs)	
	For Structuring (Configuration) System (Separate Port)	A galvanically isolated USB port for local engineering through laptop	
10	Protocol Support	IEC 61850, IEC 60870-5-103, IEC60870-5-104 (Master & Slave), MODBUS (Serial & RTU), SNTP & SNMP with Server and Client licenses	
11	Time synchronization between RTU, I/O modules, IEDs and Gateway	Required on SNTP and direct pulse (1 PPS, 1 PPM). RTU shall have capability for Time Synchronization from Minimum 2 Server with priority selection	
	Real time stamping at RTU level, I/O level	Required, Mandatory	

Remote Terminal Unit (RTU)			
SL. NO.	**TECHNICAL PARTICULARS**	**TPCODL REQUIREMENT**	**BIDDER RESPONSE**
12	**Response Time**		
	Digital Input	1 msec or better	
	Analog Measurement	1 sec or better	
	Digital Output	<1 sec or better	
13	I/O handling Capacity	Min 5000 Physical Tags / RTU	
14	Pseudo Points (Digital, Analog)	Required	
15	Calculated Points (Digital, Analog)	Required	
16	SOE List storage	Min 1000 (shall be user configurable)	
	SOE list Retention Period	1 Month	
17	Fault Disturbance Recorder	1000 events	
	FDR Retention Period	1 Month	
18	Development of Interlock logic	Required, Mandatory	
19	Support of mathematical function - Arithmetic, Logical, Trigonometric functions, Differential and Integration functions, Timer, Counter etc.	Required, Mandatory	
20	Logic and Calculation functionality	Required, Mandatory	
21	Check-Before-Execute Scheme for Control	Required (Bidder shall submit their Check-before-Execute scheme)	
22	Auxiliary Relays for Digital Outputs	Required, Auxiliary relays with Min 10 Ampere rating with 2 NO contacts (to be wired in Series) for each digital outputs	
23	Status LEDs on all module – for fault indication and Inputs / Outputs	Required	
24	Module replacement in RTU	Hot-Swappable module	
25	Software – All diagnostic tools, simulator tool, maintenance tools, configuration application for database and process control program development, documentation and maintenance	Required	
26	Engineering Functions	a) Configuration shall be possible both locally and remotely	
		b) RTU shall have multilevel passwords	

Remote Terminal Unit (RTU)			
SL. NO.	**TECHNICAL PARTICULARS**	**TPCODL REQUIREMENT**	**BIDDER RESPONSE**
		c) On-line monitoring facility of real time data for monitoring/analyzing the real time status of the process, program logic from the engineering station	
		d) Allow configuration of the RTU with different versions of the Configuration Tool	
		e) ICD file generation shall be possible from the proposed Configuration Tool	
		f) RTU must have the provision to configure the IP of the redundant SCADA Systems (Socket IP)	
27	Cyber Security	Bidder to confirm Cyber security measures as indicated in the Specification	
28	Battery Backup / Flash-PROM backup	Required	
29	Auxiliary Power Supply	Redundant 18-72 VDC (24/48V DC) Supply MCBs with add-on NO contact. The RTU shall have adequate protection against reversed polarity, over current and under voltage conditions, to prevent the internal logic from being damaged and becoming unstable causing mal-operation	
29.1	Auto-Startup and Restoration	In case of Power Supply Failure, Auto-Startup and Restoration of the RTU required	
30	RTU health monitoring contacts (CPU, Communication, I/O modules, Power Supply)	Required both Physical and Soft, Mandatory	
31	Environment Requirement, Reliability & Cooling	RTU with accessories will be installed in the Relay/Control room with no temperature or humidity control. The RTU shall be capable of operating in ambient temperature from 0 to +65 degree C with rate of temperature change of 20 degree C/hour and relative humidity of 95%, non-condensing	
		All the modules shall be with conformal coating	
32	Reporting on IEC 104	RTU shall Communicate to Eight Independent Remote SCADA Master on IEC 60870-5-104	
33	SMS software	SMS Utility software for Main & Stand by RTU	
34	Support of SFTP	RTU product offered will transfer Disturbance and fault record collection over SFTP using SSH secure protocol using the same network through which data will be communicated to the control center through IEC 60870-5-104 protocol.	

Remote Terminal Unit (RTU)			
SL. NO.	**TECHNICAL PARTICULARS**	**TPCODL REQUIREMENT**	**BIDDER RESPONSE**
35	IED Pass Through	Support of RTU for IED Pass Through for configuration of IEDs/BCPUs	

Managed Layer - 2 Switch			
SL. NO.	**TECHNICAL PARTICULARS**	**TPCODL REQUIREMENT**	**BIDDER RESPONSE**
1	Make		
2	Model		
3	Type of Switch	Industrial Grade, 19" Rack mountable Managed Switch	
4	No. of Ports per switch	Minimum 24	
4.1	No. of Copper ports (10/100 mbps)	Minimum 24 ports	
5	**Compliance**		
5.1	Shall support 802.1Q VLAN, 801.2p, 802.1d STP, 802.3ad (Port aggregation), 802.1w RSTP, 802.1s MSTP, 802.3ad LACP, IEEE 802.1ab Link Layer Discovery Protocol and also suitable for Ring Configuration	Required	
5.2	IEEE 1613 compliance	Mandatory	
5.3	IEC 61850 Compliance	Mandatory	
5.4	QAS (802.1p)	Mandatory	
6	Time Synchronization	SNTP, IEEE1588 V2	
7	Suitable for PRP/HSR architecture	Optional	
8	Other Required Features	Automatic Learning, Negotiation, and Crossover Detection	
		Support Industrial Automation Protocols i.e. IEC61850, MODBUS, Ethernet/IP etc.	
		Shall support Layer 2 switch ports with Secure VTP or similar protocols to reduce administrative burden for VLANs Configuration	
		Shall support both Rapid Spanning Tree Protocol (RSTP) & Multiple Spanning Tree Protocol (MSTP)	
		Port Mirroring	
		Discover the neighboring device, giving the details about the platform, IP Address, Link connected through etc.	

Managed Layer - 2 Switch			
SL. NO.	**TECHNICAL PARTICULARS**	**TPCODL REQUIREMENT**	**BIDDER RESPONSE**
		Shall support to prevent edge devices not in the network administrator's control from becoming STP root nodes	
		Shall support configurable SNMP traps	
9	Management Tools support	Web-based, Telnet & Command Line Interface (CLI) for quickly configuring major managed functions	
		SNMPv1/v2c/v3 for different levels of network management	
		Remote Monitoring (RMON)	
		Rich set of diagnostics with logging and alarms	
10	Auxiliary Power Supply	Redundant Power supply module of 18-72V DC shall be available (Based on the Architecture proposal). The Switch shall have in-built adequate protection against reversed polarity, over current and under voltage conditions, to prevent the internal logic from being damaged and becoming unstable causing mal-operation	
11	Health Monitoring of Hardware such as Ethernet ports, Power supply cards & Communication links and internal voltages through SNMP/IEC61850 to SCADA System/Purchaser's NMS	Protocol shall be SNMP	
12	Environment Requirement, Reliability & Cooling	Switch with accessories will be installed in the Relay Panel/Switchgear with no temperature or humidity control. The Switch shall be capable of operating in ambient temperature from 0 to +65 degree C with rate of temperature change of 20 degree C/hour and relative humidity of 95%, non-condensing	
		All the modules shall be with conformal coating	

Multi- Function Meter (MFM)			
SL. NO.	**TECHNICAL PARTICULARS**	**TPCODL REQUIREMENT**	**BIDDER RESPONSE**
1	Make		
2	Model		
3	Accuracy Class	Class 0.2S / 0.5S (IEC62053-11 and IEC62053-22)	
4	Sampling rate	128 Samples/Cycle for true RMS measurement	
5	Voltage Input	0 to 690 V L-L, 400 V L-N	
	Voltage Burden	< 0.15 VA	

Multi- Function Meter (MFM)			
SL. NO.	**TECHNICAL PARTICULARS**	**TPCODL REQUIREMENT**	**BIDDER RESPONSE**
	PT Ratio	1.0 - 6500	
	Primary Value of PT	Shall be programmable	
	Range of Reading	1 - 999000 V	
6	CT Type	Ring CT	
	Current Input	1 A / 5A selectable from the front display	
	CT Burden	< 0.1 VA per phase	
	CT range	0.1% to 200%	
	Current over range	5A CT = 15A RMS continuous, 250A for 1 Sec 1A CT = 3A RMS continuous, 50A for 1 Sec	
	Range of Reading	0-60000 Amp	
	Primary Value of CT	Shall be programmable	
7	Power Factor	0.5 (lag) to 1.0 (unity) and 1.0 (unity) to 0.5 (lead)	
8	Accuracy kW / kWH	0.5 S as per IEC62053:22	
9	Real time & Average parameters	Required	
10	Four Quadrant measurement	Required	
11	LED Load Bar Indication	Optional	
12	Self-Diagnostic LED	Required	
13	Real time clock	Required	
14	Min./Max of parameters	Required	
15	THD	Required	
16	Individual Harmonics up to 39th	Required	
17	Real time waveform monitoring	Standard software to monitor real-time waveform	
18	Communication Port	Min 1 no. RS 485 port	
19	Isolation	Galvanic	
20	Communication protocols	MODBUS RTU, ASCII, selectable at site	
21	User defined registers	Optional	
22	Energy pulse LED for calibration test	Required	
23	Relay output	Optional	
24	Auxiliary Power Supply	Power Supply 18-72V (24V & 48V as per site requirement) The MFM shall have in-built adequate protection against reversed polarity, over current and under voltage conditions, to prevent the internal logic from being damaged and becoming unstable causing mal-operation	

Multi- Function Meter (MFM)			
SL. NO.	**TECHNICAL PARTICULARS**	**TPCODL REQUIREMENT**	**BIDDER RESPONSE**
25	Environment	MFM will be installed on the Relay Panel in Control room with no temperature or humidity control. The MFM shall be capable of operating in ambient temperature from 0 to +65 degree C with rate of temperature change of 20 degree C/hour and relative humidity of 95%, non-condensing	
26	Mounting Panel cutout	92 mm x 92 mm, flush mounting	
27	Programming features	The meter should allow the user to configure the registers for the electrical parameters.	
		Unit should be fully programmable in the field and also remote configuration including PT/CT ratios and should have adequate protection for authorization for changes.	
28	Parameters to be monitored and reported:	Volt, Amp, Cos (Phi), kWatt, kvar, kVA, HZ, MWH Import & Export, MVARH Import & Export.	

Engineering Station (Laptop)			
SL. NO.	**TECHNICAL PARTICULARS**	**TPCODL REQUIREMENT**	**BIDDER RESPONSE**
1	Make		
2	Model		
3	Hardware	Laptop with latest processor, 64 bit, 1 TB HDD, 8 GB RAM, DVD RW, 4 USB Ports, 1 HDMI Port, 15” Display with 1 No. serial to USB converter , Min 1 No. of Ethernet port	
4	Software	Microsoft Windows & Office License	
		Antivirus software	
		RTU Configuration Software	
		IEC61850 Configuration Tool	
		RTU/BCU/BCPU, Master Simulation & Protocol Analyzer Software	
5	Accessories	Wireless Mouse & Laptop Bag RTU Configuration cable ,2 Mtrs LAN cable forEthernet port connection with IED or RTU ,USB to Serial Cable	
6	Auxiliary Power Supply	230V AC with adapter	

Serial Server			
SL. NO.	**TECHNICAL PARTICULARS**	**TPCODL REQUIREMENT**	**BIDDER RESPONSE**
1	Make		
2	Model		
3	Type	Industrial Grade, Din-rail mountable/19" Rack Mountable Serial Server Managed Switch	
4	No. of Serial Ports (RS485) per Server	8 ports	
5	No. of Ethernet Copper ports (10/100 mbps)	2 ports	
6	Serial to Ethernet Protocol Conversion	This server shall communicate with RTU on Modbus TCP/IP protocol or Open Protocol as considered in the RTU.	
7	Shall support 802.1Q VLAN, 801.2p, 802.1d STP, 802.3ad (Port aggregation), 802.1w RSTP, 802.1s MSTP, 802.3ad LACP, IEEE 802.1ab Link Layer Discovery Protocol and also suitable for Ring Configuration	Required	
8	IEEE 1613 compliance	Mandatory	
9	IEC 61850-3 Compliance	Mandatory	
10	Conformal Coating	Mandatory	
11	Time Synchronization	SNTP	
12	Management Tools support	Web-based, Telnet & Command Line Interface (CLI) for quickly configuring major managed functions	
		SNMPv1/v2c/v3 for different levels of network management	
		Remote Monitoring (RMON)	
13	Auxiliary Power Supply	Redundant 18-72 VDC (24V / 48V DC) Supply with MCBs with add-on NO contact (Based on the Architecture proposal). The device shall have in-built adequate protection against reversed polarity, over current and under voltage conditions, to prevent the internal logic from being damaged and becoming unstable causing mal-operation	
14	Operating Temperature	„ -40°C to +85°C operating temperature (no fans)	

Interposing Relay (Digital Output)			
SL. NO.	**TECHNICAL PARTICULARS**	**TPCODL REQUIREMENT**	**BIDDER RESPONSE**
1	Make		
2	Model		
3	Type	Magnetic Blow out	
4	Contact Configuration	2 NO + 2 NC with LED Indicator + Free wheeling	
5	Contact Material	AgNi	
6	Contact make and carry	30A for 3 sec. & 5A continuously at 660V	
7	Contact mechanism	Self-Reset	
8	Coil Voltage	24VDC	
9	Input impedance	more than 50 Kilo ohms	
10	Operating time	Less than 15 m secs (DC)	
11	Mechanical durability	100000 cycle	
12	Ambient Temperature	-40 deg C to + 55 deg C	
13	Type of Mounting	Din Rail Mounting	
14	Socket	S8LD SOCKET	
15	Standard applicable	IEC 60255-5	
16	Other Accessories:	Necessary TB, Din rail channel and other accessories to mount in SIC/RTU/CRP Panel	

Contact Multiplying Relay (Digital Inputs)			
SL. NO.	**TECHNICAL PARTICULARS**	**TPCODL REQUIREMENT**	**BIDDER RESPONSE**
1	Make		
2	Model		
3	Type	CMR	
4	Contact Configuration	2 NO + 2 NC with LED Indicator + Free wheeling	
5	Contact Material	Silver alloy	
6	Contact make and carry	5 Amps @ 24VDC / 48V DC	
7	Coil voltage	24VDC / 48V DC	
8	Contact Resistance	50 M ohms	
9	Die Electric Strength		
9.a	Between open contacts	500V RMS	
9.b	Between contact and coil	2500 VAC	
12	Insulation Resistance	500 M Ohms @ 500VDC	
13	Operate time at Nominal voltage	20 milli secs	
14	Release time at Nominal voltage	10 milli secs	

Contact Multiplying Relay (Digital Inputs)			
SL. NO.	**TECHNICAL PARTICULARS**	**TPCODL REQUIREMENT**	**BIDDER RESPONSE**
15	Ambient temperature	-40 deg C to + 55 deg C	
16	Life Expectancy		
16.a	Mechanical Operations	20 million DC Relay	
16.b	Electrical Operations	> 100,000 operations	
19	Coil Resistance at nominal voltage(DC)	30,000 ohms + 10% @ 20 C	
20	Type of contact multiplie	2NO+2NC with LED Indicator + Free wheeling	
21	Type of mounting	DIN RAIL MOUNTING WITH SOCKET	
22	Standard applicable	IEC 60255-5	
23	Other Accessories:	Necessary TB, Din rail channel and other accessories to mount in SIC/RTU/CRP Panel	

End of Section- C

SECTION – D

DRAWINGs & DOCUMENTs

CONTENTS:

1.0 Tender Purpose

1.1 Mandatory documents required along with the Bid

1.1.1 Duly signed copy of TENDER as an acceptance to all terms and conditions as mentioned in this tender.

1.1.2 **Bidder and Sub-Vendors - Company Statistics**

Details	Bidder Response
Bidder's Name	
Address	
Contact (s), Title (s), Telephone (s), E-mail id (s)	
Name of the Chairman/ MD/ CEO/ Partners	
Nature of Ownership	
Date of Incorporation of Company/Entity	
Headquarter Location	
Other Office Locations, Functions and Personnel Strength	
1) Number of Employees by Function 2) Implementation 3) Sales 4) Support 5) Quality Assurance 6) Administrative 7) Management	
Size of Team for the Proposed Solution	
Location of Support Centers for Proposed Solution	
Other Businesses	

Table # 1: Bidder & Sub-Vendors – Company Statistics

Similarly, Bidder to submit the above details of all sub-vendors.

1.1.3 Bidder should depict complete understanding of the as-is system of the Utility based on the information provided in the Bid Document. It should also require listing down all the deliverables that has been planned as a part of the overall project with timelines.

1.1.4 Submission of documents as mentioned in Pre-Qualification Requirement

1.1.5 Technical Literature / GTP / Type Test Reports etc.

1.1.6 Details of all databases proposed and its relationship with application. Data flow diagram with entity relationship shall be submitted for all applications. Bidder shall clearly mention the list of application which are required to build data models manually.

1.1.7 GTP to be furnished about computing, network and integration interface infrastructure.

1.1.8 Submit details of methodology followed by the bidder and its sub-vendors in successfully implementing similar projects.

1.1.9 Schedule of Deviations if any from specification strictly following the prescribed format.

1.1.10 Commercial specification details as per attached sheet.

1.1.11 Proper authorization letter to sign the tender on behalf of bidder shall accompany the bid.

1.1.12 Compliance to the approved vendor list.

1.1.13 List of major relevant experiences of the Principal, Bidder, Sub-Vendors and the Product respectively.

1.1.14 Technical support facilities including qualified man-power, testing tools & instruments and integration facilities available within India.

1.1.15 Technical data sheet of all equipment including Sub-vendors systems, product brochure, white papers and case studies.

1.1.16 System Architecture drawings.

1.1.17 Detailed Bill of Material, covering all aspects of proposed System Architecture and functionality required by Purchaser as per the RFP.

1.1.18 Compliance to data sheets covered in the specification. ***(Refer Annexure E2 - Technical Requirement SAS System for Conventional Sub-stations)***

1.1.19 Product life cycle document of all equipment of Bidder's own and of Sub-Vendors.

1.1.20 Quality Assurance Plan (QAP), Manufacturing Quality Plan (MQP), Field Quality Plan (FQP).

1.1.21 Testing facilities in India

1.1.22 Confirmation on lifetime, spares, manufacturing, onsite & Offsite technical support of the supplied equipment for the period of 10 years.

1.1.23 **Project Team Structure**

Furnish the detail of the team that would be deployed by bidder to execute the project. Please provide details of the team structure in the following format:

Name of Staff	Position Assigned	International or Domestic	Firm	Employment status with the firm (Full time/ Associate)	Education (Degree, Year, Institution)	Area of Expertise and no. of years of relevant experience	Task Assigned
A. Professional Staff							
B. Support Staff							

Table # 2: Proposed Project Team Structure

Similarly, bidder shall arrange the team details of the Sub-vendors, that would be deployed to execute the project

1.1.24 **Team details (CVs)**

Use the following format for key personnel who would be involved in the project. Please include details of team members proposed to implement the project, install or manage hardware, install and manage Substation Automation System, LAN/WAN etc., please ensure that the CV covers all the required field and details.

1.	Proposed Position			
2.	Name of Firm and Role			
3.	Name of Staff			
4.	Date of Birth		Nationality	

5.	Education		
	Year	Degree/Examination	Institute/Board
6.	Membership of Professional Associations		
7.	Other Training		
8.	Countries of Work Experience		
9.	Languages		

	Language	Speaking	Reading	Writing

10.	Employment Record			
	From	To	Employer	Positions Held

11.	Detailed Tasks Assigned	12.	Work Undertaken that best illustrates capability to handle the tasks assigned:
13.	Certification		

	I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes myself, my qualifications, and my experience. I understand that any willful misstatement described herein may lead to my disqualification or dismissal, if engaged.		
	Signature of authorized representative of the staff	Date:	
	Full name of authorized representative:		

Table # 3: Format for CV Submission

Similarly, Bidder to submit the key personnel details of the Sub-Vendors, who would be involved in the project. Please include details of team members proposed to implement the project, install or manage hardware, install and manage Substation Automation System, LAN/WAN etc.

2.0 After Award of Contract

Documentation shall be provided by the bidder for all equipment and functions offered as part of this procurement including Sub-vendors equipment/systems and functions. All documentation shall be in English. The documentation shall cover all systems required by Purchaser, including all its hardware, software, and interfaces and shall cover functionality, testing, installation, system startup, operations, and maintenance.

2.1 General Requirement

a. The Bidder shall furnish the following drawings/documents during detailed engineering as per schedule ***(Refer Section-A, Item 9.0)*** from date of PO Placement Bidder to submit all datasheets, detailed GTP of the proposed BOM items during detailed engineering for the approval and finalization by Purchaser.

b. System Architecture Drawing and design documentation. This drawing should show in detail of the following:

i. Network connections

ii. Protocol used

iii. Type of interconnecting cable

iv. All equipment, systems, RTU, network switches etc. which are part of the complete proposed solution.

c. Panel GA and Complete wiring diagram

d. Functional Design Specification document

e. Step by Step test procedures for Factory Acceptance Test (FAT) and Site Acceptance Test (SAT)

f. SCADA I/O List with protocol details along with addresses

g. Interconnection Schedule (ICS) for Automation, detailed drawing indicating interconnections between various components.

h. Hardware, Software and Application manuals for all the equipment supplied including that of Third parties.

i. All Software Licenses (both own & third party), key for Hardware Locks

j. All interoperability tables

k. Software matrix indicating the details regarding versions, current license, expandability, tags/license limitations (if any) etc. along with the offer.

l. Guaranteed technical parameters & Guaranteed availability and reliability

m. Calculation for power supply dimensioning

n. Bill of Material listing equipment designation, make, type ratings, etc. of all the equipment's supplied

o. Logic Diagram (Hardware & Software)

p. Submit the details of all databases proposed and its relationship with application. Data flow diagram with entity relationship shall be submitted for key applications. The detail shall clearly mention the list of application which are required to build data models manually.

q. Operator's Manual

r. Complete documentation of implemented protocols between various elements

s. IP addressing chart for all the systems, RTU, network switches and other components / equipment which are connected to the network

t. Other network diagram with all details pertaining to IP address and interfaces used to be provided as a controlled and restricted copy.

u. Password management policy document to be provided with mechanism for storage and changing of password at specified interval clearly defined.

v. Credentials created for all OEM systems for support to be provided as consolidated document stating clearly the SLA timelines agreed with each of the OEM.

w. SLA signed document for system support and restoration in case of breakdown to be clearly document and provided as submission document.

x. Bidder to provide recommendation on proposed network bandwidth required for smooth operation of the system in non-blocking mode. Diagnostic and performance evaluation software and hardware tools

y. All tools and documents necessary to develop and maintain software such as complier, CASE tool-kits and version control software shall be delivered along with RTU Software.

z. Details of software (Operating systems, application software, engineering tools, communication systems management software, license details, I/O distribution protocol-wise etc.) for all offered systems (including RTU and configuration laptop computers etc.) and loadable in CD/DVD ROM.

aa. Final as built drawings of all automation and communication system as final documents in AutoCAD & PDF format

bb. Other documents as may be required / applicable during detailed engineering

cc. All drawings and data shall be annotated in English.

dd. Bidder shall furnish Four (4) hardcopies and 3 soft copies on reliable media of all drawings, manuals (Administration, Operation & Maintenance, Configuration, Troubleshooting and Installation), Technical catalogues, Test Certificates and Acceptance Test Reports.

ee. Two copies of the internal test report, FAT and SAT documents with test protocol formats shall be submitted for approval at least four (4) weeks before Factory Acceptance Test. Two copies of SAT protocol shall be submitted for approval at least four (4) weeks before Site Acceptance Test.

ff. Bidder shall also furnish Original plus one copy of all System Software (OS, Application and tools) along with delivery. Bidder shall submit two copies of all the configuration, application, display, database backup of all equipment on reliable secondary media.

2.2 Definitions

For the purposes of this project, the following definitions shall be used:

a. **Documents or Documentation** – Textural and graphical information describing the offered equipment, systems, and other items peripheral for Substation Automation System, whether embodied in hardcopy or electronic form such as common word processor files. Documents may also be referred to as manuals, guides, books, drawings, transmittals, and specifications. Documents are further divided into standard, OEM, and custom documents.

b. **Standard documents** – Documents produced by the Bidder and used prior to the award of this contract that are applicable to all users of the equipment and software, including Purchaser. It is expected that the Bidder will use a formal revision control scheme to maintain its standard

documents. Documents not maintained under such a scheme shall be considered custom documents.

c. **OEM documents** – OEM (Original Equipment Manufacturer) documents are those standard documents produced by Vendor, Sub-vendors. Documents produced by Vendor, Sub-vendors for customized elements of the System shall be deemed custom documents.

d. **Custom documents** – All documents not categorized as standard or OEM documents including the Bidder's standard documents that are modified to meet Purchaser's specific requirements.

e. **Project Documents** – Project documents are those documents produced for the conduct of the project, but which do not directly describe the Sub-Station Automation System. Examples of project documents include meeting minutes, action item lists, test plans and procedures, and transmittal and document lists.

2.3 Project Planning Documentation

2.3.1 Documentation Plan

Bidder to note that after the order acceptance, the project kick of meeting will be arranged by the Purchaser, in which MDL will also be finalized, Bidder shall furnish the schedule for submission of documents for the documents mentioned in the MDL and accordingly arrange submit the documents for Purchaser's Review and Approval.

It is expected that certain major documents, such as the detailed hardware and software design documentation, will consist of a series of submittals made over a period. The documentation plan shall address this by including a detailed list of all individual documentation submittals for the project.

Documents shall be submitted in a sequence as per the MDL, that allows Purchaser to have all the information necessary for reviewing or approving a document at the time of its submittal. The documentation plan shall be subject to Purchaser approval.

2.3.2 Project Progress Reports

A project progress report shall be prepared by the Bidder and sent to Purchaser every two weeks through the start of the warranty period. The report shall be submitted to Purchaser's Project Manager no later than the 10th calendar day of each month. The report shall cover the project from the start of the contract through the last working day of the month.

The progress report shall include a general assessment of the progress on the project. This assessment shall reference the latest implementation schedule, which shall be included in the report. The schedule shall show the baseline and the current schedule, progress on individual

tasks, and the forecasted completion dates for upcoming tasks and the entire project. Updated training and documentation plans shall be included.

The report shall include an explanation of existing and forecast schedule variances, the cause or source of the variance, alternatives considered, solutions adopted or recommended, and the outcome achieved or anticipated. In particular, the report shall note the needed delivery date of Purchaser furnished information. The Bidder shall be responsible for any schedule delays due to insufficient notification to Purchaser of the need for such information.

The report shall identify unresolved contract issues. This shall include a description of the item and the current due date, the consequences of any delay in resolution, and any recommendations pertinent to the decision process. The report shall also include the following items:

a. A list of action items, including the following information:

i. Action item number

ii. Date the item was opened

iii. References to the originating transmittal and any reference documents

iv. Action item status (Open, Closed)

v. Resolution due Date

vi. Responsible Organization or Person

vii. A description of the action required

viii. The date of action completion (when each item is closed)

ix. References to transmittals or other documents recording the resolution.

b. Correspondence logs, one for transmittals to Purchaser from the Bidder and one for transmittals to the Bidder from Purchaser. Each log shall have the following information for each transmittal:

i. The transmittal numbers

ii. The date of transmission (not the date written)

iii. The date received

iv. The subject of the transmittal

v. Identification of any action items addressed by the transmittal

vi. A list of any documents attached to the transmittal.

2.3.3 **Project Meetings, Agendas, and Minutes**

Project meetings shall be held to review project progress, to ensure correct interpretation of the contract, to review technical and commercial issues, and to maintain co-ordination between Purchaser and Bidder. Meetings shall be scheduled at appropriate times. Purchaser prefer to schedule meeting every month on average. The meetings shall be divided between Purchaser's and Bidder's offices. The Bidder's project manager shall prepare a meeting agenda in time for review by Purchaser before the meeting.

The Bidder shall prepare minutes of each meeting. Both Purchaser and the Bidder shall review and approve the minutes. The approved minutes shall be considered binding agreements, subject to concordance with the contract. Where the approved minutes conflict with the contract, either the minutes shall be revised or a change order to the contract shall be generated. Where the minutes of a meeting conflict with the approved minutes of a previous meeting, the conflict shall be documented in the later minutes and those approved minutes shall have precedence.

2.3.4 **Project Correspondence**

All requests and transfers of information between the parties shall be made in writing and shall be documented with letters of transmittal. All correspondence from each party shall be dated (with the date of transmittal, not the date of writing) and uniquely numbered. Except for the meeting minutes, each letter or other project correspondence shall be limited to a single topic to simplify correspondence management. Correspondence transmitted via mail shall be considered as binding if a printed copy of the correspondence is delivered within four weeks of the mail transmission.

Correspondence may be exchanged by electronic mail. Such correspondence shall not be considered a substitute for formal correspondence, however. Agreements established through e-mail transmittals must be recorded as formal correspondence before they become binding. A printed copy of e-mail attached to a transmittal cover sheet shall be considered a formal transmittal.

All project management documentation, such as, correspondence, memos, meeting minutes, and monthly progress reports, shall be maintained. A mutually agreeable file numbering scheme shall be developed and used to minimize file storage and retrieval efforts.

2.3.5 **Detailed Implementation Schedule**

The Bidder shall submit for Purchaser's approval a detailed implementation schedule. This shall describe all the project activities of both the Bidder and Purchaser. As a minimum, this schedule shall include the following:

a. Kickoff Meeting

b. Preparation and finalization of MDL document

c. Hardware procurement, integration, and testing

d. Delivery dates for Purchaser furnished data, interface equipment, and software

e. Subsystem integration and testing

f. Interface testing

g. Preparation of test plans and procedures

h. Factory and Site tests

i. Variance correction and retest

j. System disassembly, delivery, and installation

k. Final system and user documentation

l. Training

m. Submittal dates, review cycles, and acceptance dates for the hardware, software, and interface requirements documents.

The training and documentation schedules may be maintained outside the implementation schedule. However, the implementation schedule shall include all the dependencies of tasks contingent on documentation and training tasks.

The Bidder shall use a commercially available project management application (for example, Microsoft Project) to maintain the project schedule. This project management application shall be used to track the progress of the project from start through completion. Schedule monitoring shall be based on a comparison of completed tasks versus scheduled tasks and estimation of the required effort to complete the remaining tasks. The schedule presented to Purchaser shall be that used by the Bidder to manage their internal resources.

2.4 Document Format

Documents shall be delivered in two phases:

a. Approval documents, submitted for Purchaser's review and approval

b. Final documents

Purchaser prefers that documents be delivered in both hard and soft form. Softcopy shall be delivered on magnetic media. Final documents shall be delivered on hardcopy, and on softcopy on Secondary Media. Any user shall be able to access on-line documentation on

Engineering Laptop including functional design documents, user guides, maintenance manuals, on-line help, and operating procedures via a simple procedure involving a one-click operation.

Documents shall be supplied in a format that can be edited by Purchaser. Handwritten texts are not acceptable. Purchaser's standard word processing software is Microsoft Office. The Bidder is encouraged to use this software for documents. If the Bidder uses other word processing or document production software, four copies of the software, suitable for installation on a personal computer using the Windows10 operating system or newer versions, shall be provided.

Drawings and diagrams may be supplied embedded in the document files or may be supplied as separate files. Purchaser's standard drawing software is AutoCAD. If the Bidder uses other drawing software, four copies of the software, suitable for installation on a personal computer using the Windows10 operating system or newer versions, shall be provided.

Documents delivered as hardcopy shall be printed on both sides of A4 size paper and bound in three-ring binders. Divider pages with appropriately labeled tabs shall separate chapters. The spine of each volume shall be labeled with the document title and volume number so it may be easily identified when shelved.

Documents delivered on softcopy media shall be formatted for printing on A4 size paper.

Each document shall include a title or information page showing the document number, title, and revision record. The document number shall be a unique number assigned in accordance with the Bidder's standard practice. The title page shall include a space into which Purchaser may enter a document number assigned from Purchaser's document management system. The revision record shall describe each new version of the document since its original production. The revision record shall include:

i. The date of the change

ii. A brief description of the change

iii. An indication that the change has been reviewed and approved in accordance with the Bidder's quality assurance procedure

iv. The version or release of the hardware or software to which the document applies.

Each document shall include a table of contents. If a document is divided into several physical volumes, each volume shall contain the complete table of contents of the whole document. Furthermore, each document shall have a cross-reference table, listing all topics of

significance covered by the document, and giving the page or section references of all pages or sections with discussions of the topic.

Documents that describe generic or typical Substation Automation elements will not be acceptable to Purchaser unless the specific material applicable to this project can be readily identified and materiel not applicable to this project can be similarly identified. Custom documents shall not contain any material that is not pertinent to this project.

Where the phrase "on-line documentation" is used in these Specifications, it shall be interpreted to mean the ability to view the document from any workstation. The Bidder shall provide all software necessary to provide this capability. For non-OEM documentation (documentation produced by the Bidder), the Bidder shall also provide the capability to edit and annotate the document.

2.5 Document Review and Approval

All standard and OEM documents provided pursuant to this contract shall be subject to review by Purchaser. Custom documents provided pursuant to this contract shall be subject to approval by Purchaser.

2.5.1 Document Review

Purchaser's review of documents shall be limited to determining that:

a. The documents have been produced in accordance with the documentation standards of the Bidder or Sub-vendors

b. All hardware and software are in full conformance with the contract

c. The documents clearly and accurately describe the features and options of the hardware and software that pertain to the Substation Automation System and other applications

d. The documents are written in English, and hard copies are printed legibly, and well bound.

Purchaser will review documents as per the schedule mentioned in the MDL. If Purchaser does not transmit comments on the documents within the review period, the Bidder shall discuss with the Purchaser.

If Purchaser transmits comments on any documents, the Bidder shall respond to the comments within seven working days or as per the MDL after receipt of the comments. If the comments address OEM documents, the Bidder shall act as an advocate of Purchaser to initiate and facilitate resolution of the comments with the Sub-vendor.

2.5.2 **Document Approval**

All custom documents shall be subject to a formal approval process. The review for approval performed by Purchaser will be similar to that for document review process but will more closely examine the functionality and design aspects of the hardware or software. Clarity and completeness of the presentation of the material within the documents will be a key element of the review for approval.

The approval process shall proceed as follows:

a. The Bidder shall transmit documents subject to the approval process to Purchaser as per MDL. This MDL time may be adjusted by mutual agreement to accommodate the other activities of Purchaser and the Bidder. Requests by either party to change the time shall be made within two working days of receipt of the documents by Purchaser.

b. Purchaser shall return comments to the Bidder within the agreed time. The transmittal cover for the comments shall clearly indicate that the document is either:

Approved – If approved, the Bidder may proceed with the work covered by the document. No further approval action is required.

Approved with Comments – If approved with comments, the Bidder may proceed with the work covered by the document and the comments.

Not Approved – If not approved, the Bidder may proceed with the work covered by the document and the comments only at their risk. No schedule or cost relief will be granted for any work undertaken prior to approval of the appropriate documents.

c. If desired by any party, the comments may be discussed to clarify Purchaser's intent.

d. The Bidder shall then revise and resubmit the documents within five working days after receipt of the comments from Purchaser. This time may be adjusted by mutual agreement to accommodate the other activities of Purchaser and the Bidder. Requests by either party to change the time shall be made within two working days of receipt of the comments by the Bidder.

All changes made to documents to reflect approval comments shall be clearly highlighted and the revision record shall be updated to reflect the changes. Purchaser prefers the use of the change-tracking feature of the word processor used to produce the documents.

e. The review and comment process shall be repeated until the document is accepted. After the document is accepted, Bidder shall deliver the required number of final copies free of highlighting due to tracking of changes.

All changes made to documents to reflect approval comments shall be clearly highlighted and the revision record shall be updated to reflect the changes. Purchaser prefers the use of the change-tracking feature of the word processor used to produce the documents.

2.5.3 **Scope of Reviews and Approvals**

The acceptance or approval of any documents by Purchaser shall not relieve the Bidder of the responsibility to meet all the requirements of the contract or of the responsibility for the correction of the documents. The Bidder shall have no claim for additional costs or extension of time on account of delays due to revisions of the documents that may be necessary for ensuring compliance with the contract.

All deliverable documentation shall be revised by the Bidder to reflect the delivered System. Any modifications to the offered/installed system resulting from the factory and site acceptance tests shall be incorporated in this documentation. All previously submitted documents that have been changed because of engineering changes, contract changes, or errors or omissions shall be resubmitted for review and approval.

2.6 Deliverable Documentation

Two soft copy and three hard copies shall be provided for review and approval. Two soft copy and five hard copies shall be provided for all the final documentation for each site.

Document	Delivery Date
Basic hardware documents i. List of deliverables, configuration diagram ii. Network configuration, interconnection lists iii. Site installation drawings and procedures	As per MDL
Equipment manuals	With each hardware delivery
Hardware maintenance manual	With each hardware delivery
Software list of deliverables	As per MDL
Software development standards	As per MDL
Database definition	i. For standard software – As per MDL ii. For other software – with the software functional description
Interface Requirements Document	With the software functional description
Software functional description	As per the project schedule
Installation images and source code	With the System delivery
Detailed design document	As per the project schedule
System maintenance manual	With the System delivery

2.7 Document Standards

The Bidder shall provide a document defining the standards used to create and maintain all documentation supplied by the Bidder. The standards shall define:

a. The word processing or document production software used to create the documents

b. Templates for each document type

c. Definitions of the contents for each document type

d. Drawing standards to be followed

e. The approval process to be followed for document releases.

2.8 Hardware Documentation

The following documentation shall be provided for all hardware provided pursuant to this contract:

a. List of deliverable hardware

b. Equipment configuration diagram

c. Network configuration diagram

d. Interconnection list

e. Site installation drawings and procedures.

The other hardware documentation to be supplied shall be commensurate with the hardware maintenance philosophy to be employed by Purchaser.

Equipment manuals shall be provided for all hardware to be maintained by the Bidder or a third-party maintenance Bidder. Equipment manuals and hardware maintenance manuals shall be provided for all hardware to be maintained by Purchaser.

2.8.1 List of Deliverable Hardware

The list shall itemize each hardware item and include equipment configuration information. The configuration information shall be enough so that Purchaser can procure an identical item from the manufacturer. The list shall also include network names and addresses (or these shall be included in the network configuration diagram) and shall include a space for Purchaser to enter equipment identification for their own purpose.

2.8.2 Equipment Configuration Diagram

The equipment configuration diagram shall depict the logical interconnection of all the Bidder-supplied equipment and its connection to Purchaser supplied equipment. The configuration

diagram shall use the same terminology as the list of deliverable hardware so that the correspondence between the two can be readily determined.

2.8.3 **Network Configuration Diagram**

This document shall show the design of the local and wide area networks supplied by the Bidder as well as the communications network supplied by Purchaser. Both logical and physical depictions shall be provided for the network supplied by the Bidder. Only a logical depiction is required for the network supplied by Purchaser.

2.8.4 **Interconnection List**

The physical interconnections among the components, other than those shown on the network configuration diagram, shall be depicted. Each cable shall be identified, along with its terminations.

2.8.5 **Site Installation Drawings and Procedures**

The site drawings shall depict the physical arrangement of the components. References to the appropriate equipment manuals are acceptable. The drawings and procedures shall include:

a. Equipment physical drawings showing dimensions, cabinet internal arrangements, and the size and weight of each enclosure

b. Unpacking, moving, handling, and other installation details

c. The location of external connections including types and sizes of connectors

d. Input power and grounding requirements

e. Environmental requirements

2.8.6 **Equipment Manuals**

Equipment manuals shall contain the following:

a. A description of the function of the equipment

b. Installation, setup, and operating instructions

c. A block diagram showing the logical and physical interconnections among the major components

d. Expansion and upgrade capabilities and instructions

e. Preventative maintenance instructions

f. Detailed functional, logical, electrical, and mechanical characteristics of all interfaces to the device, including protocol descriptions

g. Troubleshooting and repair guides including a description and instructions for the diagnostics furnished.

2.8.7 **Hardware Maintenance Manuals**

The hardware maintenance manual shall describe the preventive maintenance and restorative procedures required to maintain the equipment in good operating condition. The information in the manuals shall include:

a. Operating details – This information shall include a detailed description of how the equipment operates and a block diagram illustrating each major assembly in the equipment. Descriptions of external data transfers with other equipment, including data patterns, security check-codes, and transfer sequences shall be included. The operational sequence of major assemblies within the equipment shall be described and illustrated by functional block diagrams and timing diagrams. Detailed logic diagrams shall also be provided as necessary for troubleshooting analysis and field repair actions.

b. Preventive maintenance instructions – These instructions shall include all applicable visual examinations, hardware testing and diagnostic routines, and the adjustments necessary for periodic preventive maintenance of the equipment. Instructions on how to load and use any test and diagnostic program and any special or standard test equipment shall be an integral part of these procedures.

c. Corrective maintenance instructions – These instructions shall include procedures for locating malfunctions down to the field-replaceable module level. These guides shall include adequate details for quickly and efficiently locating the source of an equipment malfunction. The instructions shall also include explanations for the adjustment or replacement of all items, including printed circuit cards. Schematic diagrams of electrical, mechanical, and electronic circuits, parts-location illustrations, photographs, cable routing diagrams, and sectional views giving details of mechanical assemblies shall be provided as necessary to replace faulty equipment. For mechanical items requiring field repair, information on tolerances, clearances, wear limits, and maximum bolt-down torque shall be supplied. Information on the loading and use of special off-line diagnostic programs, tools, and test equipment, as well as any cautions or warnings that must be observed to protect personnel and equipment shall be included.

d. Parts information – This information shall include the identification of each replaceable or field- repairable module. All other parts shall also be identified. The identification shall be of a level of detail enough for procuring any repairable or replaceable part. Cross-references between the Bidder's part numbers and the manufacturer's part numbers shall be provided.

2.8.8 Bidder shall submit equipment warranty details of all the supplied system/equipment with detailed inventory list with make, model, Serial number, Software versions.

2.9 Software Documentation

The following documents shall be provided for all software:

a. List of Deliverable Software

b. Software development standards

The Bidder or Sub-vendors shall provide the following documents for all software that has been produced for the offered solution. This shall include all the required OS and application software for the systems mentioned in the specification:

a. Database definition and data flow, along with an explanation of stored procedures

b. Interface Requirements Document

c. Software functional description

d. Installation images and source code

e. Source code version control and revision control documentation.

f. Software release / Patch details as consolidated document to be submitted by Bidder.

g. Recommended update frequency of all the software should be submitted as consolidated document by bidder.

The following documents shall be produced for all software produced specifically for this contract:

a. Software Requirements Matrix

b. Detailed design documents

2.9.1 List of Deliverable Software

The list shall itemize each software item and include version and license information. The distribution media for each software item shall be identified. The list shall also indicate for each item whether source code is supplied.

2.9.2 Software Development Standards

The Bidder shall document the development standards used to develop the Substation Automation System and other systems software. Purchaser reserves the right to reject software that does not conform to the development standards. The standards shall define:

a. Program design disciplines

b. Cyber Security measures

c. Resources under which the program must operate

d. Basic services

e. Interface definitions

f. Linkage conventions

g. Input and output specifications

h. Database naming and access conventions

i. Storage rules

j. Quality assurance procedures

k. Configuration design review methods

l. Software configuration control schemes.

2.9.3 **Database Definition**

The database definition shall identify the characteristics of all systems databases. It shall include, but shall not be limited to, the following:

a. The name or identification of the database

b. A description of the intended use of the database. If the database is specific to a single application, the application shall be identified

c. A description of the organization of the database (the database schema or model)

d. A description of each field of each data item

e. Instructions for generating and populating the database

f. Details of programming interfaces. This shall encompass access methods, address schemes, and read, write, and modify actions

g. Initialization description – How or by what software is the data initialized & to what value(s)

h. Details of maintenance actions.

Purchaser encourages the use of "self-documenting" database technology, where the database definition is developed and stored with the data. The resulting documentation should be printable.

2.9.4 **Interface Requirements Document**

The Interface Requirements Document shall describe in detail the interfaces between the offered systems and Purchaser provided/existing systems and networks. The Interface Requirements Document will be used by both the Bidder and Purchaser as the definition of the interface between the Substation Automation System, SCADA/ADMS and all other

systems, so that each system can be designed or modified to meet its requirements. Purchaser will provide all required information to the Bidder so that it can prepare the document accordingly.

As a minimum, the Interface Requirements Document shall cover the following aspects:

a. Description of the hardware interface

b. Description of the communication protocols and the options and parameters selected

c. Data exchange requirements including timing, priority, volume, and security requirements. A specific list of data to be exchanged during factory and site testing shall also be included.

d. Description of the performance requirements

e. Exception (for example, error) processing

f. Failover/Backup processing

g. Alarm conditions

h. Archiving requirements.

2.9.5 **Software Functional Description**

The intent of the software functional description shall be to describe the functions to be performed by each software module from the standpoint of a user. (Software functional descriptions are also referred to as user guides.) The functional operation of the Substation Automation System and other systems shall be clearly described so that it can be understood without understanding the detailed operation of each software module.

Software functional descriptions shall also be used as the first step in the design of a custom (for example, new functionality). Thus, it shall have enough information for Purchaser to determine that the new functionality will meet the requirements of the contract.

The software functional description shall include the following minimum content:

a. Functional description – A narrative description of each program. Where appropriate, solution algorithms shall be described

b. Performance requirements – The execution periodicity, processing capacity, and tuning and execution parameters that control or limit the capabilities of the software

c. Resource requirement – The expected minimum requirements for main memory, auxiliary memory, processor capacity, and other resources required by the software

d. User interface – A description of the interface used to control the software, including all user inputs and program responses

e. Software interface requirements – A description of the logic interfaces with other programs

f. Data requirements – A description of all data and databases accessed by the software, including execution parameters

g. Error messages – A concise description of all error messages and possible corrective actions

h. Diagnostic messages – Where the software generates a record of its internal operations, the messages shall be described

i. Maintenance and expansion procedures – A description of either maintenance procedures or expansion procedures that is relevant to maintenance of the program or expansion of the program.

It is Purchaser's strong preference that software functional descriptions are provided as on-line documentation.

2.9.6 **Installation Images and Source Code**

All software shall be delivered in three forms:

a. As a fully operational system installed on auxiliary memory

b. As distribution images suitable for installation on the system

The distribution images shall include all operating system, platform software, application software, and library of modifications incorporated into the delivered software. All standard software shall be supplied on the original installation media used by the Bidder to build the system. All customized software shall be supplied as part of the code management library along with the source code or other distribution image against which the code changes are to be applied.

It shall be possible for Purchaser to completely generate, build, install, and configure the entire System from the distribution images, source code, and software utilities provided with the System. To this end, "make files" or other compilation, generation, and installation tools, scripts, and directives shall be delivered.

For the purposes of this requirement, "software" shall specifically include the databases supplied with the System. That is, enough definition and content images shall be supplied such that the System databases can be created and installed on the Sub-Station Automation System and other offered systems.

2.9.7 **Software Requirements matrix**

The Bidder shall provide a list of all software requirements, cross-referenced to show where each requirement is discussed in the relevant software document.

The Software Requirements Matrix shall list each of the requirements for the Sub-Station Automation and other systems stated in this specification, in numerical order, referenced by chapter, section, and paragraph number. This list of specified requirements shall be supplemented by a list of all functions provided by the Bidder's software system that go beyond the specified requirements.

For each requirement on the list, a reference shall be given to the chapter and section where the requirement is described or covered in each of the following of the Bidder's documents:

a. Item on the List of Software Deliverables

b. Software Functional Description

c. Operations Manual

d. Factory Acceptance Tests

e. Site Acceptance Tests.

2.9.8 **Detailed Design Document**

The detailed design documents are intended as a second level of detail to the software functional descriptions. In general, a detailed design document shall relate to a single software functional description. It is expected that, for customized software, the Bidder will first deliver a software functional description for approval by Purchaser. After approval, the Bidder will then produce a detailed design document for approval. Production of the software will proceed after approval of the detailed design document.

The detailed software design documentation shall include, but shall not be limited to, the precise design information needed for planning, analysis, and implementation of the software. It shall include a show the divisions of the software design entities; a dependency description specifying the dependent entities, their coupling, and required resources, an interface description providing details of external and internal interfaces not provided in the software functional description; and a detailed design description containing the internal details of each design entity.

The detailed software design documentation shall provide a detailed description of how the software will support the functions described in the software functional description. Detailed software design documentation shall include a diagram of the software indicating major modules and an overview of the operation of each module. It shall describe data structures and flow, and a diagram or description of the way the modules interfaces with other modules.

2.9.9 **System Maintenance Manual**

The System Maintenance Manual shall describe all user procedures necessary to build and maintain the Sub-station Automation System and other supplied systems. It shall provide information on optimizing system performance.

It shall include details on Configuration upgrades, firmware and patch upgrades

The System Maintenance Manual shall also include documentation of the distributed system software supporting the configuration control function, data integrity, startup, restart, and the network management subsystem.

The manual shall provide a list of the Internet Protocol (IP) addresses of all devices in a manner compatible with Purchaser's security standards and shall describe the procedures for upgrading or adding additional devices. The System Maintenance Manual shall provide detailed information on troubleshooting all processors of the Substation automation and other supplied systems. It shall describe the use of error logs, the meaning of all program-generated error or informational messages, and the recommended response to these messages. It shall explain what the user should do to save information after a processor failure and shall describe the procedures to gather this information to allow the user to communicate in an informed manner with maintenance personnel. It shall include a description of the procedures to restore normal operation after a failure of the offered systems.

2.10 Operating Manual

The Bidder shall submit, for review and approval, operating manuals for all Substation Automation functions. The operating instructions associated with all features shall be incorporated into these manuals. Context sensitivity shall be used to go directly to the appropriate place in the manual.

The manuals shall be organized for quick access to each detailed description of the user procedures that are used to interact with the Substation Automation functions. The manuals shall present in a clear and concise manner all information that a user needs to know to understand and operate satisfactorily. The manuals shall make abundant use of screen snapshots to illustrate the various procedures.

2.11 System Administration Documentation

The Bidder shall submit, for review and approval, all system administration manuals. The system administration instructions associated with all features shall be incorporated into these manuals. Context sensitivity shall be used to go directly to the appropriate place in the manual.

2.12 Database Editor's Manual

The Database Editor's Manual shall describe the procedures to define, build, edit, archive, and expand all the databases of the delivered systems. It shall contain information describing how a user may define and add new attributes to an existing database entity. It shall also describe how to restore any database to a previously saved version if the database had been corrupted.

2.13 Acceptance Test Procedures

Acceptance test procedures (FAT & SAT) designed to test the specified requirements shall be provided. The procedures will comprise step-by-step instructions to verify that:

a. The system hardware and software are fully present and fully integrated, and its documentation is complete.

b. All the functional and performance requirements of the contract are met.

The test procedures shall be organized in the order that they are to be performed. Tests that require collection of data under controlled conditions shall be carefully planned with data collection procedures scheduled, as needed, before the tests themselves.

c. The test procedure shall be prepared in the format of step-by-step guides. Test descriptions, initial conditions, functions to be tested, expected responses, and recording areas are contained in the acceptance test procedures. The steps to achieve these functions may be provided as references to the user manuals or maintenance manuals. An attempt shall be made to cover all normal and abnormal circumstances in the procedures. The goal is to be able to rigorously test the system by strictly following carefully pre-planned procedures with minimum reliance on unstructured testing.

End of Section- D

STANDARD TECHNICAL SPECIFICATION COVER SHEET

Specification No. : ENG-EHV-1003

Specification Name : Technical Specification for 33/11kV 20/25 MVA Power Transformer

SATYA PRASAD NAYAK	SHANTAPRIYA JENA	JYOTIPRAKASH MOHANTY	Vijender Goyal	KHAJAN BHARDWAJ	POURUSH GARG
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	Ty pe 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 v oltage	
	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 **(Tolerance shall be as per IS 2026 Part-1,Clause 9, Table No.1)**	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 nt 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^2
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	

	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

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 ±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 30ºC.

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 ±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 insulationpapers 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 bepresent.

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 itshould 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^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 materialscovering above stated parameters along with below parameters during stage inspection:

1. Substance (Grammage) (g/m3)
2. Compressibility
3. Tensile strength
4. Conductivity of water extract
5. Shrinkage in air
6. Flexibility
7. Cohesion between plies1.
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	**Thermosetting powder paint**	Inside Outside	01 01	30 60
2	**Liquid Paint**			
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 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 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 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 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		
	(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 :

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/TPWODLSpecification 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 (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 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 iscommenced.

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 proofcabinet, 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 standbysource and vice versa.

d) End Limit Switch shall be provided to prevent operation beyond extreme taps & Contacts shall be providedfor operation through SCADA.

e) Limit switch to cut off electrical operation on insertion of manual handle (Contacts shall be provided foroperation 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 operationthrough SCADA).

h) Remote/local selector switch (maintained contact type). (Contacts shall be provided for operation throughSCADA).

i) Mechanical tap position indicator showing rated tap voltage against each position and resettable maximumand 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) Gasketted 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 ismaintained 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 forOLTC 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^2 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	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/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

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/cm2 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/cm2 for 4 hours - There shall not be any leakage or mechanical damage
20	Mechanical Strength Test		With oil at 8 kg/cm2 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 mental 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 prov ided 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.

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.

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:
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

capableof 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 electricalisolation 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 draininga 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 affectingthe 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 relativeto 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:-

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	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 contract 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 dantaged 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-ISerial 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 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 standrds, & 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 loses 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/TPWODLand 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 δ) 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 <Um≤ 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/TPWODLwill 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 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 δ
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/TPWODLstore 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/TPWODLreserves 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/TPWODLreserves 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/TPWODLcost, 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/TPWODLeither 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/TPWODLstores. The findings and conclusions of these tests shall be binding on the bidder.

e) Test at TPCODL/TPNODL/TPSODL/TPWODLstore/Site: after receipt of transformers at TPCODL/TPNODL/TPSODL/TPWODLstores/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/TPWODLreserves 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

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/TPWODLmay 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/TPWODLmay 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/TPWODLshall 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/TPWODLspecifications 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/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/mm2	
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^2 (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 Bottom Cover	mm mm 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^2R loss at rated current for the principal tapping at 75°C.	kW	
7.4	Calculated I^2R 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.	Details of HV Bushings line 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	 kV A kV (rms) mm mm MM/YYYY Ltr.	
21	Details of LV Bushings line (LV line end) 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	 kV A kV(rms) mm mm MM/YYYY Ltr.	
22.0	Details of Neutral Bushings 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	 kV A kV (rms) mm mm MM/YYYY Ltr.	
23.0	Details of Core Grounding Bushings 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	 kV A kV (rms) mm mm MM/YYYY Ltr.	

24.0	Details of LV Cable Connection a) Clearances i) Phase to Phase ii) Phase to Earth b) Drawing enclosed c) Length Of Each phase Bus Bars. The Bus bars are suitable for how many numbers of 1Cx 1000 sq mm, 11kV, XLPE cable.		
25.0	Designed Fault Levels: a) HV b) LV	 MVA MVA	
26.0	Core a) Material & Grade b) thickness in mm c) Type of core d) Operating flux density e) Maximum flux density f) Over fluxing capability for 10% voltage & 3% frequency variation g) Specific No load loss for the grade of core chosen at the specified flux density. h) Net weight of CRGO lamination in core. (Kg minimum). (Please submit copy of graph in support of this)	 Yes / No Watts/Kg	
27.0	Details of CTs on HV Bushings (Line) a) No. of cores b) Ratio for each core c) VA burden - for each core (along with Imag and VK wherever necessary) d) Accuracy class of each core e) Year of manufacture. f) Short time thermal current rating i) Current ii) Rated time	 kA	
28.0	Details of CTs on LV Bushings.(Line) a) No. of cores b) Ratio for each core c) VA burden - for each core (along with Imag and VK wherever necessary) d) Accuracy class of each core. e) Year of manufacture. f) Short time thermal current rating i) Current ii) Rated time	 kA	
29.0	Rail gauge (along both axis)		

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	Marshalling Box a) Derived control supply Voltage b) 415 V /control supply auto-changeover facility provided. c) Local OTI/WIT provided. d) Remote OTI/WIT provided. e) Two sets of 0/4-20 mA signals for OTI/WIT provided. f) List of annunciations. g) Two sets of potential free contacts for annunciations provided.		
35.0	Whether Marshalling boxes (ground as well as tank) provided as per specifications		
36.0	Surface Preparation/Painting 1) Material used fir Adequate rust proofing done on transformer and radiator (Details of measures to be enclosed) 2) Type of paint (epoxy/enamel) 3) Whether galvanized radiator offered as alternative.		
37.0	Conservator Oil preservation system Details (Air bag) a) Material of separator/Air bag b) Details of air pressure for the separator i. Design pressure ii. Working pressure iii. Bursting pressure (Puncture strength) c) Procedure of oil filling with air bag to be enclosed. d) Any precautions to be taken during maintenance of transformer with air bag to be mentioned here.		
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-1010

Specification Name : ENG-ELC-005- SPECIFICATION FOR 33kV XLPE ARMOURED CABLE- R1

JYOTIPRAKASH MOHANTY	SHANTAPRIYA JENA	SATYA PRASAD NAYAK	Ranjan Kumar Sahoo	VARUN BHATNAGAR	VARUN BHATNAGAR
Prepared by	Reviewed by	Reviewed by	Reviewed by	Approved by	Released by
TPWODL	TPNODL	TPCODL	TPSODL	TPWODL	TPWODL
10-12-2022	10-12-2022	12-12-2022	12-12-2022	13-12-2022	13-12-2022

CONTENTS

1. SCOPE:

This specification covers technical requirements of design, manufacture, testing at manufacturer's works, packing, forwarding, supply and unloading at site/store, performance of 33 kV XLPE armoured cable for trouble free and efficient operations.

Inclusive Sizes: -

3 CORE CABLE	1 CORE CABLE
3CX 35 sq.mm	1C X 300 sq.mm
3CX 50 sq.mm	1C X 400 sq.mm
3CX 70 sq.mm	1C X 630 sq.mm.
3CX 95 sq.mm	1C X 1000 sq.mm.
3C X 300 sq.mm	
3C X 185 sq.mm	
3C X 240 sq.mm	
3C X 400 sq.mm	

2. APPLICABLE STANDARDS:

The equipment covered by this specification shall unless otherwise stated, be designed, manufactured and tested in accordance with the latest editions of the following Indian, International Standards and shall conform to the regulations of the local authorities:

IS 7098 (Part 2)	Cross-linked Polyethylene (XLPE) insulation for Cables
IS 8130	Conductors for insulated electrical cables and flexible cords
IS 10418	Specification for Drums for Electric cables
IEC 60228	Conductor for insulated cables
IS 3975	Low carbon galvanized steel wires, formed wires and tapes forarmoring of cables
IS 5831	Specification for PVC insulation sheath for electric cables
IEC-60811	Test methods for insulations and sheaths of electric cables andcords.
ASTM D 6097	Standard test method for relative resistance to vented water treegrowth in Solid Dielectric insulating materials
ICEA T 31-610	Test method for conducting longitudinal water penetrationresistance tests on blocked conductors
IS 10810	Methods of tests for cables
IS 4905	Methods for random sampling
IS 4984	High density polyethylene pipes for water supply
IS 2530	Methods of test for polyethylene moulding materials and polyethylene compounds
IS 4826	Specification for hot dipped galvanized coatings on round steel wires
IS 5:2007	Colors for ready mixed paints and enamels

ASTM 2863	Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics
	(Oxygen Index)
IEC 60754	Apparatus and procedure for the measurement of the amount of halogens evolved during the combustion of materials taken fromelectric or optical fiber cable constructions
IEC-60502 (Part-2)	Power cables with extruded insulation and their accessories for rated voltages from 1 kV (Um = 1.2 kV) up to 30 kV (Um = 36 kV) - Part 2: 22kV Cables for rated voltages from 6 kV (Um = 7.2 kV) up to 30 kV (Um= 36 kV).
IEC 332	Test on electric cables on the fire conditions
ASTM 2843	Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics

3. CLIMATIC CONDITIONS OF THE INSTALLATION:

SL.NO.	CONDTIONS	VALUES
1	Max. altitude above sea level	1200m
2	Max. Ambient Temperature	50 °C
3	Max. Daily average ambient temp	35 °C
4	Min Ambient Temp	0 °C
5	Maximum temperature attainable by an object exposed to sun	60 °C
6	Maximum Humidity	95%
7	Minimum Humidity	10%
8	Average No. of thunderstorm days per annum	70
9	Average Annual Rainfall	150 cm
10	Average No. of rainy days per annum	120
11	Thermal Resistivity of soil	150 Deg. Ccm/W
12	Wind Pressure	126 kg/sq. m up to an elevation of 10 meter.
14	Earthquakes of intensity in horizontal direction	equivalent to seismic acceleration of 0.3g
15	Earthquakes of intensity in vertical direction	equivalent to seismic acceleration of 0.15g
16	Wind velocity	300 km/hr.

Environmentally, some of the regions, where the work will take place include coastal areas, subject to high relative humidity, which can give rise to condensation. Onshore winds will frequently be salt laden.On occasions, the combination of salt and condensation may create pollution conditions for outdoor insulators. Some places are in heavily industrial polluted areas. Therefore, outdoor material and equipment shall be designed and protected for use in exposed, heavily polluted, salty, corrosive and humid coastal atmosphere.

The atmosphere is generally laden with mild acid and dust in suspension during thedry months and is subjected to fog in cold months. The design of equipment and accessories shall be suitable to withstand seismic forces as mentioned above.

4. GENERAL TECHNICAL REQUIREMENTS:

S. No.	Description	Requirement	
		3 CORE CABLE	1 CORE CABLE
1	Voltage grade	33 kV (Earthed system)	
2	Max System voltage	36 kV	
3	Frequency	50 Hz	
4	Variation in frequency	+/- 3%	
5	Conductor	Watertight Stranded Aluminum (compacted circular)	
6	Conductor screen	Semi conducting tape and screen	
7	Insulation	XLPE	
8	Insulation screen	Shall have three layers:	Shall have three layers:
9		a) Bonded Semiconducting, b) Semiconducting water swellable tape, c) Metallic copper tape	a) Bonded Semiconducting b)Semiconducting water swellable tape, c) Metallic copper tape d) Polyester transparent tape over copper screen
10	Core identification strip	Beneath copper screen	NA
11	Inner sheath	Pressure Extruded PVC ST- 2 with PP fillers	Extruded PVC ST-2
12	Armour	GI wire round binded with rubberized cotton binding tape	Aluminum wire binded by rubberized cotton tape
13	Outer sheath	PVC ST-2 FRLSH type of color 'Yellow Lemon shade' code: 355 asper IS 5:2007	

5. GENERAL CONSTRUCTION:

The cross-linked polyethylene insulated (XLPE) 33 kV Cable Dry cured & water cooled shall be manufactured and tested strictly in accordance with the Indian Standard IS 7098 (Part – 2)/ Relevant IEC/ International standards and its latest amendments.

All material used in the manufacturing of cables shall be new and shall be selected as the best available for the intended use.

The rating factors for variation in ground and air temperature, depth of laying, thermal resistivity of soil and different laying configuration of cables shall be provided by the Bidder.

5.1 Conductor

S.No.	Parameter	Requirement						
1	Conductor	As per IS 8130						
2	Class	Class II						
3	Material	Plain Aluminium, grade H2/H4						
4	Shape	Stranded Compacted Circular						
5	Nominal size of conductormm2	95	185	240	300	400	630	1000
6	Min. number of strands	15	30	30	30	53	53	30
7	Max. DC resistance @ 20deg C (Ohm/km)	0.32	0.164	0.125	0.1	0.0778	0.0469	0.0291
8	Conductor Short circuit current rating for 1 second (KA)	9	17.4	22.6	28.3	37.7	59.4	94.3
9	Min. weight of conductor(kg/km/core)	244	481	624	780	1080	1650	2600
10	Longitudinal water sealing ofconductor	a) Non-conductive water swellable yarn/ tape/ combination of both shall be provided in between interstices of the conductor. b) Also, this water swellable tape and yarn shall be compatible to withstand conductor continuous temperature of 90 deg C and short circuit temperature of 250 deg C without any decay. c) It shall not affect the electrical conductivity of the conductor.						

S.No.	Parameter	Requirement
11	Cleanliness and uniformity	a) Before stranding, the cross-section of the Aluminium conductor shall be circular, and shall have uniform smooth surface, free from sharp edges and free from any defects. b) Stranded Conductor shall be free from oil traces & aluminum dust. Conductor (after stranding) shall be super cleaned c) Traces of aluminum dust on conductor or conductor screen shall not be acceptable.
12	Conductor jointing	Not acceptable in any strand or in any conductor after it is stranded.
13	Raw material supplier	Conductor raw material shall be procured from reputed suppliers viz., BALCO/ HINDALCO/ NALCO/ Vedanta
14	Diameter of conductor	To be specified by bidder

5.2 Conductor Screen:

S. No.	Parameter	Requirement
1	Material	**1st layer:** Semi-conducting tape **2nd layer:** Semi-conducting compound
2	Configuration	**1st layer:** Semi-conducting tape shall be applied over conductor with nominal thickness of 0.2 mm. **2nd layer:** Semi-conducting compound screen shall be applied through triple extrusion process.
3	Min. thickness	Minimum thickness of semi-conducting compound screen shall be 0.5 mm at any point of measurement.
4	Resistivity	Resistivity of semiconducting conductor screen shall not exceed 1000 Ω-m
5	Uniformity on interfacial region	Interfacial region between conductor screen and insulation shall be uniform. Protrusion/ convolution/ other defects are not acceptable in the region.
6	Raw material supplier	Semiconducting compound shall be procured fromreputed raw material suppliers viz., Dow/Borealis/Hanwa

5.3 Insulation:

S. No.	Parameter	Requirement
1	Material and extrusion process	XLPE insulation shall be applied through CCV/VCVline by triple extrusion process with 'Dry Curing' and 'Water Cooling'.

2	Raw material supplier	a) XLPE compound shall be procured from reputed raw material suppliers viz., Dow/Borealis/Hanwa b) Both XLPE and semi conductive compounds shall be used from same raw material supplier.
3	Thickness and Eccentricity	a) Nominal thickness shall be 8.8 mm. b) Minimum thickness shall be 7.82 mm at any point of measurement. c) Eccentricity of insulation shall not exceed 10%.
4	Thermal stability	The insulation properties shall be stable under thermal conditions arising out of continuous operation at conductor temperature of 90 deg. C rising momentarily to 250 deg. C under short circuit conditions.
5	Cleanliness and uniformity	Interfacial region between insulation and insulation screen shall be uniform. Protrusion/convolution/ other defects are not acceptable. Core shall be free from void and contamination.

5.4 Insulation Screen & Core identification strip:

S. No.	Parameter	Requirement
1	Material	a) **1st layer:** Semi-conducting compound b) **2nd layer**: Semi-conducting water swellable tape c) **3rd layer:** Annealed copper tape

	Configuration	**a) 1st layer: Non-Metallic Part:** Extruded Insulation semiconducting screen shall be bonded type. Resistivity shall not exceed 500 Ω-meter. Surface of insulation screen shall be smooth, free from cavity/ nicks/scratches/ other visible defects. Min. thickness shall be 0.5 mm at any point of measurement. **b) 2nd layer: Water Swellable tape:** Semi-conducting water swellable tapes shall be applied over non-metallic screen. Minimum thickness of water swellable shall be 0.3 mm and minimum overlapping shall be 15%. **Core identification strip:** **For 3 Core Cable** Each of the three core identification strips shall be applied longitudinally beneath copper screen. Width of the colored strip shall be 7-10 mm. R, Y, B
		For 1 Core Cable NA c) **3rd layer: Metallic Part**: Annealed copper tape, helically wound over the water swellable tape with minimum 15% overlap. Minimum thickness shall be 0.045 mm at any point of measurement.
3	Raw material supplier	Semiconducting compound shall be procured from reputed raw material suppliers viz., Dow/ Borealis/ Hanwa
4	Diameter of cores	To be specified by bidder
5	Weight of cores/km (approx.)	To be specified by bidder
6	Weight of copper tape/km (approx.)	To be specified by bidder

5.5 Fillers:

S. No.	Parameter	Requirement	
		3 CORE CABLE	1 CORE CABLE
1	Material	Virgin Polypropylene fibers of natural color	NA
2	Configuration	Virgin Polypropylene fibers shall be tightly filled in empty space asfillers.	

5.6 Inner Sheath:

S. No.	Parameter	Requirement	
		3 CORE CABLE	1 CORE CABLE
1	Material	Black colored Polyvinyl chloride (PVC) type ST-2 compound	
2	Configuration	The laid-up cores shall be provided with *pressure extruded* Polyvinyl chloride (PVC) type ST- 2 compound conforming to IS: 5831 with latest amendments. Pressurized extrusion is required to remove any gaps remaining in between the fillers and to make the cable as circular as possible. It shall be applied to fit closely on to the laid-up cores and shall be possible to remove easily without causing any damage to the underlying insulated cores and screens.	Extruded PVC ST-2 type conforming to IS: 5831. It shall be applied to fit closely and shall be possible to remove easily without causing any damage to the underlying insulated cores and screens.
3	Raw material supplier	PVC compound shall be procured from reputed raw material suppliers viz., Shakun, Kalpana, KLJ, DCM ShriRam. PVC compound from cable manufacturer shall be considered only after factory evaluation for the same.	
4	Min. thickness at any point of measurement	**3 CORE CABLE**	

35 sq. mm.	50 sq. mm..	70 sq. Mm.	95 sq.mm.	185 sq.mm	240 sq.mm	300 sq.mm.	400 sq.mm.
0.7mm	0.7mm	0.7mm	0.7 mm	0.7mm	0.7mm	0.7 mm	0.7 mm

1 CORE CABLE			
300 sq.mm.	400 sq.mm.	630 sq.mm.	1000 sq.mm.
0.5mm	0.5 mm	0.6 mm	0.7 mm

5.7 Armour:

S. No.	Parameter	Requirement	
		3 CORE CABLE	**1 CORE CABLE**
1	Material	Low carbon annealed hot dippedgalvanized round steel wires	H4 Grade Aluminium wires
2	Compliance to Standard	It shall comply with the requirements ofIS 3975 along with latest amendments.Hot dipped galvanizing layer shall be uniform on low carbon annealed steel wires. Zinc coating shall be 290 g/m2 as per IS 4826:1979.	It shall comply with the requirements of IS 8130 alongwith latest amendments.

3	Nominal Dimensions				**3 Core cable**				
		35 sq.mm	50 sq.mm	70 sq.mm	95 sq.mm	185 sq.mm	240 sqmm	300 sq.mm	400 sq.mm
		3.15 (GIWire	3.15 (GI Wire)	3.15 (GI Wire)	3.15 (GI Wire)	4.00 (GI Wire)	4.00 (GI Wire)	4.00 (GI Wire)	4.00 (GI Wire)

S. No.	Parameter	Requirement					
		3 CORE CABLE			**1 CORE CABLE**		
		1 Core cable					
		300 sq.mm	400 sq.mm	630 sq.mm	1000 sq.mm		
		2 mm (Aluminum wire)	2 mm (Aluminum wire)	2.5 mm (Aluminum wire)	3.15 mm (Aluminum wire)		
4	Approx. Armor Short circuit rating in kA for 1 sec	**3 Core cable**					
		95 sq.mm		185 sq.mm	240 sq.mm	300 sq.mm.	400 sq.mm
		9		20	20	20	20
		1 Core cable					
		400 sq.mm		630 sq.mm	1000 sq.mm		
		20		20	20		
		Fault current for the armour with minimum 90 % coverage.					

5	Jointing in the armour wires	Not acceptable in any armour wire	
6	Laying of armour	The armor wires shall be applied as closely as practicable. Shall not be less than 90% of total circumference.	
7	Binding	The rubberized cotton binding tape shall be applied to bind the armor wires such that it shall not affect the electrical properties of the armor wires and the overall cable.	
8	Weight of armor	To be furnished by Bidder	
9	Raw material supplier	Steel armour shall be procured fromreputed raw material suppliers viz., TATA Steel, Jindal Steel, SAIL	Aluminium armour shall be procured from reputed raw material suppliers viz., TATA/ BALCO/ HINDALCO/ NALCO/ Vedanta

5.8 Outer Sheath

S.No.	Parameter	Requirement							
1	Material	Polyvinyl chloride (PVC) ST-2 **FRLSH** type compound with **'lead naphthenate'** additive							
2	Configuration	Polyvinyl chloride (PVC) ST-2 FRLSH type compound with **'lead naphthenate'** additive as 'termite & rodent repellent' applied by extrusion process.							
3		**3 CORE CABLE**							
	Min. Thickness at any point of measurement	35 sq.mm	50 sq.mm	70 sq.mm	95 sq.mm	185 sq.mm	240 sq.mm	300 sq.mm	400 sq.mm
		2.52 mm	2.52 mm	2.68 mm	2.68 mm	3.0 mm	3.0 mm	3.0 mm	3.0 mm
		1 CORE CABLE							
		300 sq. mm.		400 sq.mm		630 sq.mm		1000 sq.mm	
		2.04 mm		2.04 mm		2.36 mm		2.52 mm	
4	Color	Yellow Lemon color, color code: 355 as per IS 5:2007.							
5	Surface uniformity	Surface of outer sheath shall be free from cavity/ nicks/ other visible defects.							
6	Raw material supplier	PVC compound shall be procured from reputed raw materialsuppliers viz., Shakun, Kalpana, KLJ, DCM ShriRam. PVC compound from cable manufacturer shall be considered onlyafter factory evaluation for the same.							

7	Weight of outer sheath/km	To be provided by bidder

5.9 Sealing End Cap:

S.No.	Parameter	Requirement
1	Material	Adhesive coated polyolefin heat shrinkable
2	Configuration	Adhesive coated polyolefin heat shrinkable end cap shall be provided at both ends of the cable.
3	Additional requirements	2 nos. additional cable end caps shall be provided with each drum and placed in the drum.

5.10 Other Requirements:

S.No.	Parameter	Requirement
1	Overall diameter of cable in mm	To be provided by bidder
2	Weight of Overall cable in kg/km	To be provided by bidder

6. MARKING:

Steel drums shall be provided. Drum shall be free from sharp edges and visual defect.

Stencil plate on one flange side of the drum and laminated paper sheet on other side flange of drum.

Cable length on one drum shall be 250 meters max. +/- 5%. As per PO terms

I. Following details shall be provided on flanges of drum:

a) Manufacturer's name
b) Type of Cable
c) Size of Cable
d) Voltage Grade
e) Length of the cable on the drum
f) Direction of the rotation of the drum
g) Gross mass
h) Country of manufacture
i) Year and month of manufacture
j) Purchase Order no.
k) Drum No.

II. Following details shall be embossed on the outer sheath:

At interval of every 1 meter, following details to be embossed:

i) TPWODL/ TPCODL/ TPNODL/ TPSODL

ii) Manufacturer name
iii) Month & Year of Manufacture
iv) Voltage grade
v) Size of the cable
vi) Purchase Order no.
vii) Cable code

Note: - Sequential meter marking shall be printed.

7. TESTS:

The bidder shall be required to submit complete set of the following test reports along with the offer:

7.1 ACCEPTANCE TESTS

Test on Conductor

- Conductor resistance test
- Test for non-conductivity of water swellable tape/yarn of conductor
- Visual inspection for conductor cleanliness
- Conductor water penetration test

Test on Conductor Screen

- Thickness of semi-conducting tape over conductor
- Test for conductivity of semi-conducting tape over conductor
- Resistivity of extruded semi-conducting conductor screen
- Thickness of extruded semi-conducting conductor screen

Test on Insulation

- Tensile strength & Elongation at break (before ageing)
- Insulation thickness
- Eccentricity and Ovality of insulation
- Hot set test
- Volume resistivity
- Void & contamination test on core (by silicon oil dip method)
- Surface smoothness of insulation

Test on Insulation Screen

- Resistivity of insulation screen
- Thickness of insulation screen
- Visual inspection for any convolution/ protrusion between conductor screen and XLPE insulation, XLPE insulation and insulation screen
- Thickness & % Overlapping of semi-conducting water swellable tape
- Thickness & % Overlapping of copper tape

Test on Inner Sheath

- PVC thickness
- Color of inner sheath

Test on Armour (For 3 Core)

- Tensile test
- Mass of zinc coating
- Uniformity of zinc coating
- Adhesion test
- Diameter and no. of wires
- Coverage %

Test on Armour (For 1 Core)

- Tensile test
- Wrapping test
- Resistance test
- Diameter and no. of wires
- Coverage %

Test on Outer sheath

- Thickness
- Tensile strength and Elongation at break (before ageing)
- Color of outer sheath
- Surface uniformity of outer sheath (on full drum)/ shall be free from any damage- void, nick, cavity

- Presence of lead naphthenate in PVC outer sheath
- Flammability test
- Oxygen index
- Temperature index
- Acid gas generation
- Smoke density

Test on Complete Cable

- Partial discharge test
- High voltage test
- Raw material consumption verification

7.2 ROUTINE TESTS

- Conductor resistance test
- Partial discharge
- High voltage test with power frequency
- Resistance test for Aluminium armour

7.3 TYPE TESTS

Tests on Conductor

- Conductor resistance test
- Conductor water penetration test

Tests on Insulation

- Tensile strength & Elongation at break (before ageing)
- Ageing in air oven
- Tensile strength & Elongation at break
- Tests for thickness of insulation
- Eccentricity and Ovality of insulation
- Hot set test
- Shrinkage test
- Gravimetric test (Water absorption)
- Volume resistivity/ Insulation Resistance

Tests on Inner Sheath

- PVC thickness

Tests on Extruded semi-conducting screen

- Volume resistivity test of conductor screen
- Volume resistivity test of core screen

Tests on Outer Sheath (PVC)

- Flammability test for outer sheath
- Thickness
- Tensile strength and Elongation at break (before ageing)
- Tensile strength and Elongation at break (after ageing)
- Variation due to ageing
- Loss of mass test
- Shrinkage test
- Hot deformation test
- Heat shock test
- Thermal stability test
- Flammability test
- Oxygen index
- Temperature index
- Acid gas generation
- Smoke density

Tests on Armour for 3 Core Cable

- Tensile test
- Torsion test
- Wrapping test
- Resistance test
- Mass of zinc coating
- Uniformity of zinc coating
- Adhesion test

Tests on Armour for 1 Core Cable

- Tensile test
- Torsion test
- Wrapping test
- Resistance test

Tests on complete cable

- Partial discharge test
- Thermal ageing test
- Bending test
- Dielectric power factor test
- High voltage test
- Heat cycle test
- Impulse withstand test

Additional Tests

- Raw material consumption
- Color coding identification over copper screen (for 3C cable)
- Sequential marking check
- Cable drum length verification
- Packaging of cable on cable drum
- Weight of conductor/km
- Diameter of Conductor
- Weight of XLPE insulation plus semiconducting screen (of conductor & insulation)/ km
- Diameter over core
- Weight of core
- Weight of copper tape/km
- Diameter over inner sheath
- Weight of armour/ km
- Cable sealing end caps
- Weight of outer sheath/ km
- Diameter of complete cable

8. TYPE TEST CERTIFICATES:

The Bidder shall furnish the type test certificates for the tests as mentioned above as per the corresponding standards. All the tests shall be conducted at CPRI / ERDA as per relevant IS. Type tests should have been conducted during the period not exceeding 10 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, same shall be carried out without any cost implication to TPWODL/ TPCODL/ TPNODL/ TPSODL.

9. PRE-DISPATCH INSPECTION:

The material shall be subject to inspection by a duly authorized representative of the TPWODL/ TPCODL/ TPNODL/ TPSODL. Inspection may be made at any stage of manufacture at the discretion of the purchaser and theequipment, if found unsatisfactory as to workmanship or material, the same is liable to rejection. Bidder shall grant free access to the places of manufacture to TPWODL/ TPCODL/ TPNODL/ TPSODL's representatives at alltimes when the work is in progress. Inspection by the TPWODL/ TPCODL/ TPNODL/ TPSODL or its authorized representatives shall not relieve the bidder of his obligation of furnishing equipment in accordance with the specifications. Material shall be dispatched after specific MDCC (Material Dispatch Clearance Certificate) is issued by TPWODL/ TPCODL/ TPNODL/ TPSODL.

Following documents shall be sent along with material.

a) Test reports
b) MDCC issued by TPWODL/ TPCODL/ TPNODL/ TPSODL
c) TPWODL/ TPCODL/ TPNODL/ TPSODL Invoice in duplicate
d) Packing list
e) Drawings & catalogue
f) Guarantee / Warrantee card
g) Delivery Challan
h) Other Documents (as applicable).

10. INSPECTION AFTER RECEIPT AT STORE:

The material received at TPWODL/ TPCODL/ TPNODL/ TPSODL, Odisha store will be inspected for acceptance and shall be liable for rejection, if found different from the reports of the pre-dispatch inspection and one copyof the report shall be sent to Engineering department.

11. GUARANTEE:

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 Company up to a period of 60 months from the date of commissioning or 72 months from the date of last supplies made under the contract, whichever is earlier, supplier 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 Company, failing which the Company will be at liberty to get it replaced/rectified at supplier's risks and costs and recover all such expenses plus the Company's own charges (@ 20% of expenses incurred), from the supplier or from the "Security cum Performance Deposit" as the case may be.

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 TATA utilities.

12. PACKING:

a) **Standard length of Cable:** The cable shall be supplied in continuous standard length of 250 (3 cores) & 500 (Single core) running meters with +/- 5% tolerance.

b) **Filling condition:** Drum shall not be overfilled.

c) **Cable drum:** The cable shall be wound on non-returnable steel drums without any extra cost to TPWODL/ TPCODL/ TPNODL/ TPSODL as per IS 10418 and its latest amendments.

d) **Sealing of cable ends:** The ends of the cable shall be sealed by means of heat shrinkable polyolefin end caps. Additional 2 nos. end caps shall be provided with each drum.

e) **Requirements for Cable drums:** Cable drums shall be so constructed as to have required mechanical strength so that the drum flanges and other components do not break during transport, in actual use or in storage. The flanges and the outside surface of the barrel shall be free from protruding materials/projections/ unevenness/ sharp edges that can damage the cable or hands of the operator during rotation of drums.
A metal preservation shall be applied to the entire drum.

f) Bottom end of cable should be clamped on drum by jute or nylon rope.

g) All ferrous metal parts used shall be treated with a suitable rust-free finish or coating to avoid rusting during transit or storage. The drums shall withstand normal handling and transport.

h) **Rail/ Road transportation:** The bidder shall ensure that 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.

i) **Packaging shall be as per climate change perspective. Cable wound on cable drum shall be covered by recyclable PVC sheet for dust proof.**

13. TENDER SAMPLE:

Not Applicable

14. QUALITY CONTROL:

The bidder shall submit QAP 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. The Purchaser's engineer or its nominated representative shall have free access to the manufacturer's/sub-supplier's works to carry out inspections.

15. TESTING FACILITIES:

Supplier/ Manufacturer shall have adequate in-house testing facilities for carrying out all routine tests & acceptance tests as per relevant Indian standards.

16. MANUFACTURING FACILITIES:

The successful bidder shall submit the bar chart for various manufacturing activities clearly elaborating each stage, with quantity. This bar chart should be in line with the Quality assurance plan submitted with the offer.

17. SPARES, ACCESSORIES AND TOOLS

Not applicable.

18. DRAWINGS AND DOCUMENTS:

Following drawings and documents shall be submitted in line with the requirement of Tender specifications:

a) Completely filled in Schedule "A" Guaranteed Technical Particulars & Schedule "B" Deviations
b) Work Experience details
c) Type test certificates.
d) Drawing 1 set of Hard Copy & Soft copy PDF File containing complete information about manufacturing.

19. SCHEDULE- "A" GUARANTEED TECHNICAL PARTICULARS:

Bidder to submit clause wise compliance.

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-1022

Specification Name : Technical Specification For Heat Shrinkable Straight through Joint & Termination for 33KV Power Cable

BARSHA BANDITA	MILAN MAITY	K GOVINDARAJ	Syed Mohammed Yousuf Raja	KHAJAN BHARDWAJ	POURUSH GARG
Prepared by	Reviewed by	Reviewed by	Reviewed by	Approved by	Released by
TPCODL	TPNODL	TPWODL	TPSODL	TPCODL	TPCODL
10-01-2023	10-01-2023	11-01-2023	12-01-2023	12-01-2023	12-01-2023

CONTENTS

1. SCOPE:

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 33 kV Power Cable-Heat Shrinkable Straight Through Joint & termination with all accessories and necessary training for trouble free & efficient performance.

2. APPLICABLE STANDARDS:

The equipments covered in this specification shall unless otherwise stated, be designed, manufactured and tested in accordance with latest revisions of relevant Indian Standards/ IEC and shall conform to the regulations of local statutory authorities.

Sl. No	IEC/IS	Description
1	IS-13573(part2): 2011	Test Requirements-Cable Accessories for Extruded Power Cables (for working voltages from 3.3 kV up to and including 33 KV)
2	IS 7098(part2):2011	Cross-linked polyethylene insulated thermoplastic sheathed cables (for working voltages from 3.3 kV up to and including 33 KV)
3	IS 692: 1994	Paper insulated lead sheathed cables for rated voltages up to and including 33 KV
4	IEC 60502: 2009	Power cables with extruded insulation and their accessories for rate voltages from 1 kV up to 30 kV
5	ASTM D-2303	Standard Test Methods for Liquid Contaminant, Inclined plane track and Erosion of insulating materials
6	ASTM D-2671	Standard Test Methods for Heat Shrinkable Tubing
7	ENA TS 09-13.1981	High Voltage Heat Shrinkable Components for use with HV solid typ cables up to and including 33 kV
8	IEC 61238(part1): 2003	Test methods and requirements - Compression and mechanical connectors for power cables for rated voltages up to 30 kV. For in house connectors, third party certification is mandatatory.
9	IS 2633:1986	Method for testing of uniformity of zinc coating
10	IS 4826: 1979	Hot dipped galvanized coatings on round steel wires
11	IS 12444:1988	Continuously Cast and Rolled Electrolytic Copper Wire Rods for electrical conductors

12	IS 191	Copper
13	IS 10810	Methods of test for cables
14	IEC 60216 part 2	Determination of thermal endurance properties of electrical insulat materials
15	IEC 60216 part 8	Instructions for calculating thermal endurance characteristics using simplified procedures

3. CLIMATIC CONDITIONS:

SL.NO.	CONDTIONS	VALUES
1	Max. altitude above sea level	1200m
2	Max. Ambient Temperature	50 °C
3	Max. Daily average ambient temp	35 °C
4	Min Ambient Temp	0 °C
5	Maximum temperature attainable by an object exposed tosun	60 °C
6	Maximum Humidity	95%
7	Minimum Humidity	10%
8	Average No. of thunderstorm days per annum	70
9	Average Annual Rainfall	150 cm
10	Average No. of rainy days per annum	120
11	Thermal Resistivity of soil	150 Deg. Ccm/W
12	Wind Pressure	126 kg/sq. m up to an elevation of 10 meter.
14	Earthquakes of intensity in horizontal direction	equivalent to seismic acceleration of 0.3g
15	Earthquakes of intensity in vertical direction	equivalent to seismic acceleration of 0.15g
16	Wind velocity	300 km/hr.

Environmentally, some of the regions, where the work will take place include coastal areas, subject to high relative humidity, which can give rise to condensation. Onshore winds will frequently be salt laden. On occasions, the combination of salt and condensation may create pollution conditions for

outdoor insulators. Some places are in heavily industrial polluted areas. Therefore, Outdoor material and equipment shall be designed and protected for use in exposed, heavily polluted, salty, corrosive and humid coastal atmosphere.

The atmosphere is generally laden with mild acid and dust in suspension during the dry months and is subjected to fog in cold months. The design of equipment and accessories shall be suitable to withstand seismic forces corresponding to an acceleration of 0.1 g.

4. GENERAL TECHNICAL REQUIREMENTS:

General design and sizes of 33 kV XLPE insulated cables operated in TPCODL/ TPWODL/ TPNODL/ TPSODL Network are as mentioned below:

A) XLPE Insulated Underground Cables as per IS 7098-2: 33 KV (E)

A2XCWY-(Aluminum stranded compacted conductor, XLPE insulation, copper tape screen, wire Gl armour, PVC sheath)

A2XCWAY (Aluminum stranded compacted conductor, XLPE insulation, copper tape screen, wire Aluminum armour, PVC sheath)

CAS 33 kV 1Core- 300, 400 sq.mm (Aluminum stranded compacted conductor, XLPE insulation, copper tape screen, Corrugated Aluminum armour, PVC sheath

i. 3CX35 sq.mm A2XCWY
ii. 3CX50 sq.mm A2XCWY
iii. 3CX70 sq.mm A2XCWY
iv. 3CX95 sq.mm A2XCWY
v. 3CX185 sq.mm A2XCWY
vi. 3CX240 sq.mm A2XCWY
vii. 3CX300 sq.mm. A2XCWY
viii. 3CX400 sq.mm. A2XCWY
ix. 1CX300 sq.mm. A2XCWaY
x. 1CX400 sq.mm. A2XCWaY and Corrugated Aluminum Armour
xi. 1CX630 sq.mm. A2XCWaY
xii. 1CX1000 sq.mm. A2XCWaY

Type & Size of cable	Type of Joint
33 kV 3C X 185, 3C X 240, 3CX300 and 400 sq.mm. XLPE insulated cable	Indoor termination with 185-400 sq.mm. tinned coated mechanical connector

Type & Size of cable	Type of Joint
	Straight through Joint with 185-400 sq.mm. tinned coated mechanical connector
	Outdoor termination with 185-400 sq.mm. tinned coated mechanical connector
33 kV 3CX35, 3CX50, 3CX70, 3CX95, 3C X150 XLPE insulated cable	Indoor termination with Aluminium crimping ferrule
	Straight through Joint with Aluminium crimping ferrule
	Outdoor termination with Aluminium crimping ferrule
33 kV 1CX300, 1CX400 Sq.mm XLPE Insulated Cable	Indoor termination with 185-400 sq.mm. tinned coated mechanical connector
	Straight through Joint with 185-400 sq.mm. tinned coated mechanical connector
	Outdoor termination with 185-400 sq.mm. tinned coated mechanical connector
33 kV 1CX630 Sq.mm XLPE Insulated Cable	Indoor termination with 630 sq.mm. tinned coated mechanical connector
	Straight through Joint with 630 sq.mm. tinned coated mechanical connector
	Outdoor termination with 630 sq.mm. tinned coated mechanical connector
33 kV 1CX1000 Sq.mm XLPE Insulated Cable	Indoor termination with 1000 sq.mm. tinned coated mechanical connector
	Straight through Joint with 1000 sq.mm. tinned coated mechanical connector
	Outdoor termination with 1000 sq.mm. tinned coated mechanical connector
PILCA to XLPE transition joints	Screened Transition joint 3CX300/400 sq.mm. XLPE insulated cable with 3CX300/400 sq.mm PILCA cable (with mechanical connector)

The jointing kit containing heat shrinkable tubing, mastics, lugs, mechanical connector and other accessories for making a complete joint and termination shall be designed to meet TPCODL/TPWODL/TPNODL/TPSODL specification, ENA TS 09-13, IEC 60502, IEC 61238 part1 and IS 13573, part 2 and other relevant standards. Cable Joint and termination material shall not be adversely affected in any manner even after contact with material used in cable construction and material used as accessories in the construction of cable joints and terminations and there will be no chance of corrosion developing on any metal surface.

Assembled jointing kit components shall perform without distress in system with parameters

(mentioned below):

S. No.	Parameter	Units	Requirement
1	Max Withstand System Voltage	KV	36
2	Partial Discharge at 1.73 Uo	pC (Pico-coulombs)	<10
3	Impulse Peak Withstand	KV	170
4	Continuous operation withstand Temperature	°C	90 °C
	Short Circuit withstand temperature	°C	250 °C
5	Short Circuit Withstand Current	KA/1Sec	As per Size of the Conductor
6	Storage Temperature Range	°C	-10°C to +45°C
7	Shelf life of kit components excluding mastic and solution	Years	Min.5
8	Shelf life of mastic and solution	Years	Min.2

A. General Technical Particular for Heat Shrinkable Insulation Tubing/Sleeves/Wrap around Sleeve:

S. No.	Parameter	Requirement
1	Visual Examination	Free from protrusions, pin holes, cracks, nicks and other visible defects.
2	Wall thickness Ratio	0.6 or 60% (Minimum at any two points of measurements)
3	Internal dia of tube after full recovery	Shall not be higher than as specified in approved BOM/GTP
4	Longitudinal change	10% Max.
5	Electric Strength	10KV/MM(Min.)
6	Tensile Strength	10N/mm2 (Min.) [8N/mm2 for anti-tracking]
7	Ultimate Elongation	200%(Min.)
8	Heat Shock	No Splitting, Cracking, Dripping or flowing after 30 mins. At 200 °C (Min.) (For stress control tube: 30 Mins. At 200 °C Minimum)
9	Low Temperature Flexibility	No cracking after 4 Hrs at -20Deg.C (Max.)
10	Tracking Resistance	No tracking, erosion to top surface or flame failure after 1 hr. @ 2.5KV 1 hr. @ 2.7KV 1 hr. @ 3KV 20 min @ 3.25KV

S. No.	Parameter	Requirement
11	Volume Resistivity	$1x10^{10}$ Ohm-meter (min.) For stress control tube VR: $1X10^{7}$ Ohm-meter Min.)
12	Flame Retardant (Applicable only for Anti tracking Tubes/ sleeves)	After 1 min. burn: Burnt or charred length 250mm Max.

B. General Technical Particular for Heat Shrinkable Moulded Components/Breakouts/Weather Sheds:

S. No.	Parameter	Requirement
1	Visual Examination	Free from protrusions, pin holes, cracks, nicks and other visible defects.
2	Wall thickness Ratio	0.6 or 60% (Minimum at any two points of measurements)
3	Internal dia of tube after full recovery	Shall not be higher than as specified in approved BOM/GTP
4	Longitudinal change	25% Max.
5	Electric Strength	10 KV/MM(Min.)
6	Tensile Strength	8N/mm2 (Min.)
7	Ultimate Elongation	200 %(Min.)
8	Heat Shock	No Splitting, Cracking, Dripping or flowing after 30 mins. At 250 ^{o}C Min.
9	Low Temperature Flexibility	No cracking after 4 Hrs at -20^{o}C(Max.)
11	Volume Resistivity	$1x10^{10}$ Ohm-meter(min.)
12	Flame Retardant (for anti-tracking moulded components)	After 1 min. burn: Burnt or charred length 250mm Max.

5. GENERAL CONSTRUCTION:

a) Termination kit shall be designed based on heat shrink technology and shall be suitable for installation for 33 kV, three core and single core aluminum conductor, XLPE insulated (in line with TPCODL/TPWODL/TPNODL/TPSODL Specification for underground IS 7098-part 2. IS 13573 Part 2 &3).

b) Length of 33 KV terminations (from bottom of breakout to center of lug hole) shall be minimum:

i) 1 core cable I/D 900 mm
ii) 1 core cable O/D 1100 mm
iii) 3 core cable (I/D) Indoor terminations: 1100 mm
iv) 3 core cable O/D (Outdoor terminations): 1500 mm

- **Components of Termination Kit:**

<table>
<tr><th>S. No.</th><th>Components</th><th>Requirement</th></tr>
<tr><td>1</td><td>Heat Shrinkable insulating tube/Sleeve</td><td>a) Surface of material: shall be smooth and free from protrusion, voids and nicks.
b) Wall thickness ratio (before recovery) of all sleeves/tubes shall not be less than 60% st any two points of measurement.
<table>
<tr><th>Sl no</th><th>Size</th><th>Tube type</th><th>Qty</th><th>Size (min in mm)</th><th>OD (Before/After shrinking) mm</th></tr>
<tr><td>1</td><td>3C 300/400 sqmm I/D & O/D</td><td>Stress control tube</td><td>3</td><td>300</td><td>65/30</td></tr>
<tr><td>2</td><td>3C 300/400 sqmm O/D</td><td>Anti tracking tube</td><td>3</td><td>2000</td><td>70/30</td></tr>
<tr><td>3</td><td>3C 300/400 sqmm O/D</td><td>Anti tracking tube</td><td>3</td><td>900</td><td>70/30</td></tr>
<tr><td>4</td><td>3C 300/400 sqmm I/D</td><td>Anti tracking tube</td><td>3</td><td>1200</td><td>70/30</td></tr>
<tr><td>4</td><td>1C 300/400 sqmm O/D & ID</td><td>Stress control tube</td><td>1</td><td>300</td><td>65/30</td></tr>
<tr><td>5</td><td>1C 300/400 sqmm O/D & ID</td><td>Anti tracking tube</td><td>1</td><td>1300</td><td>70/30</td></tr>
<tr><td>6</td><td>1C 300/400 sqmm O/D & ID</td><td>Insulating tube</td><td>3</td><td>300</td><td>35/12</td></tr>
</table>
• For lower sizes length & OD of tubes should be adjusted proportionally.
• O/D – Outdoor termination , I/D indoor termination</td></tr>
<tr><td>2</td><td>Tinned coated Mechanical connector/ Compression lugs</td><td><u>Mechanical connector:</u>
a) Tinned coated Aluminium Alloy 185-400 mm^2/ 630mm^2/1000mm^2
b) Type tested as per IEC 61238(part1):2003
c) Dimensions shall be as annexure-I of this specification.
d) Approved make NILLED, PFISTERER, NEXANS, TYCO</td></tr>
</table>

		(GERMANY) **Compression Lugs:** a) Material: Aluminium b) All Aluminum lugs with anti-corrosive paste shall be long barrel type as per IS 8309: 2003. c) Dimensions shall be as annexure-I of this specification. d) 1000mm² Aluminum lugs shall be without palm hole. e) Conductivity of ferrule shall be as per IS 8309:2003.
3	**Lug Seal, Anti-tracking tube, weather sheds, stress control tube**	a) Heat shrinkable b) Fire resistant and weather resistant as per ENA TS 09-13 c) For lug seals, weather sheds & anti tracking tube
4	**Mastic tape**	a) Mastic tape shall be electrically insulating, non-tracking and water/humidity resistant. b) Volume resistivity of mastic shall not be less than volume resistivity of insulating tube as specified in ENA TS 09-13. c) Stress control mastic tape for semicon area d) Moisture sealing mastic for lugs/connectors
5	**Heat Shrink Breakout**	a) Heat shrinkable b) Fire resistant and weather resistant as per ENA TS 09-13 – for lug seals, weather sheds and Anti- tracking tubes c) Adhesive coated Breakouts shall be provided on outer sheath of the cable to prevent water ingress.
6	**Tinned coated copper braid**	a) Shall be completely insulated with adhesive coated fire retardant and weather resistant HS tube/sleeve up to copper lug at one end. b) Fire resistant and weather resistant as per ENA TS 09-13 c) Size and length as per below: For 3C cables: 70 mm² X 750 mm X 1 Run for 150/185/240/300/400/630 mm² cables. 50 mm² X 750 mm X 1 Run for below 150 sqmm. For 1C cables: 70mm² X 750 mm X 1 Run for 300/400/630 & 1000 mm² cables. Additionally 3 nos x 150 mm2 Al lugs with sealing sleeves/mastic for armor back fold earth bonding.
7	**Tinned coated copper braid as a leakage current collector**	a) Leakage current collector tinned copper braid b) 1R x 7 mm² x 150 mm per core shall be provided for terminations
8	**Tinned copper wire mesh**	Minimum 2" X 0.5m I/D & 0.7m O/D (2.5mm²) tinned copper mesh shall be provided on armor circumference beneath the copper braid.
9	**Sub-kit components**	a) GI Solid Collet dia of dia as per cable OD (1no only in 3C cables),

		b) Worm drive clip/ Jubilee clip of stainless steel (2nos) c) Compatible support rings (Aluminium for single core and GI for three core cables) d) Soldering on copper screen is not acceptable e) Constant pressure roll shall be provided for screen connections as per compatible size. For 3 core- 3nos, for 1C -1nos f) Plumb earthing on PILCA side is unacceptable. Constant pressure roll spring should be used for same g) Tinned copper binding wire 20 SWG, qty 50gms- 3C, 25gms- 1C h) Nylon string OD 1mm, 2mtr i) Silicone grease, 30 gms- 3C, 10gm -1C j) Cleaning liquid k) Vinyl tape l) Al oxide cloth m) Other necessary items
10	**Submission of BOM and instruction sheet**	a) Participating bidder shall submit BOM(during pre bid) with dimensions of each size and quantity of all components b) BOM shall be approved during tender evaluation and during GTP approval c) Instruction sheet should be submitted in each kit.

- **Components of Straight Through Jointing Kit:**

<table>
<tr><th>Sl. no</th><th>Components</th><th>Requirement</th></tr>
<tr><td>1</td><td>Heat Shrinkable insulating tube/Sleeve</td><td>a) Surface of material: shall be smooth and free from protrusion, voids and nicks.
b) Recovered thickness: Recovered thickness of insulation tubes over ferrule or connector circumference shall not be less than 10.56 mm at any point of measurement.
c) Wall thickness ratio (before recovery) of all sleeves/tubes shall not be less than 60% st any two points of measurement.

Following tubes shall be included in BOM
<table>
<tr><th>Sl no</th><th>Size</th><th>Tube type</th><th>Qty</th><th>Size (min in mm)</th><th>OD (Before/After shrinking) mm</th></tr>
<tr><td>1</td><td>3C 300/400 sqmm</td><td>Stress control tube</td><td>3</td><td>650</td><td>60/25</td></tr>
</table>
</td></tr>
</table>

		<table><tr><td>2</td><td>3C 300/400 sqmm</td><td>Red Insulating tube</td><td>6</td><td>640</td><td>65/27- 3nos, 85/37- 3nos</td></tr><tr><td>3</td><td>3C 300/400 sqmm</td><td>Dual wall tube</td><td>3</td><td>640</td><td>110/40</td></tr><tr><td>4</td><td>1C 300/400 sqmm</td><td>Stress control tube</td><td>1</td><td>60</td><td>60/25</td></tr><tr><td>5</td><td>1C 300/400 sqmm</td><td>Red Insulating tube</td><td>2</td><td>590</td><td>66/27, 85/37</td></tr><tr><td>6</td><td>1C 300/400 sqmm</td><td>Dual wall tube</td><td>1</td><td>580</td><td>110/40</td></tr></table> • For lower sizes length & OD of tubes should be adjusted proportionally.
2	**Tinned coated Mechanical connector/ Compression lugs**	**Mechanical connector:** a) Tinned coated Aluminium 185-400 mm^2/ 630mm^2/1000mm^2 b) Type Tested as per IEC 61238(part1):2003 c) Dimensions shall be as annexure-I of this specification. d) Approved make NILLED, PFISTERER, NEXANS, TYCO (GERMANY) **Compression Lugs:** a) Material: Aluminium b) All Aluminum lugs with anti-corrosive paste shall be long barrel type as per IS 8309: 2003. c) Dimensions shall be as annexure-I of this specification. d) 1000mm2 Aluminum lugs shall be without palm hole. e) Conductivity of ferrules/mechanical connectors shall be as per IS 8309: 2003.
3	**Mastic tape**	a) Mastic tape shall be electrically insulating, non-tracking and water/humidity resistant. b) Volume resistivity of mastic shall not be less than volume resistivity of insulating tube as specified in ENA TS 09-13. c) Stress grading mastic should be provided for both connector portion and semicon portion. d) Water resistant sealing mastic shall also be provided.for end sealing in straight through kit and lug sealing in termination kit.
4	**Tinned coated copper braid for GI armour continuity/**	Tinned coated copper braid for GI armor continuity: Uniformly tinned coated copper braid shall be provided for armor continuity.

	Ferrules for Aluminium armour continuity	a) Wrap tinned copper wire mesh with 50% overlap around the joint area and continue 25mm over the copper screen on both sides. Bind the copper wire mesh on copper screen with CFS a) Uniformly tinned coated wire mesh shall be provided for armor continuity. b) Tinned copper braid shall be provided for wrapping over armor circumference beneath the copper braid and size shall be as below: For 3C cables: 70 mm² X 2600 mm X 1 Run for 150/185/240/ 300/400 mm² cables. For 1C cables: 70mm² X 2500 mm X 1 Run for 630 mm² &1000 mm² cables. Additionally 2 nos x 150 mm² Al lugs for aluminium armor continuity.
5	**Tinned coated copper braid for screen continuity**	7 mm² x 150 mm- 6 nos. for 3 core only
6	**Tinned copper wire mesh**	Uniformly tinned coated copper braid shall be provided for screen continuity. Minimum 2.5mm2 tinned copper mesh shall be provided on both sides of armor circumference beneath the copper braid. For 3C 2'' X 10mtr (min 2.5 sqmm) For 1C 2'' X 12mtr (min 2.5 sqmm) 2nos & 2" X 10mtr (min 2.5 sqmm) 1 no
7	**GI wire mesh/ copper wire mesh**	a) Mechanical protection shall be provided in GI armored cables by means of heavily zinc coated GI mesh as per IS 4826 b) In 1C Aluminium armored cables, for mechanical protection, copper wire mesh shall be provided as mentioned in Sl no 5. c) For 3C W 3'' X 15mtr (heavily zinc coated) minimum
8	**Breakouts**	Adhesive coated breakout shall be provided on outer sheath at both sides on the cable to prevent water ingress. Qty. 2nos
9	**Nesting & end sealing tube**	a) Hot melted adhesive coated bested end sealing tube for protection of moisture ingress in cores. b) Length 200mm minimum c) 6 nos for 3C, 2 nos for 1C
10	**Wrap around insulating tube/Sleeve as outer most tube**	Material: Cross-linked polyolefin (Heat Shrinkable) as a waterproof seal. Shape: Wrap around form with hot-melt adhesive liner on the inner surface of the sleeve (Upon heating, the sleeve shrinks and the adhesive melts, creating a water-tight bond between the sleeve and the

		cable). Stainless steel channel shall be provided along the wrap around to close the sleeve during installation. Excellent mechanical and corrosion protection, and atmospheric sealing. High split resistance. *Note: Overlapping of wrap around sleeve is not acceptable. Length of one sleeve: Minimum 1000mm, Qty. 2nos Insulating sleeve of 500 mm should be provided to cover mid joints Portion
11	**Sub kit components**	a) GI Solid Collet dia of dia as per cable OD (2nos only in 3C cables), b) Worm drive clip/ Jubilee clip of stainless steel (3 core- 6nos, 1C 2nos), c) Compatible support rings (Aluminium for single core and GI for three core cables) d) Soldering on copper screen is not acceptable e) Constant pressure roll shall be provided for screen connection as per compatible size.. For 3 core- 6nos, for 1C -2nos f) Plumb earthing on PILCA side is unacceptable. Constant pressure roll spring should be used for same a) Tinned copper binding wire 20 SWG, qty 50gms b) Nylon string OD 1mm, 2mtr c) Silicone grease, 30 gms d) Cleaning liquid e) Vinyl tape f) Al oxide cloth g) Other necessary items
12	**Submission of BOM and instruction sheet**	a) Participating bidder shall submit BOM(during pre bid) with dimensions of each size and quantity of all components b) BOM shall be approved during tender evaluation and during GTP approval c) Instruction sheet should be submitted in each kit.

SL no	Cable size	Joint type	Connector type
1	3C 185/240/300/400	Straight through, I/D termination, O/D termination	Mechanical
2	1C 300/400/630/1000	Straight through, I/D termination, O/D termination	Mechanical
3	3C 35/70/95/150 sqmm	Straight through, I/D termination, O/D termination	Crimping

6. MARKING:

Following details shall be printed in the box:

a) Manufacture's name and address.
b) Month & Year of Manufacturing
c) Voltage Grade
d) PO No.
e) "TPCODL/ TPWODL/ TPNODL/ TPSODL" Name

HS Sleeves/tubes and breakout components shall be embossed with:

a) Manufacture's name and address.
b) Month & Year of Manufacturing
c) Batch No. / Lot No.
d) Shrink Ratio
e) Size
f) Type
g) "TPCODL/ TPWODL/ TPNODL/ TPSODL" Name

7. TESTS:

All Routine, Acceptance & Type tests shall be carried out in accordance with the Relevant IS/IEC/ ENA TS 09-13. All the components shall also be type tested as per the relevant standards mentioned below. Following tests shall be necessarily conducted on the Joint and Termination Kits In addition to others specified in IS/IEC/ENA-TS 09-13 standards:

7.1 ACCEPTANCE TESTS:

Test	Clause No.	Reference Standard
Visual inspection	3.15	ENA -TS 09-13
Physical verification of kit contents and dimensions	As per TPCODL/TPWODL/TPNODL/TPSODL approved BOM	
Electric Strength test	3.4	ENA -TS 09-13
Ultimate Elongation tests	3.12	ENA -TS 09-13
Tensile Strength	3.12	ENA -TS 09-13
Volume Resistivity	3.16	ENA -TS 09-13
Wall thickness ratio	3.3	ENA -TS 09-13
Expanded and recovered diameters	3.3	ENA -TS 09-13
Longitudinal change after recovery	3.3	ENA -TS 09-13
Heat shock test	3.7.1/3.7.2	ENA -TS 09-13
Low temperature flexibility	4.5	ENA -TS 09-13
Insulation build up thickness after shrink on Ferrule	8.1	IS 10810 -6
Flame retardant test on anti-tracking tubes and anti-tracking moulded components and earth braid protective tube after shrink on mandrill for terminations	3.5.1/ 3.5.2	ENA -TS 09-13
Area measurement of tinned copper braids (Area of one wire x no. of wires x no. of carriers)	As per TPCODL/TPWODL/TPNODL/TPSODL specification/ approved BOM	
Conductivity test on ferrules/ connectors/ lugs	8.3	IS 8309/ As per IEC 61238 part 1
Uniformity of zinc coating on GI mesh (Manufacturer's TC to be provided)	4.1	IS 2633

7.2 ROUTINE TESTS

Test	Clause No.	Reference Standard
Visual inspection of tubing and moulded components for free from pin holes, cracks, nicks, protrusion and other defects	3.15	ENA -TS 09-13
Dimension check	As per TPCODL/TPWODL/TPNODL/TPSODL	

Test	Clause No.	Reference Standard
	approved BOM	
Electric Strength	3.4	ENA -TS 09-13
Ultimate Elongation	3.12	ENA -TS 09-13
Tensile Strength	3.12	ENA -TS 09-13
Volume Resistivity	3.16	ENA -TS 09-13
Wall thickness ratio	3.3	ENA -TS 09-13
Expanded and recovered diameters of tubes	3.3	ENA -TS 09-13

7.3 TYPE TESTS:

(i) Terminations & Straight Through joints

Test	Clause No.	Reference Standard
Conductor resistance with Ferrule/Lugs/Mechanical connectors	4.1	IS 13573(Part-2)
AC Voltage withstand Test (Air)	4.2	IS 13573(Part-2)
AC Voltage withstand test (under wet conditions) (for outdoor termination only)	4.2	IS 13573(Part-2)
Partial Discharge	7.0	IS 13573(Part-2)
Impulse voltage test	6	IS 13573(Part-2)
Heat Cycle test in air and water	9.1 and 9.2	IS 13573(Part-2)
Thermal Short Circuit Test for Screen	10	IS 13573(Part-2)
Thermal Short Circuit Test for Conductor	11	IS 13573(Part-2)
DC Voltage Withstand	5	IS 13573(Part-2)
Dynamic short circuit test	12	IS 13573(Part-2)
Thermal Endurance test	IEC 60216 part 2 & 8	
Salt fog test (Only for Outdoor terminations only)	13	IS 13573(Part-2)

(II) Kit Components

a) For Tubing and Moulded Components

Test	Clause No.	Reference Standard
Corrosion Resistance	3.1	ENA -TS 09-13
Density	3.2	ENA -TS 09-13
Dimensions	3.3	ENA -TS 09-13
Electric Strength	3.4	ENA -TS 09-13
Flame Retardance	3.5	ENA -TS 09-13
Heat Shock	3.7	ENA -TS 09-13
Low temperature flexibility	3.8	ENA -TS 09-13
Relative Permittivity	3.9	ENA -TS 09-13
Tensile strength and Ultimate elongation	3.12	ENA -TS 09-13
Thermal Ageing	3.13	ENA -TS 09-13
Tracking Resistance	3.14	ENA -TS 09-13
Visual Examination	3.15	ENA -TS 09-13
Volume Resistivity	3.16	ENA -TS 09-13
Water Absorption	3.17	ENA -TS 09-13

b) For Compression Lugs, Compression Ferrules and Mechanical connectors

Test	Reference Standard
Mechanical Pull Test	IEC 61238, part - 1
Heat cycle Test (1000 Nos.)	IEC 61238, part - 1
Short circuit Test	IEC 61238, part - 1

8. TYPE TEST CERTIFICATES:

The Bidder shall furnish the type test certificates for the tests as mentioned above as per the corresponding standards. All the tests shall be conducted at **CPRI/ERDA** as per relevant IS. However, TPCODL/ TPWODL/ TPNODL/ TPSODL/ TATA-POWER reserves the right to allow any other NABL accredited/ Govt. lab report / Lab having accreditation from ILAC Signatory under exceptional circumstances after due diligence/ scrutiny by DISCOM. Type tests should have been conducted 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, same shall be carried out without any cost implication to TPCODL/ TPWODL/ TPNODL/ TPSODL.

9. PRE-DISPATCH INSPECTION:

The material shall be subject to inspection by a duly authorized representative of the TPCODL/ TPWODL/ TPNODL/ TPSODL. Inspection may be made at any stage of manufacture at the discretion of the purchaser

and the equipment, if found unsatisfactory as to workmanship or material, the same is liable to rejection. Bidder shall grant free access to the places of manufacture to TPCODL/ TPWODL/ TPNODL/ TPSODL's representatives at all times when the work is in progress. Inspection by the TPCODL/ TPWODL/ TPNODL/ TPSODL or its authorized representatives shall not relieve the bidder of his obligation of furnishing equipment in accordance with the specifications. Material shall be dispatched after specific MDCC (Material Dispatch Clearance Certificate) is issued by TPCODL/ TPWODL/ TPNODL/ TPSODL.

Following documents shall be sent along with material.

a) Test reports
b) MDCC issued by TPCODL/TPWODL/TPNODL/TPSODL
c) TPCODL/TPWODL/TPNODL/TPSODL Invoice in duplicate
d) Packing list
e) Drawings & catalogue
f) Guarantee / Warrantee card
g) Delivery Challan
h) Other Documents (as applicable).

10. INSPECTION AFTER RECEIPT AT STORE:

The material received at TPCODL/ TPWODL/ TPNODL/ TPSODL store will 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.

11. GUARANTEE:

Bidder shall stand guarantee towards design, materials, workmanship & quality of process / manufacturing of items under this 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 Company up to a period of at least 60 months from the date of commissioning or 66 months from the date of last supplies made under the contract whichever is later.

Further Bidder shall also stand guarantee towards poor workmanship in installation of straight through joint and terminations installed by bidder's jointer up to 60 months from the date of installation.

Bidder shall be liable to undertake to replace/rectify such defects at own costs, within mutually agreed time frame, and to the entire satisfaction of TPCODL/TPWODL/TPNODL/TPSODL, failing which TPCODL/TPWODL/TPNODL/TPSODL shall be at liberty to get it replaced/rectified at bidder's risks and costs and recover all such expenses plus the Company's own charges (@ 20% of expenses incurred), from the bidder or from the "Security cum Performance Deposit" as the case may be. 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 Company.

12. PACKING AND TRANSPORT:

Supplier shall ensure that all material covered by this specification shall be prepared for rail/road transport (local equipment) and be packed in such a manner as to protect it from damage in transit. The bidder shall provide instructions regarding handling and storage precautions to be taken at site.

13. TENDER SAMPLE:

Bidder shall submit the sample of material during submission of Bids.

14. QUALITY CONTROL:

The bidder shall submit QAP 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. The Purchaser's engineer or its nominated representative shall have free access to the manufacturer's/sub-supplier's works to carry out inspections.

15. TESTING FACILITIES:

Supplier/ Manufacturer shall have adequate in house testing facilities for carrying out all routine tests & acceptance tests as per relevant Indian standards.

16. MANUFACTURING FACILITIES:

The successful bidder shall submit the bar chart for various manufacturing activities clearly elaborating each stage, with quantity. This bar chart should be in line with the Quality assurance plan submitted with the offer.

17. SPARES, ACCESSORIES AND TOOLS

Not applicable.

18. DRAWINGS AND DOCUMENTS:

Following drawings and documents shall be submitted in line with the requirement of Tender specifications:

a) Completely filled in Schedule "A" Guaranteed Technical Particulars & Schedule "B" Deviations
b) BOM
c) Work Experience details

d) Type test certificates.

e) Drawing 1 set of Hard Copy & Soft copy PDF File containing complete information about manufacturing.

19. SCHEDULE- "A" GUARANTEED TECHNICAL PARTICULARS:

S. No.	Parameter	Units	To be Furnished by Bidder
1	Max Withstand System Voltage	KV	
2	Partial Discharge at 1.73 Uo	pC (Pico-coulombs)	
3	Impulse Peak Withstand	KV	
4	Continuous operation withstand Temperature	°C	
	Short Circuit withstand temperature	°C	
5	Withstand short circuit current	KA/1Sec	
6	Storage Temperature Range	°C	
7	Shelf life of kit components excluding mastic and solution	Years	
8	Shelf life of mastic and solution	Years	

A. General Technical Particular for Heat Shrinkable Insulation Tubing/Sleeves/Wrap around Sleeve:

S. No.	Parameter	To be Furnished by Bidder
1	Visual Examination	
2	Wall thickness Ratio	
3	Internal dia of tube after full recovery	
4	Longitudinal change	
5	Electric Strength	
6	Tensile Strength	
7	Ultimate Elongation	
8	Heat Shock	
9	Low Temperature Flexibility	
10	Tracking Resistance	
11	Volume Resistivity	
12	Flame Retardant (Applicable only for Anti tracking Tubes/ sleeves)	

B. General Technical Particular for Heat Shrinkable Moulded Components/Breakouts/Weather Sheds:

S. No.	Parameter	To be Furnished by Bidder
1	Visual Examination	
2	Wall thickness Ratio	
3	Internal dia of tube after full recovery	
4	Longitudinal change	
5	Electric Strength	
6	Tensile Strength	
7	Ultimate Elongation	
8	Heat Shock	
9	Low Temperature Flexibility	
11	Volume Resistivity	
12	Flame Retardant (for anti-tracking moulded components)	

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:

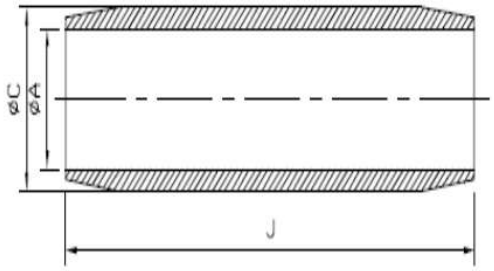
Signature

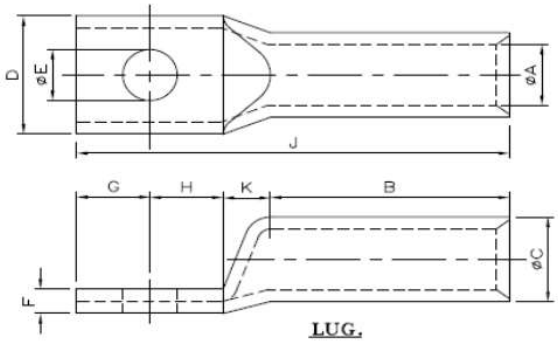
Designation

Annexure- Dimensions Ferrules & Lugs HT

Dimensional details of Aluminum ferrules for HT AL circular stranded compacted XLPE cables			
Cable Size in MM²	φA (mm) +0.3mm	φC (mm) +0.3 mm	J (mm) ±3mm
95	12	16.9	108
150	15.1	21.2	116
300	21.8	30.2	150
400	25	34.8	150
630	31.7	44.4	200
1000	41	56	250

Dimensional details of Aluminum Lugs for HT circular stranded compacted XLPE cables							
Cable Size in MM²	ϕE (mm) ±0.1mm in centre of palm	ϕA (mm) +0.5mm	ϕC (mm) +0.5 mm	D (mm) ±1.5mm	F (mm) ±0.5mm	B±3.0mm	J (mm) ±5mm
95	13	12	16.9	23.5	4.9	73	109
150	13	15.1	21.2	29.5	6	83	128
300	17	21.8	30.2	42	8.4	89	157
400	17	25	34.8	48	9.8	113	187
630	17	31.7	44.4	61	12.7	140	225
1000	-	41	56	77.5	15	160	280





LUG.

For remaining cable sizes, dimensions of Ferrules & Lugs shall be as per IS.

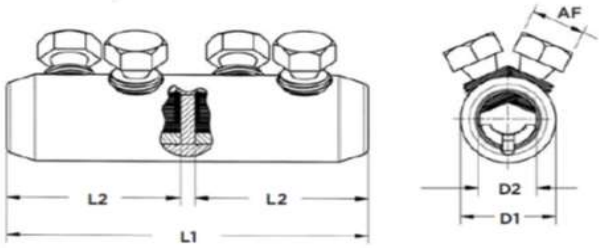
Annexure- Dimensions Mechanical connectors & Mechanical Lugs

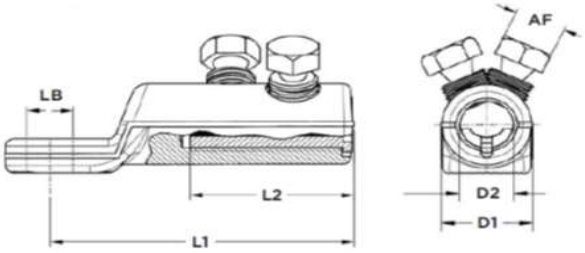
Aluminium Mechanical connectors

Cable Size in MM²	ϕD1 (mm)	ϕD2 (mm)	L (mm)
185-400	50	25.5-26	440- 450
185-400	42	25.5-26	170-200
500- 630	50	33- 33.5	180-230
1000	60	40	180-230

Tinned Aluminium Mechanical Lugs

Cable Size in MM²	ϕLB (mm)	ϕD1 (mm)	ϕD2 (mm)	L (mm)
185-400	17	42	25.5-26	137-150
500- 630	17	50	33- 33.5	150-180
1000	2x17	60	40- 40.5	180- 240





STANDARD TECHNICAL SPECIFICATION COVER SHEET

Specification No. : ENG-EHV-1045

Specification Name : SPECIFICATION FOR LEAD ACID BATTERY 24/48V, 100/150AH(2V Cell Voltage)

Prepared by	Reviewed by	Reviewed by	Reviewed by	Approved by	Released by
Ranjan Kumar Sahoo	SATYA PRASAD NAYAK	K GOVINDARAJ	SURYAKANTA MOHANTY	Shailendra Kumar Jaiswal	SHIRISH SHARAD DIKAY
TPSODL	TPCODL	TPWODL	TPNODL	TPSODL	TPSODL
28-03-2023	28-03-2023	29-03-2023	29-03-2023	29-03-2023	29-03-2023

CONTENTS

1.0 SCOPE

This specification covers the technical requirements of design, manufacture, testing at manufacturer's works, packing, forwarding, supply and unloading of lead acid 24/48V, 100/150 AH Battery at site/ stores complete with all accessories for efficient and trouble free-operation.

It is not the intent to specify completely herein all the details of tech design and construction of material. However, the material shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performingin continuous commercial operation in manner acceptable to TPCODL/TPNODL/TPSODL/TPWODL , who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance therewith. The offered material shall be complete with all components necessary for their effective and trouble-free operation. Such components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in this specification and/or the commercial order or not.

2.0 APPLICABLE STANDARDS

The equipment covered by this specification shall unless otherwise stated, be designed, manufactured and tested in accordance with the latest editions of the following Indian/International standards and shall conform to the regulations of the local statutory authorities.

IS 266-1993	Battery grade sulphuric acid
IS 1146-1981	Rubber and plastic container for lead acid storage batteries
IEE 485	Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications
IS 15549-2005	Stationary Value regulated lead acid batteries
IEC 60896-21&22:2004, PART-II.	Stationary lead acid batteries-Valve regulated types – Methods of test-Part 21 Stationary lead acid batteries-Valve regulated types – Requirements-Part 22
IEEE1188 & 1189	Recommended Practice for Maintenance, Testing, and Replacement of Valve-Regulated Lead- Acid (VRLA) Batteries for Stationary Applications

3.0 CLIMATIC CONDITIONS OF THE INSTALLATION

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	150cm
6	Average No. of rainy days per annum	120

7	Altitude above MSL not exceeding	1000m
8	Wind Speed	300 Km/hr
9	Earthquakes ofan intensity inhorizontal direction	Equivalent to seismic acceleration of 0.3g
10	Earthquakes of an intensity in vertical direction	Equivalent toseismic acceleration of 0.15g (g beingacceleration 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, dust in suspension during the dry months, and is subjected to fog in cold months.

4.0 **GENERAL TECHNICAL REQUIREMENTS**

S. No.	**Particular**	**Requirement**	
		48V, 100/150AH Battery	**24V, 100/150AH Battery**
1	Type of battery	Maintenance Free Valve Regulated Lead Acid (MF-VRLA).	
2	Container	Poly Propylene Co Polymer (PPCP)	
3	Nominal DC system voltage	48 V	24 V
4	Number of batteries	One set	One set
5	Number of cells	24	12
6	Cell type	Flat Plated AGM Valve Regulated Lead Acid	
7	Cell voltage		
	a) Nominal	2 V	2 V
	b) End cell voltage	1.85 V	1.85 V
8	Capacity of battery	100/150 Ah	100/150 Ah
	a) 10-hour rate of discharge		
9	Float charging voltage	2.23 to 2.25V	2.23 to 2.25V
	Boost charging voltage	2.30 to 2.32V	2.30 to 2.32V
10	Mounting arrangement	Self-stackable MS HRCA racks coated with acid resistant powder coating	

5.0 **GENERAL CONSTRUCTIONS:** Each battery shall be of high rate performance, lead acid type with capacity as specified in data sheet to cater requirements of normal and emergency DC loads. The battery shall consist of series connected cells for a normal battery rating specified in data sheet.

5.1 **Cell elements**

The cells shall be lead acid type flate pasted type positive plates. Both plates are constructed of heavy-duty lead alloy grids type. The plates shall be corrosion-resistant & shall have low self-discharge properties. maximum durability during all service, conditions including a high rate of discharge. Both plates shall be pasted construction of good workmanship.

5.2	**Cell lids**	The cell covers shall be made of suitable material compatible with the container material and permanently fixed with the container. It shall be capable to withstand internal pressure, Fixing of Pressure Regulation Valve & terminal posts in the cover shall be such that the seepage of electrolytes, gas escapes and entry of electro-static spark are prevented.
5.3	**Electrolyte**	The electrolyte shall be of battery-grade sulphuric acid and conforming to relevant standards. The battery shall be shipped completely charged, the sulphuric acid and water used for preparing electrolyte for the cells shall conform to latest edition of IS 266 and IS 1069.
5.4	**Containers**	The container material shall have chemical and electro-chemical compatibility and shall be acid resistant. The material shall meet all the requirements of VRLA batteries and be consistent with the life of battery. The porosity of the container shall be such as not to allow any gases to escape except from the regulation valve. The tensile strength of the material of the container shall be such as to handle the internal cell pressure of the cells in the worst working condition. The container shall be capable of withstanding the rigours of transport, storage and handling. The containers shall be enclosed in a steel tray.
5.5	**Terminals posts and connectors**	Both the +ve and –ve terminals of the cells shall be capable of proper termination and shall ensure its consistency with the life of the battery. The surface of the terminal post extending above the cell cover including bolt hole shall be coated with an acid-resistant and corrosion retarding material. Terminal posts or any other metal part which is in contact with the electrolyte shall be made of the same alloy as that of the plates or of a proven material that does not have any harmful effect on cell performance. Both +ve and –ve posts shall be clearly and unambiguously identifiable. **Connectors,** All inter-cell lead-coated copper connectors shall be protected with heat-shrinkable silicon sleeves for reducing the environmental impact including a corrosive environment.
5.6	**Venting device**	Each cell shall be provided with a pressure regulation valve. The valve shall be self-re-sealable. The valve unit shall be such that it cannot be opened without a proper tool. The valve shall be capable to withstand the internal cell pressure specified by the manufacturer, Each cell shall be equipped with a Flame Arrestor to defuse the Hydrogen gas escaped during charge and discharge. The material of the flame arrestor shall not affect the performance of the cell.
5.7	**Fasteners**	Nuts and bolts for connecting the cells shall be made of copper, brass, or stainless steel. Copper or brass nuts and bolts shall be effectively lead-coated to prevent corrosion. Stainless steel bolts and nuts can be used without lead coating.
5.8	**Separators**	The separators used in the manufacturing of battery cells shall be of glass mat or synthetic material having high acid absorption capability, resistant to sulphuric acid, and good insulating properties. The design of separators shall ensure that there is no misalignment during normal operation and handling
5.9	**Stand and battery racks**	All batteries shall be mounted in a suitable metallic stand/frame. The frame shall be properly painted with acid-resistant paint. Suitable insulation shall be provided between the stand/frame and floor to avoid the grounding of the frame/stand.

6.0	**NAMEPLATE AND MARKINGS**	The unit shall be provided with below information clearly visible, The label/detailing shall be indelibly and distinctly marked with all essential particulars as per relevant standards along with the following: i) Manufacturer's name ii) Month and Year of manufacture iii) Serial number and Type designation iv) Nominal voltage of each cell v) Ah capacity rate of the battery vi) Rated voltage vii) No. of cells in each module viii) No. of modules ix) charge voltage x) Charge current xi) Next due date for the freshening charge xii) Guarantee period. xiii) Reference standard. xiv) PROPERTY OF TPCODL/TPNODL/TPSODL/TPWODL
7.0	**TESTS**	All routine, acceptance & type tests shall be carried out in accordance with the relevant standards mentioned in clause 2.0. 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 metering cubical in addition to others specified in IS/IEC/IEEE/UL standards.
7.1	**Type Test**	All the type tests should be conducted as per the relevant standards: **A.For battery: Type Test** 1. Gas emission 2. High current tolerance 3. Short circuit current and d.c. internal resistance 4. Protection against internal ignition from external spark sources 5. Protection against the ground short propensity 6. Content & durability of required markings 7. Material identification 8. Valve operation 9. Flammability rating of materials 10. Intercell connector performance 11. Discharge Capacity 12. Charge retention during storage 13. Float service with daily discharges for reliable mains power 14. Recharge behavior 15. Service life at an operating temperature of 40° C for brief duration of exposure time. 16. Impact of a stress temperature of 60° C for brief duration exposure time with 3 h rate discharge test. 17. Abusive over-discharge 18. Thermal runaway sensitivity 19. Low-temperature sensitivity 20. Dimensional sensitivity at elevated internal pressure and temperature 21. Stability against mechanical abuse of units during installation

		B. Acceptance test i) Visual Examination ii) Verification of dimensions iii) Test for capacity iv) Test for voltage during discharge v) Verification of marking
7.2	**Routine tests**	All the routine tests should be conducted as per the relevant standards.
7.3	**Acceptance Tests**	All the acceptance tests should be conducted as per the relevant standards mentioned in clause 2.0 and shall be witnessed by TPCODL/TPNODL/TPSODL/TPWODL officials.
8.0	**TYPE TEST CERTIFICATES**	The Bidder shall furnish the type test certificates of the for the tests as mentioned above as per the corresponding standards. All the tests shall be conducted at CPRI/ERDA/NABL accredited Labs by TPCODL/TPNODL/TPSODL/TPWODL as per the relevant IS/IEC. Type tests should have been conducted in certified Test laboratories 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, same shall be carried out without any cost implication to TPCODL/TPNODL/TPSODL/TPWODL.

9.0	**PRE-DISPATCH INSPECTION**	The successful bidder shall submit the compliance as per specifications and getting approval before mass manufacturing. 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..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. Material shall be dispatched after specific MDCC (Material Dispatch Clearance Certificate) is issued by the 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)

10.0	**INSPECTION AFTER RECEIPT AT STORE**	The material received at TPCODL/TPNODL/TPSODL/TPWODL 's 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 Engineering department.
11.0	**GUARANTEE**	Bidder shall stand warrantee 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 TPCODL/TPNODL/TPSODL/TPWODL up to a period of 60 months from the date of commissioning or 66 months from the date of last supplies made under the contract, whichever is earlier. 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. In case the battery bank, battery charger or/ and the BMS fails within the guarantee period, the TPCODL/TPNODL/TPSODL/TPWODL will immediately inform the bidder who shall take back the failed/ faulty part within 15 days from the date of intimation at his own cost and replace/repair it within forty-five days of the date of intimation with a roll over guarantee. 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.
12.0	**PACKING**	Rail/ Road transportation: The bidder shall ensure that 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. Packaging shall be as per climate change perspective. TPCODL/TPNODL/TPSODL/TPWODL encourages to use environment friendly packaging. Note: Single use plastic not to be used for packing of the material.
13.0	**TENDER SAMPLE**	Not Applicable.
14.0	**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. 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. The bidder shall ensure that the material supplied is as per the Guaranteed Technical Particulars as specified in the specifications.
15.0	**MINIMUM TESTING FACILITIES**	Bidder shall have adequate in house testing facilities for carrying out all routine tests, acceptance tests as per Indian/International standards
16.0	**MANUFACTURING ACTIVITIES**	a) The successful bidder will have to submit the bar chart for various manufacturing activities clearly elaborating each stage, with quantity. This bar chart should be in line with the Quality assurance plan submitted with the offer. b) CAT-B/CAT-A approval is mandatory to start manufacturing works.

<table>
<tr><td>17.0</td><td>SPARES, ACCESSORIES AND TOOLS</td><td>Recommended and mandatory spares to be supplied by the bidder, without any cost implication to TPCODL/TPNODL/TPSODL/TPWODL .</td></tr>
<tr><td>18.0</td><td>DRAWING AND DOCUMENTS</td><td>A. Following documents shall be submitted along with the bid:
1. Completely filled–in clause wise compliance of the specification.
2. Type test Certificates for each specified test
3. Drawing of Battery
B. Following documents shall be submitted after the placement of RC/PO:
1. Completely filled–in clause wise compliance of the specification.
2. Type test Certificates for each specified test if not submit during technical evaluation
3. Drawing of Battery
4. Compliances of undertaking submitted during Technical Evaluation
5. QAP
6. O&M/Instruction Manual
All the Documents and Drawings shall be in English Language.</td></tr>
<tr><td>19.0</td><td>GUARANTEED TECHNICAL PARTICULARS</td><td>Bidder to submit completely clause wise compliance of this specification.</td></tr>
<tr><td>20.0</td><td>SCHEDULE OF DEVIATION</td><td>The bidders shall set out all deviations from this specification, Clause by Clause in this schedule. Unless specifically mentioned in this schedule, the tender shall be deemed to confirm the TPCODL/TPNODL/TPSODL/TPWODL ’s specifications.

<u>(TO BE ENCLOSED WITH THE BID)</u>
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 TPCODL/TPNODL/TPSODL/TPWODL ’s specifications:

<table>
<tr><th>S.No.</th><th>Clause No.</th><th>Details of deviation with justifications</th></tr>
<tr><td></td><td></td><td></td></tr>
</table>
We confirm that there are no deviations apart from those detailed above.

Seal of the Company Signature :

Designation :</td></tr>
</table>

CONTENTS

1. SCOPE:

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 33kV Gas Insulated Indoor switchgear complete with all accessories for trouble free and efficient performance. Scope is indicative only and bidder shall design, supply, install, test and commission GIS switchgear.

2. APPLICABLE STANDARDS:

The equipment covered by this specification shall unless · otherwise stated, be designed, constructed and tested in accordance with latest revisions of relevant Indian/IEC/other applicable standards shall confirm to the regulations of local statutory authorities. For standards relevant to Protection/Automation philosophy kindly refer to ENG-EHV- 105 & ENG-EHV-106.

Codes	Description
IS 2705/ IEC 60044-1	Current Transformers
IS 3156/ IEC 60044-2	Voltage Transformers
IS 3427/ IEC 62271-200	HV switchgear and control gear-AC Metal Enclosed switchgear for voltages above 1 kV and up to and including 52kV
IS 694-1990	PVC insulated cables for working voltage up to and including 1100V
IS 2629-1985	Recommended practice for Hot Dip Galvanizing of Iron & Steel
IS 2633-1986	Tests for uniformity of zinc coating
IS 5578-1984	Guide for marking of insulated conductors
IS 11353-1985	Guide for uniform system of marking and identification of conductors and apparatus terminals.
IEC 60060	High-voltage test techniques
IEC 60137	Bushings for Alternating Voltage above 1OOOV
IEC 60255-3	Electrical relays- Single input energizing quantity measuring relays with dependent or independent time
IEC 60255-27 requirements	Measuring relays and protection equipment-Part-27 Product safety
IEC 60265-1	High voltage switches -Part 1: Switches for rated voltages above 1 kV and less than 52 kV
IEC 60282-1	High voltage fuses
IEC 60376	Specification and Acceptance of new sulphur hexafluoride
IEC 60529	Degrees of protection provided by enclosures (IP Code)
IEC 60694	Common specifications for high voltage switchgear and control gear standards
IEC 60947	Low voltage switchgear and control gear

IEC 61010-1	Safety requirement for electrical equipment for measurement and Laboratory use.
IEC 61259	Requirement for Switching of Bus charging current by GIS Disconnectors.
IEC 61233	High Voltage Alternating current Circuit Breaker- Inductive Load Switching.
IEC 62052-11	Electricity metering equipment (a.c.) - General requirements, tests and test conditions
IEC 62053-22	Static meters for active energy (Class 0.2 Sand 0.5 S)
IEC 62271-10	HV switchgear and control gear-Alternating current disconnectors and earthing switches
IEC 62271-100	High voltage alternating current circuit breakers
IEC 61634	High Voltage Switchgear and Control gear use and handling of SF6 in High Voltage Switchgear and Control Gear.

3. CLIMATIC CONDITIONS OF THE INSTALLATION:

SL.NO.	CONDTIONS	VALUES
1	Max. altitude above sea level	1200m
2	Max. Ambient Temperature	50 °C
3	Max. Daily average ambient temp	35 °C
4	Min Ambient Temp	0 °C
5	Maximum temperature attainable by an object exposed tosun	60 °C
6	Maximum Humidity	95%
7	Minimum Humidity	10%
8	Average No. of thunderstorm days per annum	70
9	Average Annual Rainfall	150 cm
10	Average No. of rainy days per annum	120
11	Thermal Resistivity of soil	150 Deg. Ccm/W
12	Wind Pressure	126 kg/sq. m up to an elevation of 10 meter.
14	Earthquakes of intensity in horizontal direction	equivalent to seismic acceleration of 0.3g
15	Earthquakes of intensity in vertical direction	equivalent to seismic acceleration of 0.15g

16	Wind velocity	300 km/hr.

Environmentally, some of the regions, where the work will take place include coastal areas, subject to high relative humidity, which can give rise to condensation. Onshore winds will frequently be salt laden. On occasions, the combination of salt and condensation may create pollution conditions for outdoor insulators. Some places are in heavily industrial polluted areas. Therefore, Outdoor material and equipment shall be designed and protected for use in exposed, heavily polluted, salty, corrosive and humid coastal atmosphere.
The atmosphere is generally laden with mild acid and dust in suspension during the dry months and is subjected to fog in cold months. The design of equipment and accessories shall be suitable to withstand seismic forces corresponding to an acceleration as mentioned in the above table.

4. GENERAL TECHNICAL REQUIREMENTS:

Sl. No.	DESCRIPTION	REQUIREMENT
1.	**SWITCHGEAR PANEL**	
1.1	Architecture	SF6 Insulated Metal Clad
1.2	No. of Phases	Three
1.3	Rated Capacity	1500 MVA
1.4	Rated Voltage	36 kV
1.5	Service Voltage	33 kV
1.6	Rated Frequency	50 Hz
1.7	Rated lightning Impulse withstand voltage	170 kVP
1.8	One-minute Power Frequency Withstand Voltage	70 kV rms
1.9	Rated short time withstand current	· 26.3 kA for 3sec
1.10	Peak withstand current rating	66 kA
1.11	Normal service condition	Indoor
1.12	Internal arc Protection	IAC-A FLR as per IEC 62271-200, Shall withstand 26.3 kA for 1 sec
1.13	Degree of Protection	IP 65 for HV Live parts degree of Protection. IP3X Degree of Protection for Operating fascia / IP4X for other compartments
1.14	Leakage Rate for SF6	Less than 0.1% per annum
2.	**BUS BAR**	
2.1	Type	Extensible on both sides
2.2	Bus bar continuous rated current	1250 Amp
2.3	Bus bar material	Copper with Silver Coated contacts
2.4	Rated short time withstand current	26.3 kA for 3 sec
2.5	Max current Density for Bus bar	1.6 A/sq mm
2.6	Max. permissible temperature rated normal current	The maximum permissible temperature for bus bar shall be 90 deg.
3.	**CIRCUIT BREAKER for OUTGOING FEEDERS**	
3.1	Application /Class	Indoor
3.2	Type of circuit	SF6 / Vacuum and Fixed type
3.3	No. of poles	3

3.4	Rated Voltage	36 kV rms
3.5	Rated Insulation Level	
3.6	Lighting impulse	170 KV peak
3.7	One-minute power frequency withstand	70 kV rms
3.8	Rated frequency	50 Hz
3.9	Rated normal current	1250 Amp
3.10	Rated operating sequence	0-t-CO-T-CO (t=0.3sec, T= 3 min)
3.11	Max. Spring Charging Time of Motor	10 sec. for V,cu im type
3.12	Max. Power consumption of Trip & close coils	200W
3.13	Rated load breaking current (sym)	26.3 kA rms
3.14	Rated short circuit withstand current	26.3 kA (rms) for 3 sec
3.15	Rated short circuit making current	66 kA peak
4.	**CIRCUIT BREAKER for Incomer**	
4.1	Application /Class	Indoor
4.2	Type of circuit	Vacuum Fixed type
4.3	No. of poles	3
4.4	Rated Voltage	36 kV rms
4.5	Rated Insulation Level	
4.6	Lighting impulse	170 kV peak
4.7	One-minute power frequency withstand	70 kV rms
4.8	Rated frequency	50 Hz
4.9	Rates normal current	As per Tender Document
4.10	Rated operating sequence	0-t-CO-T-CO (t=0.3sec, T= 3 min)
4.11	Max. Spring Charging Time of Motor	1O sec. for Vacuum Type
4.12	Max. Power consumption of Trip & close coils	200W
4.13	Rated load breaking Current (sym)	26.3 kA rms
4.14	Rated short circuit withstand current	26.3 kA (rms) for 3 sec
4.15	Rated short circuit making current	66 kA peak
5.	**OPERATING AUXILIARY VOLTAGES**	
5.1	Trip Coil	48VDC
5.2	Closing Coil	48VDC
5.3	Spring Charging Motor (Universal Motor)	48VDC
5.4	No. of spare auxiliary contacts with wiring	6NO +6 NC
6.	**VOLTAGE TRANSFORMER**	
6.1	Location	Each bus-section
6.2	Type	Plug In type

6.3	Ratio	33/√3 / 110/√3 - 110/√3 - 110/√3		
6.4	Core Details	Core-I	Core-II	Core-III
(i)	Accuracy class	3P	3P	0.2
(ii)	Burden	50 VA	50 VA	30 VA
7.00	**CURRENT TRANSFORMER**			
7.1	For Metering and Protection			
7.1.1	Ratio	800-400/5		
7.1.2	Burden & Class			
(i)	Core -I	0.2S, 15VA; Isf< 16		
(ii)	Core -II	5P20, 15 VA		
7.2	For Differential Protection			
(i)	Ratio	As per Tender Document		
(ii)	Core- I	PS; Vkp>=225V;		
		Im<=100mA at Vkp/2; Rct<6 Ohm		
(iii)	Core- II	PS; Vkp>=225V;		
		Im<=100mA at Vkp/2; Rct<6 Ohm		
8.	**CURRENT TRANSFORMER FOR INTERCONNECTORS AND OUTGOING FEEDERS**			
8.1	For Metering and Protection			
8.1.1	Ratio	800-400/5		
8.1.2	Burden & Class			
i.	Core -I	0.2S, 15VA; Isf< 16		
ii.	Core -II	5P20, 15 VA		
8.2	For Differential Protection			
8.2.1	Ratio	As per Tender Document		
i.	Core- I	PS; Vkp>=225V;		
		Im<=100mA at Vkp/2; Rct<6 Ohm		
ii.	Core- II	PS; Vkp>=225V;		
		Im<=100mA at Vkp/2; Rct<6 Ohm		

4. GENERAL CONSTRUCTIONS:

5.1	**SWITCHGEAR**	The Switchgear Panel shall be Indoor, Double Bus Bar, SF6 Gas Insulated, Three phase, sheet steel construction encapsulated, assembled to form free standing, self-supporting dead front structure, suitable for accommodation within building and capable of continuous operation under the climatic condition as defined in the specification. The panel shall be of SF6 Gas Insulated with metal Enclosed compartmentalized design with all the High voltage compartments viz. Circuit Breaker, Bus Bar, Current Transformers and Voltage transformers separated by metallic partitions. These compartments must have pressure relief flaps for the exit of gas due to internal arc to ensure operator's safety. The switchgear panels shall be rigid without using any external bracing. The switchboard panels shall comply with relevant IS/IEC and revision thereof and shall be designed for easy operation maintenance and further extension. Bus bar, metering, circuit breaker, cables and cable box chamber shall have proper access for maintenance and proper interlocks shall be provided. GIS switchgear shall be so designed that normal service, inspection and maintenance operations including visual checking of phase sequence, earthing of connected cables, locating of cable faults, voltage tests on connected cables can be carried out safely. The switchgear shall be complete with all necessary wiring fuses, auxiliary contacts terminal boards etc. The equipment offered shall be adequately protected from all type of system voltage surges and any equipment necessary to satisfy this requirement over and above what is specified, shall be included for supply with switchgear. For operator safety the switchgear must have passive protection system against internal faults in each partitioned compartment. The passive safety section shall ensure that hot gases are guided via pressure relief discs of each unit concerned to ensure there is no hazard to persons or risk of fire. Evidence for testing of IAC criteria as per IEC 62271-200 shall be provided. Each gas compartment shall have a separate Gas pressure relief disk. The temperature-compensated gas density sensors for pressure measurement shall also permanently monitor the relevant gas compartment. Provision shall be made for action to be taken when the upper or lower threshold is exceeded, leading to a drastic reduction in damage and internal arc faults. The gas density sensor shall also be provided with Arcing contact and self-supervision contact. The gas sensors shall be replaceable and exchangeable at site without requiring any gas work. All grounding system, special tools and tackles, O & M manuals etc required for erection, operation, testing and maintenance of GIS shall be supplied within the quoted price. The requirements of embedded plates and channels for the GIS foundations and maintaining floor tolerances shall be provided by GIS supplier in advance. Anchoring bolts for fixing GIS shall be supplied by the GIS supplier. It shall be suitable for Local and Remote control. (b) Panels shall have structural steel frame-work enclosed on all sides and top by CRCA sheet steel of minimum 2mm thickness. (c) Panels shall consist of a front portion with equipment mounted on it and wiring access. All doors, cutouts and removable covers shall be gasketed all round by

		neoprene gasket. Each panel section shall be provided with thermostat-controlled space heater with ON/OFF switch and a single-phase plug point with ON/OFF switch. LED shall be provided with door switch for each panel for cubicle interior illumination. (d) Panels shall be mounted and bolted to a common base channel. The channel in turn shall be fixed to the foundation bolts at site. All foundation equipment, anchor bolts etc. including the supporting channel shall be furnished by successful bidder in advance for completion of Civil Works prior to dispatch of panels. The bottom plates of the panels shall be fitted with removable gland plates of not less than 3mm in thickness, for fixing the cable glands, the size of which shall suit the purchaser's external cables to the panels. Cable glands shall be Double Compression type and made of brass (e) Indicating instruments and meters shall be at a suitable height so that the lettering on the dials can be easily read. Control switches/push buttons and relay resetting knobs shall be conveniently located for ease of operation. The center lines of the switches, push buttons and indicating lamps shall be not less than 900 mm from the bottom of the panel. The center lines of relays, meters etc. shall be not less than 450 mm from the bottom of the panel. Top lines of relays, meters shall be matched. Isolating switch fuse units shall be provided at the panel for incoming AC and DC supplies. Push button shall be made of non-hygroscopic material with shrouds. All other insulators shall also be made of non -hygroscopic material. (f) All components of the same rating and construction which may needed to be replaced shall be interchangeable If there are removable parts with different ratings and if parts are interchangeable within the assembly of metal enclosed switchgear and control gear, any possible combination of removable and fixed parts shall withstand the rated insulation level specified for fixed parts concerned. (g) Interlocks between different components shall be provided for safety and ease of operation. All instruments shall be non-draw-out type and safeguarded in every respect from damages. The operation of a circuit breaker shall be impossible unless it is in service, disconnected, removed, test or earthing position. It shall be impossible to close the circuit breaker in service position unless it is connected to auxiliary circuit. (h) All the HV design shall ensure conformity to IEC-62271- 200 Appendix 'A' and must be Type tested for Internal Arc Test. It shall withstand 26.3 kA for 1 sec. The suppliers shall submit Type Test report from CPRI/ERDA to prove the above. Auxiliary and control equipment's installed on the panel shall be suitably protected against disruptive discharge from main circuit. Buses shall be insulated with heat shrinkable insulating sleeves. wherever bare conductor is employed. (i)Degree of Protection for the High Voltage shall be IP65.The covers and doors should only be opened when the part of main circuit contained in the compartment being made accessible is dead. Partitions of metal-clad switchgear and control gear shall be metallic and earthed. All the meters, detachable units of relays, relays and BCU shall be minimum IP4X (For Low voltage) or with an equivalent provision to completely protect it against dust ingress. All indicating lamps shall be provided with suitable series resistors and bulbs shall be replaceable from the front of the panel. Lamps shall be of LED type and suitable for continuous operation at 85% to 110% of their rated voltage. The following indicating

		lamps with colour shall be mounted over switchgear to indicate important status/alarm of breaker: • Breaker close: Red • Breaker open: Green • DC Healthy: Yellow, • SF6 pressure not OK: Amber • Space Heater not healthy: Blue • Spring Charge: White • Trip coil healthy: Blue • Auto trip: Amber All colour caps shall be similar and interchangeable and all LEDs shall be of same type and ratings. The LED lamps shall be furnished 20% in excess of actual numbers required and colour caps shall be furnished 10% in excess of actual numbers used for each colour. k) DC fail supervision relay (80) shall be provided on all control and relay panels. DC fail annunciation shall be provided on each panel and loss of DC & trip circuit fail alarm will be suitably annunciated at the panel as well as at the SCADA. All the relays and auxiliaries shall have DC auxiliary supply. Identification of components shall be in agreement with the indication on the wiring diagrams and drawings. If a component is of the plug-in type, an identification mark should be placed on the component and on the fixed part where it is to be plugged-in. Control cables are to be placed in trunking and it should be suitable to accommodate 20% wiring for future modifications. l) Control supply in individual bay have to be distributed through MCBs of suitable rating for individual control function like: • Protection· Relay., • Trip circuit • Close circuit • Spring charging circuit • Heating and lighting circuit m) MCB shall be, rated for 10kA short circuit rating. It shall be quick make, quick break, independent manual type with trip free feature. The DC MCBs and AC MCBs ratings shall be separately mentioned and the panel having AC MCB of higher rating in lieu of DC MCB shall not be accepted. MCB shall have the following: • Over current protection • ON/OFF Trip position indicators • Auxiliary contact block (wherever required) n) Wherever CB contacts are to be multiplied, latch type relay shall be used for contact multiplication. Auxiliary contact multiplier relays shall be of reputed make and selected on the basis of continuous current carrying capacity and rated voltage. The fluctuation in voltage level shall be accounted for (+/-) 10% continuously.

		o) Fuse failure relay and trip circuit supervision relay shall be suitably selected, considering burden and auxiliary voltage. External circuitry like compensating resistances will not be accepted. Separate Trip circuit supervision relay not required if it is part of numerical relay. p) Capacitor bank switching device shall be provided with suitable gate interlock mechanism with castle key along with timer to ensure safety. q) The Power cable shall be fed from the bottom and connected by plug connectors. A free socket at the panel back shall be available for cable testing and current and voltage junction. r) Future extension of the switchgear from both sides shall be applicable and no gas handling shall be required. For future upgrading or repair it must be possible to exchange panels or circuit breakers within an installed switchboard without having to remove adjacent panels. For this, each unit shall be provided with facilities ("repair openings") which will grant access to HV parts, thus allowing purchaser to conduct repairs inside the gas tanks at site, maximizing availability of the switchboard. s) Each switchgear panel shall have 20% spare terminals. All equipments mounted on front side of panel shall have individual nameplates with equipment designation engraved. Alarms for Trip & non-trip should be separate. The termination links for cables shall be segregated in vertical plane. The bidder shall deliver to site completely assembled, wired, tested panels and only the interconnecting cables shall be connected at site. The bidder shall further refer to ENG-EHV- 105 & ENG-EHV-106.
5.2	**GAS COMPARTMENTS**	The switchgear units shall be divided into several gas-filled compartments, sealed from each other by gas- tight partitions including Bus Bar Compartments of two adjacent panels, so that any leakage may be quickly localized and limited within enclosure of one panel & can be identified immediately. All the live parts including the main busbars shall be encapsulated in stainless steel enclosure filled with SF6 gas. Proposals for the partitioning of gas zones shall be clearly indicated on the drawings submitted with the tender. The equipment and connections within each compartment shall be so arranged such as to allow ready removal and replacement of any section with minimum isolation and disturbance of adjacent pressurized sections. This feature should also permit the erection and testing of extension units alongside equipment already in service with the minimum of outage time being required for final connections. The busbars of each bay shall have separate gas compartment such that any gas leakage will be localised to one bay only. Also, during extension degassing of any

		compartment should not be required. Suitable arrangements shall be provided for the thermal expansion and contraction of the busbars and busbar chambers without detriment to the current carrying capacity or gas volume. Special attention shall be paid to the sealing of housing joints so that leakage of SF6 gas is kept to absolute minimum. Each separate compartment or gas zone must be provided with its own device for monitoring continuously the gas density. These devices shall be arranged to give individual compartment indication in the local control units and initiation of remote alarms. Means shall also be provided to facilitate the checking of moisture content and gas purity. All gas density monitors shall be temperature compensated type with sufficient No. of alarm and lockout contacts for local, remote and SCADA indications. The health of switchgear would be measures by gas density switch, the switchgear panels shall be filled with gas and checked for leakage in the factory. The panels will be transported to site as completely tested units so that Gas work should not be required at site. The Bidder shall specify the type and the required quantity, quality and density of the gas to be used in switchgear and control gear and provide the user with necessary instructions for renewing the gas and maintaining its required quantity and quality. Gas-filled compartment shall be capable of withstanding the normal and transient pressure to which they are subjected in service. Gas filled compartment enclose the main circuit not only to prevent hazardous approach to live or moving parts but are so shaped that, when at or above the minimum functional pressure, they ensure that the rated insulation level for the equipment is achieved. A Partition separating a compartment filled with insulating gas from a neighbouring compartment filled with liquid, such as a cable box or a voltage transformer, shall not show any leakage affecting the dielectric properties of the two media. Measuring unit shall be mounted on the very front of the panel to monitor the gas pressure and it shall be in connection with alarm contacts to signal any increase or drop in pressure.
5.2.1	**SF6 IMMERSED INSULATION**	Busbars and items of switchgear shall be supported in the enclosures by insulators of materials compatible with SF6 gas and the products of gas decomposition. Gas barrier insulators shall comply with the specified conditions for sealing of enclosures. The insulators shall be free at all times of partial discharges at all voltage levels within the working range and shall be tested for voids and partial discharges during manufacturing.
5.2.2	**GAS LOSSES**	The Bidder shall guarantee the switchgear for a gas loss of not more than 0.1% per annum in any single gas compartment. In case of extensive and repeated gas leakage at any time during the warranty period, the Purchaser shall have the right to request the bidder to replace the part of the assembly, which caused the leakage. All costs associated with such works shall be borne by the Bidder.
5.2.3	**GAS HANDLING EQUIPMENT**	A mobile Gas handling unit with SF6 gas shall be provided for each new substation to permit emergency topping up of gas in the switchgear in the event of leakage. The unit shall be capable of evacuating air from the switchgear components and replenishing them with gas. All necessary pipe work, flexible hoses, couplings, valves, pressure and vacuum gauges shall be included to enable interconnection between the switchgear compartments and gas handling unit. An approved portable SF6 gas leakage detector shall also be provided for each new substation. GIS density monitors provided for each gas filled compartment. Gas leakage is detected by fall in gas density & the same can be reported through a digital relay vide two levels alarm - low & very low. However, under normal circumstances of erection, commissioning, extension of switchgear gas filling/handling at site is to be avoided.

5.2.4	**Pressure Relief of Gas filled compartments**	Where pressure relief devices are provided, they shall be arranged as to minimize the danger to an operator during the time that he is performing his normal operating duties if gases or vapor are escaping under pressure. The direction of the device shall be such that it shall direct the hot gas away from the cable and the operator standing in front of the panel.
5.3	**PARTITIONS AND SHUTTERS**	The insulation between live, parts of the main circuit and the inner surface of insulating partition and shutters facing theses shall withstand at least 150% of the rated voltage of the equipments. If a leakage current may reach. the accessible side of the insulating partition/ shutters by a continuous path over insulating surface or by a path broken only by small gaps of gas or liquid, it shall be not greater than 0.5mA under specified test (test to verify the strength of gas filled compartment). Partition of GIS metal clad switchgear and control gear shall be metallic and earthed.
5.4	**CIRCUIT BREAKERS**	(a) Each Panel shall have Gas insulated Circuit Breaker compartment. The Circuit breakers shall be Vacuum, fixed type in horizontal position. The CB compartment shall be provided with repair opening sealed with 0- ring so that ay maintenance if required can be carried out. b) The CB shall be spring operated, motor charged, and manually released spring closing mechanism with three pole simultaneous operations. The speed of closing operation shall be independent of the hand-operating lever. The indicating device shall mechanical type directly linked to the mechanism & shall show the OPEN and CLOSE position of breaker visible from front of the cubicle without opening any doors or covers show the OPEN and CLOSE position of breaker visible from front of the cubicle. The spring charging time of the motor shall not exceed 10 sec in case of Vacuum Circuit Breaker. The 'TRIP" and "CLOSE" coils shall be of reliable design and low consumption preferably less than 200W. Anti - pumping relays & T-N-C switch shall be provided for each panel. Electrical Endurance class- E2. c) The Breakers shall be capable of Making & Breaking the short time current in accordance with the requirement of IEC 62271-100 and latest amendment thereof and shall have 3 phase short circuit current capacity of 1500 MVA. d) Comprehensive interlocking system to prevent any dangerous or inadvertent operation shall be provided. Isolation of circuit breaker from bus bar or insertion into bus bar shall only be possible when the breaker is in the open position. e) Two stage gas density/ pressure alarm and lockout system with local and remote indication shall be provided. f) Emergency mechanical trip push button on each CB shall be provided on panel front and shall be accessible without opening any door of covers. g) Spring charge indication to be provided. h) The vacuum circuit-breakers shall to be equipped with following: • Spring-stored-energy operating mechanism with motor, auto-reclosing • Mechanical OPEN and CLOSE buttons • 1 closing solenoid • 1 shunt release • Operating cycle counter • Auxiliary switch with at least 4NO + 3NC available • Auxiliary switch for "spring charged" signal

		• Breaker tripping signal i) To reduce the number of mechanical parts inside the enclosure, the operating mechanism shafts shall be located outside it. j) The circuit-breaker has to control at least 10,000 Make-Break cycles (One operating cycle of making & Breaking) operations at rated current or 100 breaking operations at rated short-circuit breaking current without maintenance. The mechanical life of the vacuum interrupter shall comprise at least 20,000 operating cycles. k) The operating mechanism shall be maintenance- free without time limit up to 10,000 operating cycles. Its service life has to comprise at least 30,000 operating cycles.
5.5	**BUS BARS AND CONNECTORS**	a) Each Panel shall have Gas insulated Bu bar compartment. Bus bars and all other electrical connections between various components shall be made of copper of rectangular/circular cross- section. The bus bar section shall be of ample · capacity to carry the rated current as defined in the tender document continuously without., excessive heating and for adequately meeting the thermal and dynamic stresses in the case of short circuit in the system up to full MVA All bus bars shall be rigidly and firmly mounted and shall be capable of withstanding short circuit stresses and vibrations. Bidder should specify current density for Cu bus bars provided in the switchgear. The bus bars shall be extensible on both sides. The gas compartments must be divided up so that when work is done on one busbar system (e.g. for a switchgear system expansion), the second busbar system can remain in operation with all feeders without interruption and upholding the full rated insulation level. b) Adequate clearance between phases and between phase & earth shall be provided to ensure safety as per the IEC and its amendment thereof and also in accordance with the relevant latest Indian standard specification. The same shall be capable of withstanding the specified High Voltage tests as per IEC-62271/ 60060 and the amendments thereof. c) The interlocking facility should be provided between incomers, Bus couplers and sectionalizes. However, Scheme will be finalized during detail engineering. The insulators shall be made of non-hygroscopic material. d) Inter panel Busbars shall be connected without fixed bolts connections to allow easy dismantling and panel removal without disturbing the switchboard line up. e) Busbar compartments shall have repair openings to get the access for maintenance. It shall be possible to earth all busbar sections in make-proof way. f) Interlocking scheme shall be submitted along with the bid. g) The gas compartments shall be divided up so that when work is done on one busbar system (e.g. for a switchgear system expansion), the second busbar system can remain in operation with all feeders without interruption and upholding the full rated insulation level. h) Fault on one panel of switchgear shall not cause any tripping of the neighbouring next panel.
5.6	**CURRENT TRANSFORMERS**	The Current Transformers shall be of Epoxy Cast Resin Type with Window type construction and rated for 1500 MVA (3 sec) and be of the single-phase type, with separate core for metering, protection and differential. For CT/PT circuits, drop type links to be provided and lugs shall be ring type. The control wiring shall be of 4 sq. mm. multi stranded copper with 1.1 kV insulation grade. The physical location of CT core for differential protection shall be near BUS to have overlapping protection different

		zone. The additional auxiliary CTs and related wiring work required to match existing Tri. Differential Protection shall be part of this tender specification. All current transformers shall be designed to carry continuously a current of 120% of the rated current. All current transformers shall be installed with the P1 terminals adjacent to the busbars. The polarity of the primary and secondary windings of each transformer shall be clearly indicated at the respective terminals and in addition labels shall be fitted in a readily accessible position to indicate the ratio, class and duty of each transformer.
5.7	**VOLTAGE TRANSFORMERS**	The Voltage Transformer shall be_ of Epoxy cast resin Type and mounted horizontally/ Vertically, metallic plug-in design and shall be touch proof and protected by HRC fuses on both primary and secondary sides. Bus VTs shall be provided in each bus section In, the event of VT withdrawal and ensure that no live components inside the 33 kV switchgear are accessible. The VT shall be of the single-phase type, with separate core for metering and separate core for protection. The control wiring shall be of 4 sq. mm. multi stranded copper with 1.1 kV grade insulation, All voltage transformers shall be designed to carry continuously 1.2 times the normally rated voltage and 1.9 times the normally rated voltage for continuous operation up to 8 hrs.
5.8	**RELAYS**	a) The switchgear shall have numerical communicable relays designed to disconnect fault circuits with speed and discrimination and shall confirm to IEC 60255-3/1S 3231 or latest revision thereof regarding accuracy and other features. b) The relay resetting should be such that resetting of the main protection relay should reset all the other auxiliary relays. All the relays shall be communicable with suitable protocol so as to provide all the 1/0 signals required by the Purchaser. c) Relays shall support Purchaser's protection philosophy as per Annexure-C. However, the substation operation shall comply to the integrated automation requirements with the MASTER SCADA. d) All plugs in heavy current modules that carry CT circuits shall be equipped with CT shorting features when the module is withdrawn. Suitable facilities shall be provided on each measuring relay to disconnect trip outputs and then short and disconnect the CT circuits. The bidder shall further refer to TPCODL/TPNODL/TPSODL/TPWODL Protection and automation requirement in ENG_EHV-105 & ENG-EHV-106.
5.9	**AUXILIARY SWITCHES AND CONTACTORS**	Auxiliary switches shall be provided on all circuit breakers, disconnectors and earthing switches for local, remote & SCADA indication, control and interlocking. With each circuit-breaker, disconnecting device, and earthing device, there shall be supplied all necessary auxiliary switches, contactors and mechanisms for indication, protection, metering, control, interlocking, supervisory and other services. All such auxiliary switches shall be enclosed in · dust free housing. Not less than four spare auxiliary switch ways shall be provided with each circuit breaker, disconnectors and earthing switches. All auxiliary switches shall be wired up to a terminal board on the L.V panel of the switchgear whether they are in use or not in the first instance and shall be arranged in the same sequence on all equipment. Switches shall be provided to interrupt the supply of current to the tripping mechanisms of the circuit breakers directly, once the operation of the latter has been completed. All such switches and mechanisms shall be mounted in approved accessible positions clear of the operating mechanism and shall be adequately protected. The contacts of all auxiliary switches shall be strong and shall have a

		positive wiping action when closing. Direct acting auxiliary switch contacts shall be used in conjunction with busbar protection schemes in case of duplicate busbars. If sufficient aux. Contacts are not available, the contacts shall be multiplied by using suitable latching relays (bistable relays) so that the failure of DC supply shall not cause a mal-operation or undefined position of circuit breakers, disconnectors or earth switches. If any discrepancy between the aux. Contacts and latching relay contacts, this shall be monitored and alarmed locally and for remote indication.
5.10	**DC SELECTOR SWITCH**	There shall be three position DC selector switch i.e neutral, DC1 & DC2. In normal supply condition the left side panel & bus section is fed by DC1 Source and right-side panel is fed from DC2 Source. In case of failure of DC2 source, all panels will be fed by DC1 source. Similarly, in case of failure of DC1 source, all panels will be fed by DC2 source. Cabling required from DCDB to DC selector switch is included in vendor scope. DC MCB of 25 A rating with 'C/K' characteristics shall be preferred.
5.11	**DISCONNECTORS AND EARTHING SWITCHES**	Disconnectors and earth switches shall have valid type test report as per IEC 62271-102 conducted on independent test lab or witnessed by independent observers. Evidence of type tests as per IEC 62271-102 shall be submitted along with tender. Bidder shall provide the mechanical endurance Class M2 with 10,000 operations and Electrical endurance withstand shall be suitable to class E2. Disconnecting and earthing switches shall be off load type and arranged to permit safe maintenance of any section of the equipment when the remainder is live. Disconnecting switches shall be arranged for operation while the equipment is live, but will not be required to break current other than the charging currents of busbars and connections. Switch mechanism shall be so designed that the disconnector cannot be opened by forces due to currents passing through it and shall be self- locking in both the "open" and "closed" positions. The mechanism shall open and close all three phases simultaneously. Busbar disconnectors shall have the capability of loop current breaking during on load bus transfer. Local mechanical position indicators shall be provided on all switches and shall be visible from the front side of the panel. For safe isolation and earthing of the busbars and feeders, high speed fault-making spring driven disconnector and earth switches shall be provided. The contacts shall have the same fault making capability as that of the circuit breaker. As an alternative to the fault making earthing switches, circuit breakers may be used for the earthing, of the outgoing feeders and busbars. In such case adequate interlocking facilities shall be provided. The earth switches and disconnector shall employ motor operation mechanism. In addition, emergency hand operation shall be provided.
5.12	**TERMINAL BLOCKS**	a) The terminal blocks shall be 1100 V grade, 10 A rated, one piece moulded, complete with insulated barriers, stud type terminals, washers, nuts and lock nuts and identification strips. The terminal blocks for CT shall be of disconnecting type. Markings on the terminal strips shall correspond to wire numbers on wiring diagrams. The terminal blocks shall be fully enclosed with easily removable covers and made of moulded non- inflammable plastic material.

		b) A minimum clearance of 250 mm between the first row of terminal blocks and the associated cable and plate shall be, ensured. Also, the minimum clearance between two rows of terminal blocks shall be 150mn. c) All spare contacts and terminals of the panel mounted equipment and devices shall be wired to terminal blocks. All the TB's shall be of single Decker type. The bidder shall further refer to TPCODL/TPNODL/TPSODL/TPWODL Protection and automation specifications ENG-EHV-105 & ENG-EHV-106.
5.13	**ANTI-CONDENSATION HEATERS**	a) Strip type space heaters of adequate capacity shall be provided inside each panel to prevent moisture condensation on the wiring and panel mounted equipment. Space heaters shall be rated for 240 V,1 phase, 50 Hz supply. Heaters inside the panels shall not be mounted close to the wiring or any panel mounted equipment. Heaters shall be complete with either miniature circuit breakers or with isolating switches, H RC fuse on phase and link on the neutral of the heater supply b) An adjustable type thermostat shall be provided in the heater control circuit with temperature range of 0° - 90° C. The indication shall be provided for monitoring the healthiness of Space heater. c) Heater shall have humidity control and shall be arranged to cut off when cubicle internal temperature/ humidity exceeds safe value. Heater 'ON' indication shall be also provided. Also, door limit switch and internal lighting shall be provided for LV compartment. ·
5.14	**INTERIOR LIGHTING AND RECEPTACLES**	a) Each panel shall be provided with an LED fixture rated for 240 V, 1 phase, 50 Hz supply for the interior illumination of the panel during maintenance. The fitting shall be completed with switch-fuse unit and the switching of the fitting shall be controlled by the respective panel door switch. b) Each panel shall be provided with a 240 V, 1 Phase, 50 Hz, 15 A. 5 Pin receptacle with switch. The receptacle with switch shall be mounted inside the panel at a convenient location.
5.15	**POWER AND CONTROL SUPPLIES**	a) Each control panel shall be provided with necessary arrangement for receiving, distributing, isolating and fusing of DC and AC supplies for various control, signalling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with MCBs. Supply monitoring arrangement shall be provided. Selection of the MCB ratings shall be such as to ensure selective clearance of sub-circuit faults. Potential circuits for relaying and metering shall also be protected by MCBs. b) If auxiliary voltages other than those specified are required, then necessary arrangement shall be made by the bidder within the panel to obtain the desired voltages by providing step-down transformers and inverter/converter, etc. However, it is desired that no other control voltage shall be prevalent in the panel. c) All fuses shall be HRC cartridge type conforming to relevant standards, mounted on plug-in type fuse bases and cover with locking arrangement for fuse link. All accessible live connection to fuse bases shall be adequately shrouded. Fuses shall have operation indicators for indicating blown fuse condition. Fuse carrier base shall have imprints of the fuse rating and voltage. d) All cable connections between the various GIS modules and the LCC's shall be made by prefabricated multi-core cables with multi-point plug-in connections on both ends. PT's and CT's shall be hard wired, with crimped ring type lugs

		having protective insulating sleeves over the crimping joint. All wires should be marked at both ends with numbering ferrules on equipotential basis for ease of identification and tracing. All cables shall be shielded and adequate for their application (indoor / outdoor). The cables shall be fire retardant and PVC-free.
5.16	PANEL WIRING	Panels shall be supplied completely wired internally to equipment and terminal blocks and ready for the Purchaser's external cable connections at the terminal blocks. Panel wiring shall be securely supported, neatly arranged by lacing and tying, readily accessible and connected to equipment terminals and terminal blocks. Flame retardant, plastic wiring channels/troughs with strap on plastic covers shall be used for this purpose. When panels are arranged to be mounted adjacent to each other all inter-panel wiring and connections between panels shall be provided by the Bidder. All wiring shall be carried out with 1100 V grade, single core stranded copper conductor wires with PVC insulation. Extra flexible wires shall be used for wiring of devices mounted on moving parts such as swinging panels and doors. The minimum size of the stranded copper conductor used for panel wiring shall be as follows: i) All circuits except CT and PT circuits: 2.5 mm' per lead ii) CT and PT circuits: 4 mm' per lead The terminals are marked with the terminal number in accordance with the schematics and terminal diagram. The terminals do not have any function designation and are of the tension spring, screw type and plug-in type for inter panel wiring. Longitudinal troughs extending throughout the full length of the panels shall be provided for inter panel wiring, for AC and DC supplies, PT circuits, annunciator circuits and other common services. Interconnections to adjacent panels shall be brought out to a separate set of terminal blocks located near the slots or holes meant for taking the interconnecting wires. Arrangements shall permit easy inter-connections to adjacent panels at site and wires for this purpose shall be provided by the bidder looped and bunched properly inside the panels. If accidental short circuiting of certain wires is likely to result in malfunction of equipment, such as closing or tripping of a breaker or positive and negative wires, these wires shall not be terminated on adjacent terminal blocks. The unused instrument space on the front or rear of the panels shall be kept clear of wiring, to facilitate addition of devices without rewiring associated portion of the panels. Wire terminations shall be made with soldieries crimping type of (ring type lugs for all CT & PT Circuits and pin type lugs for other circuits) tinned copper lugs which firmly grip the conductor and insulation. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules, marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wires and shall not fall off when the wire is disconnected. Lock in type ferrule shall be provided. Bidder shall be solely responsible for looping all protection relays up to the BCU/BCPU or DC as per the requirement. Network cable required to communicate BCU/BCPUs with DC shall be under bidder's scope. Looping and networking cable shall be CAT-5 type. The Bidder shall be solely responsible for the completeness and correctness of the internal wiring and for the proper functioning of the connected equipment. In case

		the cables are to be routed through trenches, necessary metal clad conduits shall be used. Internal wiring to be connected to external equipment shall terminate on terminal blocks. The terminal blocks for CTs and VTs shall be provided with test links and isolating facilities. The CT terminal blocks shall be provided with short circuiting and earthing facilities. Change of CT cores should be possible by linking & delinking of terminals. Switchgear shall have 20% terminals as spare terminals in each panel & should be uniformly distributed in all the terminal blocks and shall be wired.
5.17	**CABLES TERMINATION AND ACCESSORIES**	The design of the switchgear shall permit easy access for the installation and termination of XLPE power cables. The cable connection shall be done with required cable sockets and plugs shall be suitable for purchaser's cable requirements as per the Tender Document. It shall be possible to carry out the cable testing trough separate "cable test sockets" without disconnecting cable termination from the panel and with busbars in "live" condition. Dry type termination kit to be as per TPCODL/TPNODL/TPSODL/TPWODL specification a) The purchaser's external cable connections will be terminated on the terminal blocks provided in the control panel. All necessary cable terminating accessories, termination copper lugs, supporting clamps and brackets, wiring troughs etc. for cables shall be included in the bidder's scope of supply. b) All colour caps shall be similar and interchangeable and all lamps are of same type and ratings lamps shall be furnished 20% in excess of actual numbers required and colour caps shall be furnished 10% in excess of actual numbers used for each colour.
5.18	**LABELS**	a) All equipment mounted on front and rear side as well as equipment mounted inside the panels shall be provided with individual labels with equipment designation engraved. Also, on the top of each panel on front as well as rear side, large and bold nameplates shall be provided for circuit/ feeder designation. The labels shall be mounted directly below the respective equipment. b) All front mounted equipment shall be provided, at the rear also with individual labels engraved with tag numbers corresponding to the ones shown in the panel internal wiring to facilitate easy tracing of the wiring. c) Each IED and meter shall be prominently marked. All relays and other devices shall be clearly marked with manufacturer's name, type, serial number and electrical rating data. d) Labels both external & internal shall be made on non- rusting metal preferably Aluminium anodized one. Labels shall have white letters on black background. The lettering size shall be 6 mm for panel designation and minimum 3mm for device labels. The label designations shall be subject to the Purchaser's approval. e) Each switch shall bear clear inscription identifying its function e.g. 'BREAKER' '52A' etc. Similar inscription shall also be provided on each device whose function is not otherwise defined. If any switch device doesn't bear this inscription, separate name plate giving its function shall be provided for it. Switch shall also have clear inscription for each position indication e.g. 'Trip-Neutral-Close', 'ON-OFF', 'R-Y-B-OFF' ETC. f) Section differentiation marking, bus differentiation and phase differentiation marking shall be provided a visible colour coding as per Indian coding will be preferred.

		g) All gas pipe work shall be colour coded.
5.19	**EARTHING**	a) All panels shall be equipped with a separate earth bus securely fixed along with the inside base of panels. When several panels are mounted adjoining each other, the earth bus shall be made continuous and shall be bolted with two bolts. Provision shall be made for future extension of the earth bus. Provision shall be made on the earth bus bars of the end panels for connecting the same to the earthing grid. b) An earthing conductor of 40x10 sq mm Tinned Cu (minimum) shall-be provided, extending the whole length of switchgear and control gear to sustain the Rated short time withstands current. Each equipment mounted in the panel shall be directly earthed to this earth bus by distinct connections. Bidder shall provide separate electronic earthing for all LED's. Separate earth bus bar to be run along switchgear for protection earthing of relays and communication equipments and LEDs and shall be insulated from the frame. Two bolts shall be provided for connecting the earthing conductors. c) The feeder and Busbar earthing shall be achieved through 3 position Disconnector switches with appropriate provision for mechanical interlocking with circuit breaker to ensure proper earthing. d) All metallic cases of relays, instruments and other panel mounted equipments shall be connected to the earth bus by independent copper wires of size not less than 2.5 and 4.0 sq.mm for VT and CT secondary respectively and neutral or common lead shall be earthed at one place only, preferably at the terminal blocks where they enter the panel. The colour coding for earthing wires shall be given. Bidder shall provide separate electronic earthing for all lEDs. e) Looping of earth connections, which would result in loss of earth connection to the other devices when the loop is broken, shall not be permitted. However, looping of earth connections between equipment to provide alternative paths to earth bus shall be provided. The bidder shall further refer to TPCODL/TPNODL/TPSODL/TPWODL protection and automation specification ENG-EHV-105 & ENG-EHV-106.
5.20	**PAINTING**	All sheet steel work shall be phosphated in accordance with the IS: 6005 "Code of practice for phosphating iron and steel". It should follow the seven tank process. Oil, grease, dirt shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling with dilute acid followed by washing with running water rinsing with a slightly alkaline hot water and drying. After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying. The phosphate coating shall be sealed with application of two coats of ready mixed, stoved type zinc chromate. primer. The first coat may be "flash dried" while the second coat shall be stoved. Thereafter an established painting procedure like electrostatic painting shall be followed for powder coating the panel. The colour shade shall be RAL 7032 (Grey).
5.21	**GALVANIZING**	a) All galvanizing shall be carried out by the hot dip process, in accordance with IS 2629/ ISO 1460 amended to date. However, high tensile steel nuts, bolts and spring washers shall be electro - galvanized to service condition four. The zinc coating shall be smooth, continuous and uniform. It shall be free from acid spots and shall not scale, blister or be removable by handling or packing. There shall be no impurities in the zinc or additives to the galvanic bath, which could have a detrimental effect on the durability of the zinc coating.

		b) After galvanizing no drilling or welding shall be performed on the galvanized parts of the equipment except that nuts may be threaded after galvanizing. c) To avoid the formation of white rust, galvanized material shall be stacked during transport and stored in such a manner as to permit adequate ventilation. Sodium dichromate treatment shall be provided to avoid formation of white rust after hot dip galvanization. The galvanized steel shall be subjected to tests as per IS-2633/ BS 729 amended to date.
5.22	**SYSTEM ARCHITECTURE AND COMMUNICATION**	The bidder shall refer to 'Automation Specifications for 66KV / 33 /11 KV Power System Network in New Grid Station Based on IEC-61850 Protocol', Document no- ENG-EHV-106 for System architecture andcommunication requirements.
5.23	**DATA CONCENTRATOR**	The bidder shall refer 'Automation Specifications for 66KV / 33/11 KV Power System Network in New Grid Station Based on IEC-61850 Protocol', Document no- ENG-EHV-106 for Data concentrator requirements.
5.24	**CONTROL, METERING AND PROTECTION**	Incomer Feeders should be provided with separate protection unit and separate metering & control unit. Outgoing feeders shall be provided with combined protection, metering & Control unit. All these units shall be communicable with Purchaser's SCADA on IEC-61850 protocol without any change & modification of hardware. The bidder shall further refer to Document no- ENG-EHV-105 & ENG-EHV-106 for Control, metering and protection requirements.
5.25	**TRANSFORMER MONITORING UNIT**	Refer Clause No- 4 n of 'Automation Specifications for 66KV /33 /11 KV Power System Network in New Grid Station Based on IEC-61850 Protocol', Document no- ENG-EHV-106
5.26	**REMOTE MONITORING AND MAINTENANCE STATION**	Refer 'Automation Specifications for 66KV / 33 /.11 KV Power System Network in New Grid Station Based on IEC-61850 Protocol', Document no- ENG-EHV-106
5.27	**CONTROL PHILOSOPHY**	The bidder shall refer to ENG-EHV-105 & ENG-EHV-106.
5.28	**OPERATIONAL PHILOSOPHY**	The bidder shall refer to ENG-EHV-105 & ENG-EHV-106 for Operational philosophy requirement.
5.29	**PROTECTION PHILOSOPHY**	The minimum Protection requirement for the GIS shall be as below: 5.29.1 INCOMER AND INTERCONNECTOR PROTECTION: D Line Differential Protection (Not required for the. Incoming feeder from Transformer) Line Distance Protection should be also configurable in the same relay. This shall be used as Main Line Protection. • It should be possible to activate either Line Differential or Distance relay as main protection. At the same time the other should be available as back-up protection. • Transformer Differential Protection (87T) shall be provided for Transformer Incomer feeder.

		• A separate PS class CT shall be used to give in feed to Differential Relays. • Back up protection shall consist of 0/C and E/F (67,67N,51,51N and 86-Electrical Reset Relay) A 5P20 CT shall be used to give the in feed to this relay. This protection will be a part of the bay control unit. 5.29.2 Bus Coupler and Bus Sectionalizers • High Impedance busbar protection scheme (87B) • Back up protection shall consist of 0/C and E/F (67,67N,51,51N and 86-Electrical Reset Relay). Bus Differential Protection with suitable CT Switching scheme for all Bus Sections shall be provided for entire switchgear. 5.29.3 Out Going Feeders • Line Differential Protection (87 L) with inbuilt Distance (21) Protection shall be provided. • 0/C and E/F(67,67N,51,51N and 86Electrical Reset Relay) The bidder shall refer to ENG-EHV-105 "PROTECTION SPECIFICATIONS FOR 66KV / 33 /11 KV POWER SYSTEM NETWORK IN GRID STATION" for Protection philosophy requirement.
5.30	**METERING**	For Incoming feeder, Bus Bar/ Sections and Out Going Feeders, Electronic Energy Meters shall be provided on the Control and Relay Panel. The LCC shall have electronic meter showing the current and voltage readings of the individual bay.
5.31	**SAFETY REQUIREMENTS FOR THE HANDLING OF GIS SWITCHGEAR**	a) Adequate safety training to the Employer's staff regarding gas detection, the disposal of arced products and storage b) Sufficient numbers of facemasks, goggles, hand gloves and respirators, protective clothing and gloves. c) First aid equipment including an eye wash bottle filled with distilled water d) Provision for storage of neutralizing agent along
6.	**NAME PLATE & MARKING**	All the components and operating devices of the switchgear shall be provided with durable and legible nameplates containing all technical parameters. Name plate shall be embossed with "PO no. with date", "PROPERTY OF TPCODL/TPNODL/TPSODL/TPWODL BERHAMPUR ", "CODE NUMBER", along with the following information: i) Manufacturer's Name ii) Type designation or serial no. iii) Applicable rated values iv) No. of the relevant standard v) All other technical parameters applicable to be checked shall be mentioned on the panel.

		The name plate of each functional unit shall be legible during normal service. The removable parts, if any shall have a separate nameplate with the data relating to the functional units they belong to, but this nameplate need only be legible when the removable carts is in removed position.
7.	**TESTS**	All the Routine, acceptance and Type tests shall be carried out in accordance with the relevant IS/IEC standards. All routine/acceptance tests shall be witnessed by the Purchaser/his authorized representative. All the components should also be type tested as per the relevant standards. All meters and metering elements in BCU shall also be routine and type tested as per the relevant standards and shall further be tested at site by the successful bidder. For Type test of Numerical relays, control IEDs, and communication equipment, and Factory acceptance test, Hardware Integration test and Integration System tests kindly refer ENG-EHV-105 & ENG-EHV-106. For type tests of meters, relevant IS has to be followed Following tests shall be necessarily conducted on the switchgear in addition to the others specified in IS/IEC. Bidder shall also be responsible for conducting testing on the site after the installation.: For Switchgear Type Test a) Verify the Insulation level of the equipment including at power frequency test voltage on auxiliary circuits. b) Temperature Rise tests c) Test to prove the capability of the main circuit and earthing circuit to be subjected to the rated peak and the rated short-time withstand currents. • d) Test to prove the making and breaking capacity of the included switching devices. e) Test to prove the satisfactory operation of the included switching device and removable parts. f) Test to Prove the Protection of persons against approach to live parts and contact with moving parts. g) Test to verify the protection of person against dangerous electrical effects. h) To verify the strength of gas filed compartment. i) Tightness test of gas. j) Electromagnetic compatibility Tests k) Dielectric Test I) Radio Interference Voltage test m) Measurement of the resistance of the main circuits n) Dielectric Test on cable testing circuits. o) Short-time withstand and Peak withstand current test p) Test after erection on site. q) Verification of Degree of Protection. r) The PD Test (Value shall be less than 5pC). Routine Test a) Dielectric tests on the main circuit b) Dimensions and visual checks c) Mechanical operation tests d) Tests on auxiliary and. control circuits e) Tests of auxiliary electrical, devices. f) Measurement of the resistance of the main circuit g) Partial discharge measurement h) Tightness tests i) Pressure tests of gas filled compartment

		Test after Erection on Site a) Voltage test of the Main Circuit b) Tightness tests. Special Test a) Test to assess the effects of arching due to internal fault. b) Test to detect certain defects in the solid insulation of the equipment by the measurement of Partial Discharge. c) PD and Due Test after complete Erection and Commissioning. For Current Transformer Routine Test a) Verification of terminal marking and Polarity b) Power frequency dry withstand test on Primary windings. c) Power frequency dry withstand test on Secondary windings d) Over Voltage inter-turn tests. e) Partial Discharge Measurement f) Determination of errors or other characteristics according to the requirements of the appropriates designation or accuracy class. Optional Tests. The following optional tests where applicable, shall be carried out by mutual agreement between the purchaser and bidder. a) Chopped Lighting impulse test as a type test b) Commissioning test on new CT up to and including 36 kV. Acceptance Tests a) Verification of terminal marking and Polarity b) Power frequency dry withstand test on Primary windings. c) Power frequency dry withstand test on Secondary windings d) Over Voltage inter-turn tests. e) Partial Discharge Measurement f) Determination of errors or other characteristics according to the requirements of the appropriates designation or accuracy class. g) Tan Delta test. Type Test a) Short time current Test b) Temperature rise Test. c) Lightning impulse tests for voltage transformers for service in electricity exposed installation d) High Voltage power frequency wet withstand voltage tests on outdoor current transformers. e) Determination of errors or other characteristics according to the requirements of the appropriates designation or accuracy class. For Voltage Transformer Routine Test a) Verification of terminal marking and Polarity b) Power frequency dry withstand test on Primary windings.

		c) Power frequency dry withstand test on Secondary windings d) Partial Discharge Measurement e) Determination of errors or other characteristics according to the requirements of the appropriates designation or accuracy class. Optional Tests. The following optional tests where applicable, shall be carried out by mutual agreement between the purchaser and bidder. a) Chopped Lighting impulse test as a type test. b) Short Circuit withstand capability test as a type test. c) Commissioning test on new CT up to and including 36 kV. Acceptance Tests a) Verification of terminal marking and Polarity b) Power frequency dry withstand test on Primary windings. c) Power frequency dry withstand test on Secondary windings d) Partial Discharge Measurement e) Determination of errors or other characteristics according to the requirements of the appropriates designation or accuracy class. Type Test a) Temperature rise Test. b) Lightning impulse tests for voltage transformers for service in electricity exposed installation c) High Voltage power frequency wet withstand voltage tests on outdoor current transformers up to and including 245 kV. d) Determination of errors or other characteristics according to the requirements of the appropriates designation or accuracy class. For Circuit Breaker, Type Tests a) Dielectric tests. b) Measurement of the resistance of the main circuit c) Temperature0rise tests d) Short-time withstand current and peak withstand current tests e) Additional tests on auxiliary and control circuits. f) Mechanical Operating tests at ambient temperature g) Short circuit making and breaking tests. h) Verification of Degree of Protection. i) Tightness Test j) EMC Test k) Mechanical test I) Short line fault tests m) Out of phase making and breaking test n) Electrical Endurance Tests o) Double earth fault tests p) Capacitive Current switching tests. q) Duty Cycle Test Routine tests a) Power frequency voltage withstand dry tests on the main circuit b) Voltage withstand tests on control and auxiliary circuits

		c) Measurement of the resistance of the main circuit d) Mechanical operating tests e) Design and visual checks f) Dielectric tests g) Dynamic contact resistance measurement (Signature Tests) For Relays Type Tests for Numerical Relays/ Devices: 1. Dielectric Withstand Test: IEC60255 -5 2. High Voltage Impulse Test, class III: IEC 60255-5 (5 kV peak; 1.2 / 50 us; 0.5 J; 3 positive and 3 negative shots at interval of 5 sec.) 3. DC Supply Interruption: IEC 60255-11 4. AC Ripple on DC Supply: IEC 60255-11 5. Voltage Dips and Short Interruptions: IEC 61000-4-11 6. High Frequency Disturbance: IEC 60255-22-1, class III 7. Fast Transient Disturbance: IEC 60255-22-4, class IV 8. Surge Withstand Capability: IEEE/ ANSI C 37.90.1 (1989) Special Type Test 1. Tests to verify protection of the equipment against external effects due to weather. 2. Tests to verify the protection of the equipment against mechanical damage. 3. Tests to assess the effects of arcing due to an internal fault. It shall withstand fault current of 26.3 kA for 1 sec. 4. Tests to detect certain defects in the solid insulation of the equipment by the measurement of partial discharges. However, in case any type test is not carried out at In-house laboratories, the same shall be decided for acceptance as per the mutual agreement between the Purchaser and Bidder For cable Compartment I Terminations Electrical Test after installation of the cable shall be as per IEC 60502. The 66 kV GIS system shall be provided with access ports with test bushing to permit testing of the cable system. The test terminal/cable test sockets, cable sealing end up to and including the cable circuit earth switch and disconnector (open) shall be capable of withstanding the test without failure Test facilities provided shall be such that each phase can be tested individually without the need to evacuate and refill the enclosure between tests.
8.	**TYPE TEST CERTIFICATES**	The bidder shall furnish the type test certificates 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 certified Test laboratories 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 optional type tests, if any) not carried out, same shall be carried out without any cost implication to Purchaser.
9.	**PRE- DISPATCH INSPECTION**	Equipment shall be subject to inspection by a duly authorized representative of the Purchaser. 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. Bidder shall grant free access to the places of manufacture to Purchaser's representatives at all times when the work is in progress. Inspection by the Purchaser or its authorized representatives shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specifications.

		Material shall be dispatched after specific MDCC (Material Dispatch Clearance Certificate) is issued by the Purchaser. 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 I Warrantee card g) Delivery Challan h) Other Documents (as applicable)
10.	**INSPECTION AFTER RECEIPT AT STORES**	The material received at the Purchaser's store will 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.
11.	**GUARANTEE**	Bidder shall stand guarantee towards design, materials, workmanship & quality of process / manufacturing of items under this 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 at least 60 months from the date of commissioning or 66 months from the date of last supplies made under the contract whichever is later, Bidder shall be liable to undertake to replace/rectify such defects at its own costs, within mutually agreed time frame, and to the entire satisfaction of the Purchaser, failing which the Purchaser will be at liberty to get it replaced/rectified at Bidder's risks and costs and recover all such expenses plus the Purchaser's own charges(@ 20% of expenses incurred), from the Bidder or from the" Security cum Performance Deposit" as the case may be. Bidder shall furth.er 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. Also refer ENG-EHV-105 & ENG-EHV-106. In case of SF6 gas leakage due to manufacturing defects, the manufacturer shall be penalized by a amount of Rs 5000 for damaging the environment.
12.	**PACKING**	Bidder shall ensure that all equipment covered by this specification shall be prepared for rail/road transport (local equipment) and be packed in such a manner as to protect it from damage in transit.
13.	**TENDER SAMPLE**	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 after finishing, bought out items and fully assembled component and equipment including drives. As part of the plan, a schedule for stage and final inspection within the parameters of the delivery schedule shall be furnished. The purchaser's engineer or its nominated representative shall have free access to the manufacturer/sub-supplier's works to carry out inspections.
15.	**MINIMUM TESTING FACILITIES**	The Bidder shall have in house testing facilities for carrying out all routine tests and acceptance tests as per relevant international/Indian standards.
16.	**MANUFACTURING ACTIVITIES**	The successful bidder will have to submit the bar chart for various manufacturing

		activities clearly elaborating each stage, with quantity. This bar chart shall be in line with the Quality assurance plan submitted with the offer. The bar chart will have to be submitted within 15 days from the release of the order.
17.	**SPARES, ACCESSORIES AND TOOLS**	17.1 SPARES: Bidder should quote unit rates for following mandatory spares along with the bid. However, the exact quantity of these shall be as per the BOO attached with the tender. a) Trip Coil b) Closing Coil c) Spring charging motor d) T-N-C Switch e) Local/remote selector switch f) Tulip/ Finger contact g) Indication lamps h) Auxiliary switches **i)** LED for cable charge indication In addition to above bidder shall submit recommended list spares for 3 years of operation, if any with unit prices and recommended quantity. For other requirements of training, support, services, maintenance and spares, bidder shall refer to ENG-EHV-105 and ENG-EHV-106. 17.2 SPECIAL TOOLS A& GAUGES: A list of complete set of special tools and gauges required for recection and maintenance and installation procedure should be submitted. The bidders shall give an assurance that special maintenance too.ls and tackles and spares will continue to be available through the life of the equipment, which shall be 25 years minimum. However, the supplier shall give a minimum of 12 months' notice in the event of plan to discontinue manufacturer of any component used in this equipment. Any special maintenance tools and tackles 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 plant and must be suitably marked and numbered for identification. Spanners and other maintenance equipment provided under this contract shall not be used for the purpose of the erection**.**
18.	**DRAWINGS AND DOCUMENTS**	Following drawings & Documents shall be prepared based on Purchaser's specifications and statutory requirements and shall be submitted with the bid: a) Completely filled-in Technical Parameters. b) General description of the equipment and all components including brochures c) General arrangement drawings d) Single Line Diagram e) Bill of material f) Type Test Certificates g) Experience List h) Foundation fixing drawings

Drawings/documents to be submitted after the award of the contract:

Sr. No	Description	For Approval	For Review Information	Final Submission
1	Technical Parameters	✓		✓
2	General Arrangement drawings	✓		✓
3	Single Line Diagram	✓		✓
4	Typical Mimic diagram	✓		✓
5	Schematic / inter logic diagrams	✓		✓
6	Bill of Material	✓		✓
7	Foundation Plan & loading details	✓		✓
8	Technical Brochures/ Manual/Catalogues/drawings for DC, BCU meters, relays, switches, lamps etc.		✓	✓
9	Control and Operational Philosophy of Automation		✓	✓
10	Input/ Output List		✓	✓
11	Cable Schedule, Wiring Interface diagrams & interconnection diagram		✓	✓
12	Programming language manual		✓	✓
13	Details of the Communication protocol & interoperability list for the future interfacing.		✓	✓
14	Equipment wise detailed circuit diagram		✓	✓
15	Electronic earthing scheme		✓	✓
16	Configuration diagram with functional write up		✓	✓
17	1/0 mapping		✓	✓
18	3 nos. of working drawings		✓	✓
19	6 nos. of as-built drawings		✓	✓
20	Relay co-ordination scheme		✓	✓
21	Installation / commissioning manual		✓	✓
22	Instruction for Use		✓	✓
23	Transport/ Shipping dimension drawing		✓	✓
24	QA&QC Plan	✓	✓	✓
25	Routine, Acceptance & Type Test Certificates	✓	✓	✓

The bidder shall further refer to ENG-EHV-105 & ENG-EHV-106. All the documents & drawings shall be in English language. Instruction manuals: Bidders shall furnish two soft copies (CD) and four hard copies of nicely bound manuals (In English lanugage0 covering erection and maintenance instruction and all relevant information and drawing pertaining to the main equipment as well as auxiliary devices.

19.			
Sl. No.	**DESCRIPTION**	**Units**	**As Furnished By the Bidder**
1.00	**SWITCHBOARD**		
a)	Architecture		
b)	Applicable standard		
c)	Dimensions (In mm) W.X DX H		
d)	Internal Arc Protection		
e)	Normal Service conditions		
f)	Service Voltage	kV	
g)	Rated Voltage	kV	
h)	Rated capacity	MVA	
i)	Rated power frequency withstand voltage (rms)	kV	
j)	Rated Impulse withstand voltage (1.2, 50 µs)	kVP	
k)	Rated Short time withstand current	kA	
l)	Rated Peak withstand current	kA	
m)	Busbar material		
n)	Main busbars insulation		
o)	Busbar rated continuous current	A	
p)	Max current Density for Bus bar	A/ sq. mm	
q)	Max Permissible temp rise at rated normal current		
r)	Degree of Protection for enclosure/ Partitions for meters, relays and BCU		
s)	Gas Tightness Data Absolute Leakage rate i. Type of Pressure System Controlled/Closed/Sealed ii. Rate Pressure of Compressed gas supply for operation. iii. Rated filling Pressure. iv. Permissible Leakage Rate Fp v. Relative Leakage rate F rel vi. Time between Refilling T vii. Tightness co-ordination Chart TC viii. Cumulative Leakage Measurement.	Bar Cm^3/S	
	Preferred Value for operating Expected life with regards to Leakage Performance. (40 years)	Years	
2.00	**CIRCUIT BREAKER**		
a)	Standard		

b)	Type		
c)	No of poles		
d)	Rated load breaking current (sym)	kA	
e)	Rated short circuit withstand current	kA	
f)	Rated short circuit making current	kA	
g)	Isolation		
h)	Rated Voltage	kV	
i)	Service voltage	kV	
j)	Rated frequency	Hz	
k)	Rated Insulation Level		
l)	Lightning impulse withstand voltage	kVP	
m)	One min. power frequency withstand voltage	kV(rms)	
n)	Rated operating sequence		
o)	Opening time	msec	
p)	Arcing time	msec	
q)	Total break time	msec	
r)	Making time	msec	
s)	Temperature Rise		
3.00	**OPERATING AUXILIARY VOLTAGES**		
a)	Control and signalling voltage		
b)	Spring Charging Motor (Universal Motor)		
c)	Heater and lighting circuits		
d)	No. of spare auxiliary contacts		
4.00	**CURRENT TRANSFORMER**		
a)	Type		
b)	Short circuit withstand	kA	
c)	Location		
d)	Ratio		
e)	Burden and Class (Metering and protection)		
f)	Core -I		
g)	Core -II		
h)	Ratio		
i)	Burden & Class (Differential)		
j)	Core- I		
k)	Make of CTs		
5.00	**VOLTAGE TRANSFORMER**		
a)	Make		
b)	Location		
c)	Mounting arrangement		
d)	Ratio		
e)	Burden & Class		
i.	Core- I		
ii.	Core -II		
iii.	Core-III		
6.	Protection, Control, Metering and Communication		

7.	MIMIC Diagram on Relay		
8.	Provision of flag indications and contacts for remote annunciation for Self-powered backup relay for incomers		
9.	Electrically reset type, High sped relay for tripping		
10.	Anti-pumping Relay		
11.	Makes for Auxiliary Relays		
12.	Provision of DC foil relay for each panel		
13.	**OTHERS**		
a.	Cable charge indication for all panels		
b.	Cable Side earthing arrangement		
c.	Busbar side earthing arrangement		
d.	TNC Switch		
e.	Local / Remote switch		
f.	Indication Lamps CB ON/OFF		
g.	Indication Lamps CB Auto Trip		
h.	Indication Lamps for CB Test/ Service positions		
i.	Spring Charged indication		
j.	Trip ckt. supervision scheme		
k.	MCB for AC		
l.	MCB for DC		
m.	MCB for space heater		
n.	MCB for VT's		
o.	Trip alarm scheme with hooter, Accept/ Reset PB etc		
p.	Panel anti-condensation heater with thermostat		
q.	Panel illumination lamp with switch		
r.	15 A, 3 pin socket		
s.	Makes of indicating lamps		
t.	Makes of MCB		
u.	Wiring of breaker auxiliary contacts up to terminals		
v.	Makes for Fuses/ Fuse bases		
w.	CB handling trolley		
14.	**GUARANTEE**		

20	**SERVICE LEVEL AGREEMENT**	1) Vendor Has To Submit Standard Technical Parameters With Following Details Of Spares Mentioned In The SOM & Technical Specifications (Of Each Type Supplied Of Each Rating) Supplied Along With The Tender: a. Catalogue of Switchgear Spares/CT Etc. b. Material Code c. With Guarantee Period d. Photographs - For Effective Spare Management Within One Week Of Grid Commissioning End Date 2) Problem Troubleshooting & Restoration in Warranty Period shall be in BA's scope. a. Service Engineer Availability To Attend, Identify & Restore Defects (Minor) Of Grid Equipment's Under Guarantee Period Within 48 Working Hours (Exclusion Of Material Support Cases) b. Spare Material Delivery For Restoration Of Grid Equipment (Major Defect) Under Guarantee Period Within Two Weeks. BA Must Keep Requisite Inventory Of Critical Switchgear Spares & Other Equipment's Covered In Guarantee Period To Restore Equipment Within Two Weeks. c. n Case Of Complete Replacement Of Equipment, Complete Equipment To Be Replaced Within A Period Of 4 Weeks 3) Spare Material Continuity & Availability After Expiry of Warranty Period: a. All Switchgear Spares Must Be Made Available by BA For at Least 15 Yrs. post guarantee Period Expiry. b. Other Grid Equipment Spares Must Be Made Available by BA For At Least 5 Yrs. Post Guarantee Period Expiry. c. Lead Time for Spare Delivery Post GP Expiry Must Be Within Four Weeks Of Fault Reporting To Business Associate

(TO BE ENCLOSED WITH THE 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:

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

We confirm that there are no deviations apart from those detailed above.

Seal of the Company:

Designation

Signature

CONTENTS

1.0 SCOPE

This specification covers the technical requirements of design, manufacture, testing at manufacturer's works, packing, forwarding, supply and unloading of Thyristor Based Battery Charger (FC & FCBC) with DCDB suitable for VRLA batteries of 24V & 48V of 150 AH & 200 AH respectively at site/ stores complete with all accessories for efficient and trouble free-operation.

It is not the intent to specify completely herein all the details of tech design and construction of material. However, the material shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation in manner acceptable to TPCODL/TPNODL/TPSODL/TPWODL, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance therewith. The offered material shall be complete with all components necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in this specification and/or the commercial order or not.

2.0 APPLICABLE STANDARDS

The equipment covered by this specification shall unless otherwise stated, be designed, manufactured and tested in accordance with the latest editions of the following Indian/International standards and shall conform to the regulations of the local statutory authorities.

IS 6619: 1972	Safety Code for Semi-conductor Rectifier Equipment
UL 1564	UL Standard for Safety Industrial Battery Chargers
IEC 61000-4-17	Electromagnetic compatibility (EMC) – Part 4-17: Testing and measurement techniques – Ripple on DC input power port immunity test
IEC 62133 II Edition	Rechargeable Cell/Battery Safety
IEC 62281	Safety of primary and secondary lithium cells and batteries during transport
IEC 62619	Safety requirements for secondary lithium cells and batteries, for use in industrial applications
IEC 61000-4-2	Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test
IS-13947-1993 (Part 1 to 5)	Low voltage switchgear and control gear

3.0 CLIMATIC CONDITIONS OF THE INSTALLATION

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	150cm
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)
		11	Average Thunderstorms prevailing in the area	90 days per annum
		12	Average Dust storms prevailing in the area	150 days per annum

TPCODL/TPNODL/TPSODL/TPWODL service area has heavy saline conditions along the coast and High cyclonic Intensity winds with speed up to 300 Km ph. The atmosphere is generally laden with mild acid and dust in suspension during the dry months and is subjected to fog in cold months.

4.0 GENERAL TECHNICAL REQUIREMENTS

S. No.	Parameters	TPCODL/TPNODL/TPSODL/TPWODL Requirements	
		48 V/200AH	**24V/150AH**
A	**Battery Charger**		
1.	AC input voltage	415 V ± 20% AC, 3 Phase, 4 Wire	415 V ± 20% AC, 3 Phase, 4 Wire
2.	AC input frequency	50 Hz ± 5 %	50 Hz ± 5 %
3.	DC Output Current rating	50 A	40 A
4.	DC output voltage settings:	**Nominal:** 48V; **Range:** 48 V DC to 54 V DC for FC **Range:** 48 V DC to 62V DC for FCBC	**Nominal:** 24V; **Range:** 24 V DC to 27 V DC for FC **Range:** 24 V DC to 31V DC for FCB
5.	Output Voltage Regulation	± 1 % of set output voltage value for +15% to -15% input voltage variations and for 10-100% of load variations	± 1 % of set output voltage value for +15% to -15% input voltage variations and for 10-100% of load variations
6.	Efficiency	≥ 90%	≥ 90%

		7.	Power Factor	≥ 0.98	≥ 0.98
		8.	Ripple voltage	≤ 200mV (P-P)	≤ 200mV (P-P)
		9.	Galvanic Isolation	The rectifier stage must have galvanic isolation	The rectifier stage must have galvanic isolation
		10.	Switchgear:		
			a) input side (AC)	4 pole, 25A/20 kA or suitable size MCCB	4 pole, 25A/20 kA or suitable size MCCB
			b) output side (DC)	2 pole, 100A MCCB suitable for DC operation	2 pole, 100A MCCB suitable for DC operation
		11.	Protections	a) Surge suppressors	a) Surge suppressors
				b) Soft start	b) Soft start
				c) Battery charger current limit	c) Battery charger current limit
				d) Control circuit & Voltmeter fuses	d) Control circuit & Voltmeter fuses
				e) Rectifier protection	e) Rectifier protection
				f) Blocking diode	f) Blocking diode
				g) Under voltage & over voltage	g) Under voltage & over voltage
				h) Short circuit and Overload	h) Short circuit and Overload
				i) Thermal protection (Fire safety protection)	i) Thermal protection (Fire safety protection)
				k) Wrong battery connection/reverse polarity	k) Wrong battery connection/reverse polarity
				l) Battery Earth Fault	l) Battery Earth Fault
				m) POWER ON self test	m) POWER ON self test
				n) Supply wrong phase, phase failure	n) Supply wrong phase, phase failure
		12.	Operating temperature	0ºC to 55ºC	0ºC to 55ºC
		13.	Bus bars (copper)	Suitable size for carrying 100 A (min.) current.	Suitable size for carrying 100 A (min.) current.
		14.	Connection to back-up battery bank, load and battery at site	through dedicated MCBs via bus-bar-	through dedicated MCBs via bus-bar-
		15.	Mounting arrangement	Cabinet/ rack	Cabinet/ rack
		16.	Ingress Protection	IP 42	IP 42
		17.	Cooling arrangement	suitable cooling arrangement (natural / forced air with fan) should be provided	suitable cooling arrangement (natural / forced air with fan) should be provided

		18.	Alarms (at LCD display of Battery Charger (FC & FCBC)	AC Mains Fail/MCB trip (at charger input)	AC Mains Fail/MCB trip (at charger input)	
				DC Fail/MCB trip (at charger output to load)	DC Fail/MCB trip (at charger output to load)	
				DC Fail/MCB trip (at charger output to battery)	DC Fail/MCB trip (at charger output to battery)	
				AC under-voltage -	AC under-voltage -	
				AC over-voltage	AC over-voltage	
				DC load under-voltage	DC load under-voltage	
				DC load over-voltage	DC load over-voltage	
				Charger Under Voltage	Charger Under Voltage	
				Charger Over Voltage	Charger Over Voltage	
				Fault at rectifier module-	Fault at rectifier module-	
				Battery Earth Fault	Battery Earth Fault	
		19.	LED indications	Charger ON (Green)-	Charger ON (Green)-	
				Charger fail -Alarm (Red)	Charger fail -Alarm (Red)	
				Charger over temperature ()Red	Charger over temperature (Red)	
				Charger under voltage (Red)	Charger under voltage (Red)	
				SCR Fuse Fail (Red)	SCR Fuse Fail (Red)	
				AC mains ON (Green)	AC mains ON (Green)	
				AC mains Fail (Green)	AC mains Fail (Green)	
				Float ON (Green)	Float ON (Green)	
				Boost ON (in FCBC Only)- Amber	Boost ON (in FCBC Only)- Amber	
				Phase Failure/wrong phase	Phase Failure/wrong phase	
				Charge/Discharge	Charge/Discharge	
				Charger Overload	Charger Overload	
				Output Fail	Output Fail	
				Battery Low	Battery Low	
		20.	Dimensions (L X B X H) in mm	To be provided by bidder	To be provided by bidder	
		B.	**Housing Cabinet**			

		1.	Movable	Wheels or alternative arrangement for easy movement	Wheels or alternative arrangement for easy movement
		2.	Dimensions (L X B X H)	To be provided by bidder	To be provided by bidder
		3.	Suitable for containing the charger	Yes/ No	Yes/ No-
		4.	Structure	Steel rack/cabinet, painted with anti-corrosive paint.	Steel rack/cabinet, painted with anti-corrosive paint.
		5.	Ingress protection	IP 42	IP 42
5.0	**GENERAL CONSTRUCTIONS**				
5.1	**General**	The Battery charger is required for charging the batteries and as a DC conversion unit for supply to the relay units in case of supply failures along with a situation of deep-discharged batteries/ battery failure at any site. The battery charger must have the provision for Float and Boost modes for charging the VRLA batteries. **DC Distribution Board :** The DCDB shall be floor mounting, integral to battery charger panel. Non-compartmentalized, separate partition shall be provided between battery charger and DCDB. It shall have Moving coil DC voltmeter & DC ammeter of size 96 sq.mm. Incoming 100A DP DC MCCB-1 No, Copper Bus-bar, Outgoing 25A DP DC MCB: 12 Nos. with Feeder 'ON' LED indication. Back-up Battery bank shall be connected to battery charger MCCB/MCB, therefore MCCB/MCB to be considered in Battery charger for back-up battery bank connection for safe disconnection of battery bank in case of O&M activity. **General Features :** 1. The battery charger with other components and integral DCDB shall be housed in a common cubicle with separate compartments for charger and for DCDB with adapter. The chargers shall be indoor, floor mounted, self-supporting sheet metal enclosed cubicle type. The bidder shall supply all necessary base frames, anchor bolts and hardware. The panel frame shall be fabricated using cold rolled sheet steel of thickness not less than 2.0 mm. Removable undrilled gland plates of at least 3.0 mm sheet steel and lugs for all cables shall be supplied by the bidder. The lugs for cables shall be made of electrolytic copper with tin coat. The charger shall have sufficient vermin proof. Ventilation louvers shall be backed with fine brass wire mesh. All doors and covers shall be fitted with EPDM gaskets which shall be suitable for IP 42). The Chargers shall have hinged double leaf doors. provided on front and/or backside for adequate access to the Charger internals. All the Charger cubicle doors shall be properly earthed. The degree of protection of Charger enclosure shall be at least IP-42. 2. Conformal coating on all electronics components to be considered. 3. All indicating instruments, control & selector switches and indicating lamps shall be mounted on the front side of the charger.				

4. Electronic equipment shall be of modular design consisting of plug in modules in standard 19 inches metallic racks with metallic card guides. The cards should be provided with proper handles. Card to card wiring should be preferably through a mother board. Unplanned jumpering and track modifications are not permitted. Mechanical interlocks to prevent wrong insertion of cards should be provided. Each card shall have its junction and test points identified. Maintenance aids such as extension printed wiring boards and jumper leads shall be provided.

5. The layout of charger components shall be such that their heat losses do not give rise to excessive temperature within the Charger panel surface. Operating temperature range shall be minus 5°C to plus 60°C. Location of the electronic modules will be such that temperature rise of the location, in no case, will exceed 10° Cover ambient air temperature outside the charger.

6. The float-cum-boost charger shall be suitable for charging 48V battery in addition to trickle charging and feeding power to the communication equipment whenever AC mains supply is available to the charger.

7. In spite of the fluctuations in the voltage and the frequency variation of mains supply to the charger, there must be line regulated DC output voltage for feeding the communication equipment load. The DC output voltage shall also be load regulated.

8. In the event of mains supply failure, the batteries shall supply total load current as long as the battery is not discharged below 40V/20V. A Low Voltage Disconnector (LVD) should protect the battery from deep discharge. On restoration of main supply the float-cum-boost charger shall resume its normal function of charging the battery as well as feeding communication equipment load automatically.

9. Digital Control: charger should employ digital control with DSP controller for providing predictive control of rectification & monitoring capability. The charger should have a multi line dot matrix display of suitable size, on front panel to indicate control status and event log.

10. Lightning Protection: The system shall be adequately protected against lightning at the input.

11. Locking facilities shall be provided as following:

(a.) For locking Trickle/Boost selector switch in the trickle position only. This would be used for having key mechanical interlock between Trickle/Boost selector switch and isolator in D.C. distribution board which is being procured separately by the Owner.

(b.) The Charger enclosure door locking requirements shall be met by the application of padlocks. Padlocking arrangement shall allow ready insertion of the padlock shackle but shall not permit excessive movement of the locked parts with the padlock in position.

WIRING

- Each Charger shall be furnished completely wired up to power cable lugs and terminal blocks ready for external connection. The power wiring shall be carried out with 1.1 KV grade PVC insulated cables conforming to IS:1554 (Part-I).

The control wiring shall be of 1.1KV grade PVC insulated stranded copper conductors of 2.5sq.mm. Conforming to IS: 694. Control wiring terminating at electronic cards shall not be less than 1.0 sq. mm. Control terminal shall be suitable for connecting two wires with 2.5 sq.mm. Stranded copper conductors. All terminals shall be numbered for ease of connections and identification. At least 20% spare terminals shall be provided for circuits.

- Power and control wiring within panels shall be kept separate. Any terminal or metal work which remains alive at greater than 415 V, when panel door is opened, shall be fully protected by shrouding.

- An air clearance of at least ten (10) mm shall be maintained throughout all circuits, except low voltage electronic circuits, right up to the terminal lugs. Whenever this clearance is not available, the live parts should be insulated or shrouded.

AC Terminations

- The input terminal should be single phase or three phases as the case may be cleared marked as R Y B and N and for AC three phase, L and N for AC single phase.AC input termination shall be suitably protected against the accidental touch/contact with the working staff for their protection and shall also have clear and prominent be “Danger” marking.

- Screening shall be provided between AC and DC components to prevent accidents. The AC input connection to the rectifier module shall be by means of locking type plug and socket arrangement.

- All the connection between distribution and modules shall be through proper rated cables only. Fuses and circuit breakers for each module shall be easily accessible and properly rated.

DC Terminations

- The output of each rectifier in the negative load shall be taken through full rated ISI marked MCBs. All the AC, DC control & alarm cabling shall be supplied with the rack. All DC +ve and - ve leads shall be clearly marked.

Battery Temperature Compensation

- The charger shall be provided with the appropriate circuitry to interface with the temperature probe assembly. With the probe, the charger shall automatically compensate gassing and constant voltage setting inversely proportional to the probe’s temp/ battery ambient temp., so that over charging at high temperature and under charging at low temperature can be prevented.

Fuses

- All fuses shall be HRC Link type. Fuses shall be mounted on fuse carriers which are in turn mounted on fuse bases. Wherever it is not possible to mount fuses on carriers, fuses shall be directly mounted on plug-in type base. In such case one insulated fuse pulling handle shall be supplied for each charger. Fuse rating shall be chosen by the Bidder depending on the circuit requirement. All fuses in the chargers shall be monitored. Fuse failure annunciation shall be provided on the failure of any fuse.

		Blocking Arrangements • Blocking arrangement shall be provided in the positive pole of the output circuit of the charger to prevent reverse current flow from the DC battery into the charger. **Radio Interference** • The equipment shall be efficiently screened against interference to radio and also other communication equipment, which may be installed in the same building. All sources of noise shall be filtered if necessary with suppressors generally in accordant with relevant standards.
5.2	**Terminals**	Separate terminals shall be provided on Battery charger for connecting load (min. 12 numbers of outgoing) through DC Distribution Box (DCDB) and for connecting battery terminals. All terminals shall be of suitable size nickel plated steel. Suitable nickel plated copper lugs shall be provided by the supplier for the use of purchaser for connecting the load wiring. All connectors and leads shall be suitable for carrying discharge current for 30 min. continuously and through fault short circuit current which the battery can produce and withstand for the period declared.
5.3	**Connectors**	Nickel plated copper connectors shall be used for connecting the terminals of battery charger with the battery bank. Bolts, nuts and washers shall be nickel plated/ stainless steel. All terminals and interconnectors shall be fully insulated or shall have insulation shrouds.
5.4	**Cooling and ventilation**	Proper arrangement of natural air or forced air fan cooling (if required) to be provided for the Battery charger to restrict the temperature rise beyond 40ºC
5.7	**Stand and racks**	Suitable corrosion resistant Battery charger racks and cable supports shall be provided. Metallic racks shall be properly earthed. The bottom tier of stand shall have a ground clearance of 150 mm (minimum), above the floor. Racks shall be made of alkali resistant powder coated steel or stainless steel to ensure corrosion resistance.
5.8	**User interface with controller**	**Local Monitoring:** Web browser via Ethernet or WLAN Through Serial Port WEB server Web UI with configurable access rights, login control and user profiles **Remote monitoring:** Web browser, MODBUS Protocol Communication, OEM specific protocols via Ethernet, RS485 Remote alarming: Dry contacts; dial-out together with modems / RTU
5.8	**Painting**	The racks shall be painted with anti-corrosive paint of 80 micron thickness (minimum) of shade RAL 7032.
5.9	**Packing**	Bidder shall ensure that all the equipment covered by this specification shall be prepared for rail/ road transport (local equipment) and be packed in such a manner as to protect it from any damage in transit.
6.0	**NAME PLATE AND MARKINGS**	The unit shall be provided with a name plate clearly visible and effectively secured against removal. The name plate shall be indelibly and distinctly marked with all essential particulars as per relevant standards along with the following: i) Manufacturer's name ii) Month and Year of manufacture

		iii) Serial number and Type designation iv) Rated input voltage v) Rated input voltage vi) Maximum input current vii) Maximum output current viii) Guarantee period. ix) Reference standard x) Property of **TPCODL/TPNODL/TPSODL/TPWODL** Also, the danger plate should be shown on the front of the enclosure/ cabinet/ racks housing the battery bank.
7.0	**TESTS**	All routine, acceptance & type tests shall be carried out in accordance with the relevant standards mentioned in clause 2.0. All routine & acceptance tests shall be witnessed by the purchaser/his authorized representative. All the components shall also be type tested as per the relevant standards. Following tests shall be necessarily conducted on the metering cubical in addition to others specified in IS/IEC/IEEE/UL standards.
7.1	**Type Test**	a) Measurement of Power loss/ consumption in rectifier auxiliaries b) Equipment reactance test c) Measurement of voltage regulation / AVR regulation d) Efficiency and power factor measurement test e) Temperature rise test so as to determine the temperature rise of Semiconductor, Ferrite cores and cabinet etc. f) Measurement of insulation resistance. i. AC input to earth ii. AC input to DC output iii. DC output to earth g) DC voltage current characteristic h) High Voltage Tests. i) Determination of regulation j) Measurement of ripple k) Reverse leakage test l) Test for confirmation of reduction in float voltage with increase of battery temperature and vice-versa
7.2	**Routine tests**	All the routine tests should be conducted as per the relevant standards mentioned in clause 2.0.
7.3	**Acceptance Tests**	a) Measurement of voltage regulation b) Efficiency and power factor measurement c) Temperature rise test so as to determine the temperature rise of Semiconductor capacitor, choke, Ferrite cores and cabinet etc. d) Measurement of insulation resistance. i. AC input to earth ii. AC input to DC output iii. DC output to earth e) DC voltage current characteristic f) High voltage tests. g) Determination of regulation. h) Measurement of ripple i) Tests for indications and alarms as per this specification j) Tests for indicating instruments. k) Determination of system set points. l) Soft start test
8.0	**TYPE TEST CERTIFICATES**	The bidder shall furnish the type test certificates for the tests as mentioned above as per the corresponding standards. All the tests shall be conducted at CPRI/ERDA or

		any third-party NABL accredited laboratory, as per the relevant standards mentioned in clause 2.0. Type tests should have been conducted in certified Test laboratories 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, same shall be carried out without any cost implication to the purchaser.
9.0	**PRE-DISPATCH INSPECTION**	The successful bidder shall submit one prototype samples for further testing and compliance as per specifications and getting approval before mass manufacturing. 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 purchaser and the equipment if found unsatisfactory as to workmanship or material, the same is liable to rejection. Bidder shall grant free access to the places of manufacture to the TPCODL/TPNODL/TPSODL/TPWODL representatives at all times when the work is in progress. 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. Material shall be dispatched after specific MDCC (Material Dispatch Clearance Certificate) is issued by the Purchaser. Following documents shall be sent along with material : a) Test reports b) MDCC issued by Purchaser c) Invoice in duplicate d) Packing list e) Drawings & catalogue f) Guarantee / Warrantee card g) Delivery Challan h) Other Documents (as applicable)
10.0	**INSPECTION AFTER RECEIPT AT STORE**	The material received at Purchaser's 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 Engineering department.
11.0	**GUARANTEE**	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 60 months from the date of commissioning or 66 months from the date of last supplies made under the contract, whichever is earlier. 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 Purchaser, failing which the Purchaser will be at liberty to get it replaced/rectified at Bidder's risks and costs and recover all such expenses plus the Purchaser's own charges (@ 20% of expenses incurred), from the Bidder or from the "Security cum performance Deposit" as the case may be. In case the battery bank, battery charger or/ and the BMS fails within the guarantee period, the purchaser will immediately inform the bidder who shall take back the failed/ faulty part within 15 days from the date of intimation at his own cost and replace/repair it within forty-five days of date of intimation with a roll over guarantee. 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. **Service Level Agreement:**

		Services to be included during guarantee period: 1. Guarantee shall be for 60 months from the date of commissioning or 66 months from the date of last supplies made under the contract, whichever is earlier. 2. In case of any failure vendor shall report to site, within 24 hours of receipt of reporting of failure occurrence. 3. Vendor shall provide replacement of faulty part/ equipment within 4 days, after the confirmation of the fact that the part/ equipment cannot be repaired at site. 4. Vendor shall provide detailed root cause analysis of the fault within 15 days from the date of occurrence of the fault/ failure. 5. Any spare part replacement, testing and its commissioning to be done by the vendor only, without any price implication to the purchaser. 6. Any equipment, software or hardware to test the Battery Charger with the back-up battery bank, to be borne by the vendor only. **Service to be included during tender:** 1. Vendor needs to provide life-cycle support and supplies to ensure necessary support in terms of services and spares for 15 years from the date of PO. 2. Vendor needs to provide AMC for 10 years after guarantee period.
12.0	**PACKING**	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. The material used for packing should be environment friendly.
13.0	**TENDER SAMPLE**	Not Applicable.
14.0	**TRAINING**	The successful bidder shall provide training to 5 teams of TPCODL/TPNODL/TPSODL/TPWODL at site, regarding the handling, operation and maintenance of the thyristor based Battery Charger.
15.0	**QUALITY CONTROL**	The bidder shall submit 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. The Purchaser's engineer or its nominated representative shall have free access to the manufacturer's/sub-supplier's works to carry out inspections.
16.0	**MINIMUM TESTING FACILITIES**	Bidder shall have adequate in house testing facilities for carrying out all routine tests, acceptance tests as per Indian/International standards mentioned in clause 2.0.
17.0	**MANUFACTURING ACTIVITIES**	The successful bidder will have to submit the bar chart for various manufacturing activities clearly elaborating each stage, with quantity. This bar chart should be in line with the Quality assurance plan submitted with the offer. This bar chart will have to be submitted within 15 days from the release of the order.
18.0	**SPARES, ACCESSORIES AND TOOLS**	A list of important spares to be recommend by manufacturer and to be supplied with the equipment. The quantities of spares shall be decided by the purchaser.
19.0	**DRAWING AND DOCUMENTS**	Following drawings and documents shall be prepared based on Purchaser specifications and statutory requirements and shall be submitted with the bid : a) Completely filled in General Technical Particulars b) General arrangement drawing for thyristor based battery charger (with SLD and detailed circuit diagram). c) Experience List

d) Type test certificates
e) 2 Copies of Instruction manual (O&M/Trouble shooting guide) shall be provided with each unit

After the award of the contract, soft copies of following drawings, drawn to scale, describing the equipment in detail shall be forwarded for approval.

Sr. No.	Description	For Approval	For Review Information	Final Submission
1.	Technical Parameters	✓		✓
2.	GA Drawing	✓		✓
3.	Installation Instruction			✓
4.	Transport/ Shipping dimension drawing		✓	✓
5.	QA & QC Plan	✓	✓	✓
6.	Test Certificates	✓	✓	✓

All the documents & drawings shall be in English language.
Instruction Manual (in English language) covering erection and maintenance instructions and all relevant information and drawings pertaining to the main equipment as well as auxiliary devices shall also be submitted by the BA.

20.0 GUARANTEED TECHNICAL PARTICULARS

Clause-wise compliance to this specification.

21.0 SCHEDULE OF DEVIATION

(TO BE ENCLOSED WITH THE 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:

S. 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-HV-2007

Specification Name : ENG-ELC-006- TECHNICAL SPECIFICATION FOR 11KV XLPE ARMOURED CABLE- R1

JYOTIPRAKASH MOHANTY	SHANTAPRIYA JENA	SATYA PRASAD NAYAK	Ranjan Kumar Sahoo	VARUN BHATNAGAR	VARUN BHATNAGAR
Prepared by	Reviewed by	Reviewed by	Reviewed by	Approved by	Released by
TPWODL	TPNODL	TPCODL	TPSODL	TPWODL	TPWODL
10-12-2022	10-12-2022	12-12-2022	12-12-2022	13-12-2022	13-12-2022

CONTENTS

1. SCOPE:

This specification covers technical requirements of design, manufacture, testing at manufacturer's works, packing, forwarding, supply and unloading at site/store, performance of 11 kV XLPE ARMOURED cable, for trouble free and efficient operations.

Inclusive sizes: -

3 CORE CABLE	1 CORE CABLE
3C X 95 sq.mm.	1C X 300 sq.mm.
3C X 120 sq.mm.	1C X 400 sq.mm.
3C X 185 sq.mm.	
3C X 150 sq.mm.	1C X 630 sq.mm.
3C X 300 sq.mm.	
3C X 400 sq.mm.	1C X 1000 sq.mm.
3C X 400 sq.mm. (co-extruded cable)	

2. APPLICABLE STANDARDS:

The equipment covered by this specification shall unless otherwise stated, be designed, manufactured and tested in accordance with the latest editions of the following Indian, International Standards and shall conform to the regulations of the local authorities:

IS 7098 (Part 2)	Cross-linked Polyethylene (XLPE) insulation for Cables
IS 8130	Conductors for insulated electrical cables and flexible cords
IS 10418	Specification for Drums for Electric cables
IEC 60228	Conductor for insulated cables
IS 3975	Low carbon galvanized steel wires, formed wires and tapes for armoring of cables
IS 5831	Specification for PVC insulation sheath for electric cables
IEC-60811	Test methods for insulations and sheaths of electric cables and cords.
ASTM D 6097	Standard test method for relative resistance to vented water tree growth in Solid Dielectric insulating materials
ICEA T 31-610	Test method for conducting longitudinal water penetration resistance tests on blocked conductors
IS 10810	Methods of tests for cables
IS 4905	Methods for random sampling
IS 4984	High density polyethylene pipes for water supply
IS 2530	Methods of test for polyethylene moulding materials and polyethylene compounds

IS 4826	Specification for hot dipped galvanized coatings on round steel wires
IS 5:2007	Colors for ready mixed paints and enamels
ASTM 2863	Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
IEC 60754	Apparatus and procedure for the measurement of the amount of halogens evolved during the combustion of materials taken from electric or optical fiber cable constructions
IEC-60502 (Part-2)	Power cables with extruded insulation and their accessories for rated voltages from 1 kV (Um = 1.2 kV) up to 30 kV (Um = 36 kV) - Part 2: 22 kV Cables for rated voltages from 6 kV (Um = 7.2 kV) up to 30 kV (Um= 36 kV).
IEC 332	Test on electric cables on the fire conditions
ASTM 2843	Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics

3. CLIMATIC CONDITIONS OF THE INSTALLATION:

SL.NO.	CONDTIONS	VALUES
1	Max. altitude above sea level	1200m
2	Max. Ambient Temperature	50 °C
3	Max. Daily average ambient temp	35 °C
4	Min Ambient Temp	0 °C
5	Maximum temperature attainable by an object exposed to sun	60 °C
6	Maximum Humidity	95%
7	Minimum Humidity	10%
8	Average No. of thunderstorm days per annum	70
9	Average Annual Rainfall	150 cm
10	Average No. of rainy days per annum	120
11	Thermal Resistivity of soil	150 Deg. Ccm/W
12	Wind Pressure	126 kg/sq. m up to an elevation of 10 meter.

14	Earthquakes of intensity in horizontal direction	equivalent to seismic acceleration of 0.3g
15	Earthquakes of intensity in vertical direction	equivalent to seismic acceleration of 0.15g
16	Wind velocity	300 km/hr.

Environmentally, some of the regions, where the work will take place include coastal areas, subject to high relative humidity, which can give rise to condensation. Onshore winds will frequently be salt laden. On occasions, the combination of salt and condensation may create pollution conditions for outdoor insulators. Some places are in heavily industrial polluted areas. Therefore, Outdoor material and equipment shall be designed and protected for use in exposed, heavily polluted,salty, corrosive and humid coastal atmosphere.

The atmosphere is generally laden with mild acid and dust in suspension during thedry months and is subjected to fog in cold months. The design of equipment and accessories shall be suitable to withstand seismic forces corresponding to an acceleration of 0.1 g.

4. GENERAL TECHNICAL REQUIREMENTS:

S. No.	Description	Requirement	
		3 CORE CABLE	1 CORE CABLE
1	Voltage grade	11 kV (Earthed system)	
2	Max System voltage	12 kV	
3	Frequency	50 Hz	
4	Variation in frequency	+/- 3%	
5	Conductor	Watertight Stranded Aluminum (compacted circular)	
6	Conductor screen	Semi conducting tape and screen	
7	Insulation	XLPE	
8	Insulation screen	Shall have three layers:	Shall have three layers:
9		a) Bonded Semiconducting, b) Semiconducting water swellable tape, c) Metallic copper tape	a) Bonded Semiconducting, b) Semiconducting water swellable tape, c) Metallic copper tape d) Polyester transparent tape over copper screen
10	Core identification strip	Beneath copper screen	NA
11	Inner sheath	Pressure Extruded PVC ST- 2 with PP fillers	Extruded PVC ST-2
S. No.	Description	Requirement	
		3 CORE CABLE	1 CORE CABLE

12	Armour	GI wire round binded with rubberized cotton binding tape	Aluminum wire binded by rubberized cotton tape
13	Outer sheath	PVC ST-2 FRLSH type of color 'Crimson Red shade' code:355 as per IS 5:2007	
14	Outer sheath (for co-extruded cable)	a) Inner layer: HDPE ST-7, Crimson Red shade b) Outer sheath: HDPE ST-7, Black color	NA
15	Guarantee	up to a period of 60 months from the date of commissioning or 72 months from the date of last supplies made under the contract whichever is earlier.	

5. GENERAL CONSTRUCTION:

The cross-linked polyethylene insulated (XLPE) 11 kV Cable (Dry cured & water cooled) shall be manufactured and tested strictly in accordance with the Indian Standard IS 7098 (Part – 2)/ Relevant IEC/International standards and its latest amendments.

All material used in the manufacturing of cables shall be new and shall be selected as the best available for the intended use.

The rating factors for variation in ground and air temperature, depth of laying, thermal resistivity of soil and different laying configuration of cables shall be provided by the Bidder.

5.1 Conductor

S. No.	Parameter	Requirement							
1	Conductor	As per IS 8130							
2	Class	Class II							
3	Material	Plain Aluminium, grade H2/H4							
4	Shape	Stranded Compacted Circular							
5	Nominal size ofconductor mm2	95	120	150	185	300	400	630	1000
6	Min. number ofstrands	15	15	15	30	30	53	53	53
7	Max. DC resistance@ 20 deg C (Ohm/km)	0.32	0.25	0.206	0.164	0.1	0.08	0.047	0.03
8	Conductor Short circuit current ratingfor 1 second	9 kA	11.3 kA	14.2 kA	17.5 kA	28.3 kA	37.7 kA	59.4 kA	94.3 kA
9	Min. weight ofconductor (kg/km/core)	244	308	390	480	780	1080	1650	2600

10	Longitudinal water sealing of conductor	a) Non-conductive water swellable yarn/ tape/ combination of both shall be provided in between interstices of the conductor. b) Also, this water swellable tape and yarn shall be compatible to withstand conductor continuous temperature of 90 deg C and short circuit temperature of 250 deg C without any decay. c) It shall not affect the electrical conductivity of the conductor.
11	Cleanliness anduniformity	a) Before stranding, the cross-section of the Aluminium conductor shall be circular, and shall have uniform smooth surface, free from sharp edges and free from any defects. b) Stranded Conductor shall be free from oil traces & aluminum dust. Conductor (after stranding) shall be super cleaned c) Traces of aluminum dust on conductor or conductor screen shall not be acceptable.
12	Conductor jointing	Not acceptable in any strand or in any conductor after it is stranded.
13	Raw material supplier ,	Conductor raw material shall be procured from reputed suppliers viz., BALCO/ HINDALCO/ NALCO/ Vedanta / Equivalent (in-line with TS)
14	Diameter of conductor	To be specified by bidder

5.2 Conductor Screen:

S. No.	Parameter	Requirement
1	Material	**1st layer:** Semi-conducting tape **2nd layer:** Semi-conducting compound
2	Configuration	**1st layer:** Semi-conducting tape shall be applied over conductor with nominal thickness of 0.2 mm. **2nd layer:** Semi-conducting compound screen shall be applied through triple extrusion process.
3	Min. thickness	Minimum thickness of semi-conducting compound screen shall be 0.5 mm at any point of measurement.
4	Resistivity	Resistivity of semiconducting conductor screen shall not exceed 1000 Ω-m
5	Uniformity on interfacial region	Interfacial region between conductor screen and insulation shall be uniform. Protrusion/ convolution/ other defects are not acceptable in the region.
6	Raw material supplier	Semiconducting compound shall be procured from reputed raw material suppliers viz. Dow/ Borealis/ Hanwa/ Equivalent (in-line with TS)

5.3 Insulation:

S. No.	Parameter	Requirement
1	Material and extrusion process	XLPE insulation shall be applied through CCV/VCV line by triple extrusion process with 'Dry Curing' and 'Water Cooling'.
2	Raw material supplier	**a) XLPE compound shall be super cleaned and procured from reputed raw material suppliers viz. Dow/Borealis/Hanwa/** Equivalent (in-line with TS) b) Both XLPE and semi conductive compounds shall be used from same raw material supplier.
3	Thickness and Eccentricity	a) Nominal thickness shall be 3.6 mm. b) Minimum thickness shall be 3.14 mm at any point of measurement. c) Eccentricity of insulation shall not exceed 10%.
4	Thermal stability	The insulation properties shall be stable under thermal conditions arising out of continuous operation at conductor temperature of 90 deg. C rising momentarily to 250 deg. C under short circuit conditions.
5	Cleanliness and uniformity	Interfacial region between insulation and insulation screen shall be uniform. Protrusion/convolution/ other defects are not acceptable. Core shall be free from void and contamination.

5.4 Insulation Screen & Core identification strip:

S. No.	Parameter	Requirement
1	Material	a) **1st layer:** Semi-conducting compound b) **2nd layer**: Semi-conducting water swellable tape c) **3rd layer:** Annealed copper tape
2	Configuration	**a) 1st layer: Non-Metallic Part:** Extruded Insulation semiconducting screen shall be bonded type. Resistivity shall not exceed 500 Ω-meter. Surface of insulation screen shall be smooth, free from cavity/ nicks/scratches/ other visible defects. Min. thickness shall be 0.3 mm at any point of measurement. **b) 2nd layer: Water Swellable tape:** Semi-conducting water swellable tapes shall be applied over non-metallic screen. Minimum thickness of water swellable shall be 0.3 mm and minimum overlapping shall be 15%. **Core identification strip:** **3 CORE CABLE: -** Each of the three core identification strips shall

S. No.	Parameter	Requirement
		be applied longitudinally beneath copper screen. Width of the colored strip shall be 7-10 mm. R, Y, B. **1 CORE CABLE: - NA** c) **3rd layer: Metallic Part**: Annealed copper tape, helically wound over the water swellable tape with minimum 15% overlap. Minimum thickness shall be 0.045 mm at any point of measurement.
3	Raw material supplier	Semiconducting compound shall be procured from reputed raw material suppliers viz.,Dow/Borealis/Hanwa / Equivalent (in-line with TS)
4	Diameter of cores	To be specified by bidder
5	Weight of cores/km (approx.)	To be specified by bidder
6	Weight of copper tape/km (approx.)	To be specified by bidder

5.5 Fillers:

S. No.	Parameter	Requirement	
		3 CORE CABLE	**1 CORE CABLE**
1	Material	Virgin Polypropylene fibers of natural color	NA
2	Configuration	Virgin Polypropylene fibers shall be tightly filled in empty space as fillers.	

5.6 Inner Sheath:

S. No.	Parameter	Requirement	
		3 CORE CABLE	**1 CORE CABLE**
1	Material	Black colored Polyvinyl chloride (PVC) type ST-2 compound	
2	Configuration	The laid-up cores shall be provided with *pressure extruded* Polyvinyl chloride (PVC) type ST-2 compound conforming to IS: 5831 with latest amendments. Pressurized extrusion is required to remove any gaps remaining in between the fillers and to make the cable as circular as possible. It shall be applied to fit closely on to the laid-up cores and shall be possible to remove easily without causing any damage to the underlying insulated cores and screens.	Extruded PVC ST-2 type conforming to IS: 5831. It shall be applied to fit closely and shall be possible to remove easily without causing any damage to the underlying insulated cores and screens.

3	Raw material supplier	PVC compound shall be procured from reputed suppliers viz, Shakun, Kalpana, KLJ, DCM ShriRam/ Equivalent (in line with TS). PVC compound from cable manufacturer shall be considered only after factory evaluation for the same.

4	Min. thickness at anypoint of measurement	**3 CORE CABLE**					
		95 sq.mm.	120 sq.mm.	150 sq.mm.	185 sq.mm.	300 sq.mm.	400 sq.mm.
		0.6 mm	0.6 mm	0.6 mm	0.7mm	0.7 mm	0.7 mm
		1 CORE CABLE					
		300 sq. mm.	400 sq.mm.	630 sq.mm.		1000 sq.mm.	
		0.4 mm(min)	0.4 mm	0.5 mm		0.6 mm	

5.7 Armour:

S. No.	Parameter	Requirement					
		3 CORE CABLE				**1 CORE CABLE**	
1	Material	Low carbon annealed hot dippedgalvanized round steel wires				H4 Grade Aluminum wires	
2	Compliance to Standard	It shall comply with the requirements of IS 3975 along withlatest amendments. Hot dipped galvanizing layer shall be uniform on low carbon annealed steel wires. Zinc coating shall be 290g/m2 as per IS 4826:1979.				It shall comply with the requirements of IS8130 along with latest amendments.	
3	Nominal Dimensions	**3 Core cable**					
		95 sq.mm	120 sq.mm	150 sq.mm	185 sq. mm.	300 sq.mm	400 sq.mm.
		2.5 (GI Wire)	2.5 (GI Wire)	2.5 (GI Wire)	3.15(GI WIRE)	3.15 (GI Wire)	4.00 (GI Wire)
		1 CORE CABLE					
		300 sq. mm.	400 sq.mm	630 sq.mm			1000 sq.mm
		2 mm (Aluminum wire)	2 mm (Aluminum wire)	2 mm (Aluminum wire)			3.15 mm (Aluminum wire)
4	Approx. Armor Short circuitrating in kAfor 1 sec	**3 Core cable**					
		95 sq.mm	120 sq.mm	150 sq.mm		300 sq.mm	400 sq.mm.
		9	12	15		15	15
		1 CORE CABLE					
		300 sq. mm	400 sq.mm	630 sq.mm			1000 sq.mm
		15	15	15			15
		Fault current for the armour with minimum 90 % coverage.					

5	Jointing in the armour wires	Not acceptable in any armour wire
6	Laying of armour	The armor wires shall be applied as closely as practicable. Shall not be less than 90% of total circumference.
7	Binding	The rubberized cotton binding tape shall be applied to bind the armor wires suchthat it shall not affect the electrical properties of the armor wires and the overall cable.
8	Weight of armor	To be furnished by Bidder
9	Raw material supplier	Steel armour shall be procured from reputed raw material suppliers viz., TATA Steel, Jindal Steel, SAIL/ Equivalent (in-line with TS) / Aluminium armour shall be procuredfrom reputed raw material suppliers viz TATA/ BALCO/HINDALCO/NALCO/Vedanta Only/ Equivalent (in-line with TS)

5.8 Outer Sheath (for Normal cable)

S. No.	Parameter	Requirement					
1	Material	Polyvinyl chloride (PVC) ST-2 **FRLSH** type compound with **'lead naphthenate'** additive					
2	Configuration	Polyvinyl chloride (PVC) ST-2 FRLSH type compound with **'lead naphthenate'** additive as 'termite & rodent repellent' applied by extrusion process.					
3	Min. Thickness at any point of measurement	**3 CORE CABLE**					
		95 sq.mm	120 sq.mm	150 sq. mm	185 sq. mm.	300 sq.mm	400 sq.mm.
		2.2 mm	2.2 mm	2.36 mm	2.52 mm	2.84 mm	3.0 mm
		1 CORE CABLE					
		300 sq. mm.	400 sq.mm	630 sq.mm			1000 sq.mm
		1.56 mm	1.72 mm	1.88 mm			2.2 mm
4	Color	Crimson Red color, color code: 540 as per IS 5:2007.					
5	Surface uniformity	Surface of outer sheath shall be free from cavity/ nicks/ other visible defects.					
6	Raw material supplier	**PVC compound shall be procured from reputed raw material suppliers viz.,** Shakun, Kalpana, KLJ, DCM ShriRam. Equivalent (in-line with TS) PVC compound from cable manufacturer shall be considered only after factory evaluation for the same.					
7	Weight of outer sheath/km	To be provided by bidder					

5.9 Outer Sheath (for Co extruded 3C Cable)

S. No.	Parameter	Requirement
1	Inner layer	HDPE ST-7, Crimson red of color code 540, Minimum thickness at any point of measurement – 3 mm

2	Outermost layer	HDPE ST-7, Black color, Nominal Thickness at any point of measurement – 2 mm. Carbon content shall be as per IS 7098
3	Surface uniformity	Surface of outer sheath shall be free from cavity/ nicks/ other visible defects.
4	Raw material supplier	**HDPE shall be procured from reputed raw material suppliers viz., Shakun, Kalpana, KLJ, SCJ Plastics, and Borealis**, Equivalent (in-line with TS)
5	Weight of outer sheath/km	To be provided by bidder
6	Weight of HDPE/km	To be provided by bidder

5.10 Sealing End Cap:

S. No.	Parameter	Requirement
1	Material	Adhesive coated polyolefin heat shrinkable
2	Configuration	Adhesive coated polyolefin heat shrinkable end cap shall be provided at both ends of the cable.
3	Additional requirements	2 nos. additional cable end caps shall be provided with each drum and placed in the drum.

5.11 Other Requirements:

S. No.	Parameter	Requirement
1	Overall diameter of cable in mm	To be provided by bidder
2	Weight of Overall cable in kg/km	To be provided by bidder

6 MARKING:

Steel drums shall be provided. Drum shall be free from sharp edges and visual defect. Stencil plate on one flange side of the drum and laminated paper sheet on other side flange of drum.

Cable length on one drum shall be 250 meters max. +/- 5%. (As per PO Terms.)

I. Following details shall be provided on flanges of drum:

a) Manufacturer's name
b) Type of Cable
c) Size of Cable
d) Voltage Grade
e) Length of the cable on the drum
f) Direction of the rotation of the drum
g) Gross mass
h) Country of manufacture
i) Year and month of manufacture

j) Purchase Order no.

k) Drum No.

II. Following details shall be embossed on the outer PVC Jacket (For normal Cable) & HDPE layer (for co-extruded cable):

Embossing may be clearly visible**.** At interval of every 1 meter, following details to be embossed:

i) TPWODL/ TPCODL/ TPNODL/ TPSODL

ii) Manufacturer's name

iii) Month & Year of Manufacturing

iv) Voltage grade

v) Size of the cable

vi) Purchase Order no.

vii) Cable code

Note: - Sequential meter marking shall be printed.

7 TESTS:

The bidder shall be required to submit complete set of the following test reports along with the offer: -

7.1 ACCEPTANCE TESTS

Test on Conductor

7.1.1 Conductor resistance test

7.1.2 Test for non-conductivity of water swellable tape/yarn of conductor

7.1.3 Visual inspection for conductor cleanliness

7.1.4 Conductor water penetration test

Test on Conductor Screen

7.1.5 Thickness of semi-conducting tape over conductor

7.1.6 Test for conductivity of semi-conducting tape over conductor

7.1.7 Resistivity of extruded semi-conducting conductor screen

7.1.8 Thickness of extruded semi-conducting conductor screen

Test on Insulation

7.1.9 Tensile strength & Elongation at break (before ageing)

7.1.10 Insulation thickness

7.1.11 Eccentricity and Ovality of insulation

7.1.12 Hot set test

7.1.13 Volume resistivity

7.1.14 Void & contamination test on core (by silicon oil dip method)

7.1.15 Surface smoothness of insulation

Test on Insulation Screen

7.1.16 Resistivity of insulation screen

7.1.17 Thickness of insulation screen

7.1.18 Visual inspection for any convolution/ protrusion between conductor screen and XLPEinsulation, XLPE insulation and insulation screen

7.1.19 Thickness & % Overlapping of semi-conducting water swellable tape

7.1.20 Thickness & % Overlapping of copper tape

Test on Inner Sheath

7.1.21 PVC thickness

7.1.22 Color of inner sheath

Test on Armour (For 3 Core)

7.1.23 Tensile test

7.1.24 Mass of zinc coating

7.1.25 Uniformity of zinc coating

7.1.26 Adhesion test

7.1.27 Diameter and no. of wires

7.1.28 Coverage %

Test on Armour (For 1 Core)

7.1.29 Tensile test

7.1.30 Wrapping test

7.1.31 Resistance test

7.1.32 Diameter and no. of wires

7.1.33 Coverage %

Test on Outer sheath (for Normal cable)

7.1.34 Thickness

7.1.35 Tensile strength and Elongation at break (before ageing)

7.1.36 Color of outer sheath

7.1.37 Surface uniformity of outer sheath (on full drum)/ shall be free from any damage- void,nick, cavity

7.1.38 Presence of lead naphthenate in PVC outer sheath

7.1.39 Flammability test

7.1.40 Oxygen index

7.1.41 Temperature index

7.1.42 Acid gas generation

7.1.43 Smoke density

Test on Outer sheath (for 3 Core extruded cable)

INNER LAYER

7.1.44 Thickness

7.1.45 Tensile strength and Elongation at Break (before ageing)

7.1.46 Color

OUTER LAYER

7.1.47 Thickness

7.1.48 Tensile strength and Elongation at Break (before ageing)

7.1.49 Carbon Content

7.1.50 Color

7.1.51 Surface uniformity of outer sheath (on full drum)/ shall be free from any damage- void,nick, cavity

Test on Complete Cable

7.1.52 Partial discharge test

7.1.53 High voltage test

7.2 ROUTINE TESTS

i) Conductor resistance test

ii) Partial discharge

iii) High voltage test with power frequency

iv) Resistance test for Aluminium armour

7.3 TYPE TESTS

Tests on Conductor

7.3.1 Conductor resistance test

7.3.2 Conductor water penetration test

Tests on Insulation

7.3.3 Tensile strength & Elongation at break (before ageing)

7.3.4 Ageing in air oven

7.3.5 Tensile strength & Elongation at break

7.3.6 Tests for thickness of insulation

7.3.7 Eccentricity and Ovality of insulation

7.3.8 Hot set test

7.3.9 Shrinkage test

7.3.10 Gravimetric test (Water absorption)

7.3.11 Volume resistivity/ Insulation Resistance

Tests on Inner Sheath

7.3.12 PVC thickness

Tests on Extruded semi-conducting screen

7.3.13 Volume resistivity test of conductor screen

7.3.14 Volume resistivity test of core screen

Tests on Outer Sheath (PVC)

7.3.15 Flammability test for outer sheath

7.3.16 Thickness

7.3.17 Tensile strength and Elongation at break (before ageing)

7.3.18 Tensile strength and Elongation at break (after ageing)

7.3.19 Variation due to ageing

7.3.20 Loss of mass test

7.3.21 Shrinkage test

7.3.22 Hot deformation test

7.3.23 Heat shock test

7.3.24 Thermal stability test

7.3.25 Flammability test

7.3.26 Oxygen index

7.3.27 Temperature index

7.3.28 Acid gas generation

7.3.29 Smoke density

Tests on Outer Sheath - HDPE ST 7 (for Co-extruded cable)

7.3.30 Thickness

7.3.31 Tensile strength and Elongation at break (before ageing)

7.3.32 Tensile strength and Elongation at break (after ageing)

7.3.33 Shrinkage test

7.3.34 Carbon Black Content

Tests on Armour for 3 Core Cable

7.3.35 Tensile test

7.3.36 Torsion test

7.3.37 Wrapping test

7.3.38 Resistance test

7.3.39 Mass of zinc coating

7.3.40 Uniformity of zinc coating

7.3.41 Adhesion test

Tests on Armour for 1 Core Cable

7.3.42 Tensile test

7.3.43 Torsion test

7.3.44 Wrapping test

7.3.45 Resistance test

Tests on complete cable

7.3.46 Partial discharge test

7.3.47 Thermal ageing test

7.3.48 Bending test

7.3.49 Dielectric power factor test

7.3.50 High voltage test

7.3.51 Heat cycle test

7.3.52 Impulse withstand test

Additional Test (To be checked by Inspector)

7.3.53 Raw material consumption

7.3.54 Color coding identification over copper screen (for 3C cable)

7.3.55 Sequential marking check

7.3.56 Cable drum length verification

7.3.57 Packaging of cable on cable drum

7.3.58 Diameter over outermost sheath of co-extruded cable

7.3.59 Weight of outer sheath of co-extruded cable/ km

7.3.60 Weight of total HDPE of co-extruded cable/ km.

8 TYPE TEST CERTIFICATES:

The Bidder shall furnish the type test certificates for the tests as mentioned above as per the corresponding standards. All the tests shall be conducted at CPRI / ERDA as per relevant IS. However, TPWODL/ TPCODL/ TPNODL/ TPSODL/ TATA-POWER reserves the right to allow any other NABL accredited/ Govt. lab report under exceptional circumstances after due diligence/ scrutiny by DISCOM. Tests should have been conducted during the period not exceeding 10 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, same shall be carried out without any cost implication to TPWODL/ TPCODL/ TPNODL/ TPSODL.

9 PRE-DISPATCH INSPECTION:

The material shall be subject to inspection by a duly authorized representative of the TPWODL/ TPCODL/ TPNODL/ TPSODL. Inspection may be made at any stage of manufacture at the discretion of the purchaser and the equipment, if found unsatisfactory as to workmanship or material, the same is liable to rejection. Bidder shall grant free access to the places of manufacture to TPWODL/ TPCODL/ TPNODL/ TPSODL's representatives at all times when the work is in progress. Inspection by the TPWODL/ TPCODL/ TPNODL/ TPSODL or its authorized representatives shall not relieve the bidder of his obligation of furnishing equipment in accordance with the specifications. Material shall be dispatched after specific MDCC (Material Dispatch Clearance Certificate) is issued by TPWODL/ TPCODL/ TPNODL/ TPSODL.

Following documents shall be sent along with material.

a) Test reports

b) MDCC issued by TPWODL/ TPCODL/ TPNODL/ TPSODL

c) TPWODL/ TPCODL/ TPNODL/ TPSODL Invoice in duplicate

d) Packing list

e) Drawings & catalogue.

f) Guarantee / Warrantee card

g) Delivery Challan

h) Other Documents (as applicable).

10 INSPECTION AFTER RECEIPT AT STORE:

The material received at TPWODL/ TPCODL/ TPNODL/ TPSODL, Odisha store will be inspected for acceptance and shall be liable for rejection, if found different from the reports of the pre-dispatch inspection and one copyof the report shall be sent to Engineering department.

11 GUARANTEE:

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 Company up to a period of 60 months from the date of commissioning or 72 months from the date of last supplies made under the contract, whichever is earlier, supplier 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 Company, failing which the Company will be at liberty to get it replaced/rectified at supplier's risks and costs and recover all such expenses plus the Company's own charges (@ 20% of expenses incurred), from the supplier or from the "Security cum Performance Deposit" as the case may be.

12 PACKING:

a) **Standard length of Cable:** The cable shall be supplied in continuous standard length of 250 (3 cores) & 500 (Single core) running meters with +/- 5% tolerance.

b) **Filling condition:** Drum shall not be overfilled.

c) **Cable drum:** The cable shall be wound on non-returnable steel drums without any extra cost to TPWODL/ TPCODL/ TPNODL/ TPSODL as per IS 10418 and its latest amendments.

d) **Sealing of cable ends:** The ends of the cable shall be sealed by means of heat shrinkable polyolefin end caps. Additional 2 nos. end caps shall be provided with each drum.

e) **Requirements for Cable drums:** Cable drums shall be so constructed as to have required mechanical strength so that the drum flanges and other components do not break during transport, in actual use or in storage. The flanges and the outside surface of the barrel shall be free from protruding materials/projections/ unevenness/ sharp edges that can damage the cable or hands of the operator during rotation of drums.

A metal preservation shall be applied to the entire drum.

f) Bottom end of cable should be clamped on drum by jute or nylon rope.

g) All ferrous metal parts used shall be treated with a suitable rust-free finish or coating to avoid rusting during transit or storage. The drums shall withstand normal handling and transport.

h) **Rail/ Road transportation:** The bidder shall ensure that 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.

i) **Packaging shall be as per climate change perspective. Cable wound on cable drum shall be covered by recyclable PVC sheet for dust proof.**

13 TENDER SAMPLE:

Not Applicable

14 QUALITY CONTROL:

The bidder shall submit QAP 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. The Purchaser's engineer or its nominated representative shall have free access to the manufacturer's/sub-supplier's works to carry out inspections.

15 TESTING FACILITIES:

Supplier/ Manufacturer shall have adequate in-house testing facilities for carrying out all routine tests & acceptance tests as per relevant Indian standards.

16 MANUFACTURING FACILITIES:

The successful bidder shall submit the bar chart for various manufacturing activities clearly elaborating each stage, with quantity. This bar chart should be in line with the Quality assurance plan submitted with the offer.

17 SPARES, ACCESSORIES AND TOOLS

Not applicable.

18 DRAWINGS AND DOCUMENTS:

Following drawings and documents shall be submitted in line with the requirement of Tender specifications:

a) Completely filled in Schedule "A" Guaranteed Technical Particulars & Schedule "B"

Deviations

b) Work Experience details

c) Type test certificates.

d) Drawing 1 set of Hard Copy & Soft copy PDF File containing complete information about manufacturing.

19 SCHEDULE- "A" GUARANTEED TECHNICAL PARTICULARS:

Bidder to submit clause wise compliance.

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

CONTENTS

1. SCOPE

This specification covers technical requirements of design, manufacture, construction, performance, testing at manufacturer's works, packing, forwarding, supply and unloading at stores/site of 11kV Indoor switchgear panels, complete with all accessories for trouble free and efficient performance.

2. APPLICABLE STANDARDS

The equipment covered by this specification shall unless otherwise stated, be designed, manufactured and tested in accordance with latest editions of the following standards and shall conform to the regulations of local statutory authorities. For standards related to protection & Automation, kindly refer the ENG-ELC-028 & ENG-ELC-033.

SL. No.	Code	Detail
1	IS 3156/ IEC 60044-2	Voltage Transformers
2	IS 2705/ IEC 60044-1	Current Transformers.
3	IS 3427/IEC 62271-200	HV Switchgear and control gear
4	IS 694-1990	PVC insulated cables
5	IS 2629	Recommended practice for hot dip galvanized
6	IS 2633	Tests for uniformity of zinc coating
7	IS 5578	Guide for making insulated conductors
8	IEC 62053-22	Static meters for active energy (Class 0.2 S and 0.5 S)
9	IEC 62052-11	Electricity metering equipment
10	IEC 60282	High voltage fuses
11	IEC 60529	Ingress Protection
12	IEC62271-10/100	High voltage alternating current
13	IEC 61010-1	Safety requirement for electrical equipment for measurement and laboratory use
14	IEC 61000	Electromagnetic compatibility (EMC)
15	IEC 60947	Low voltage switchgear and control gear
16	IEC 60815	Pollution levels
17	IEC 60694	Common specifications for high voltage switchgear and control gear standards
18	IEC 60255-3	Electrical relays

19	IEC 60255-27	Measuring relays
20	IEC 60060	High voltage test techniques
21	IEC 60364 / 60479 / 60621 / IEEE STD.80	Standards for station grounding
22	IS 11353	Guide for uniform system of marking and identification
23	IEC 60270	Partial discharge measurement
24	IEC 60265	High voltage switches relays with dependent or independent time
25	IEC 60255-3	Electrical relays- Single input energizing quantity measuring relays with dependent or independent time
26	IEC 60255-27	Measuring relays and protection equipment-Part-27 Product safety requirements
27	IEC 60255	Electrical relays
28	IEC 60137	Bushings for Alternating Voltage above 1000V
29	IEC 60099-4	Surge Arrestor: Metal Oxide surge arrestors without gaps for ac system
30	IEC 60060	High voltage test techniques
31	CENELEC/SVDB	Pressure Vessel Codes

3. CLIMATIC CONDITIONS OF THE INSTALLATION:

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	150cm
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, dust in suspension during the dry months, and is subjected to fog in cold months.

4. Guaranteed Technical Requirement

S.No	Description	Requirement
4.I	SWITCHGEAR PANEL (2 I/C , 1 Bus Coupler, 2 Bus PT, 14 O/G)	
4.1.1	Architecture	Metal-clad-air insulated
4.1. 2	No. of Phases	Three
4.1.3	Rated Capacity	500 MVA
4.1.4	Rated Voltage	12 kV
4.1.5	Service Voltage	11 kV
4.1.6	Rated Frequency.	50 Hz
4.1.7	Rated impulse withstand voltage	75 kVP
4.1.8	Rated Power Frequency Withstand Voltage	28kV(ms)
4.1.9	Rated short time withstand current	25 kA for 3 seconds.
4.1.10	Peak withstand current rating	66 kA
4.1.11	Bus bar continuous rated current	1250 A
4.1.12	Bus bar material	Copper with Silver coated connections
4.1.13	Internal Arc Protection	IAC-A FLR as per IEC 62271-200, shall withstand 25 kA for 1 sec
4.1.14	Degree of protection for enclosure / partitions/ for meters, relays and BCU	IP 4X/IP 4X/IP 5X or equivalent to completely protect against dust ingress
4.1.15	Normal service condition	Indoor

4.1.16	Temperature Rise	The maximum permissible temperature for bus bar shall be 90 deg C at an ambient temperature not exceeding 40 deg C, as per IEC 694. However, the temperature rise for accessible enclosures and covers shall not exceed 30K and in case, they are not required to be touched during normal operation, the limit shall be raised by 10K.
4.2	**Circuit Breaker**	
4.2.1	Type	Vacuum (VCB)
4.2.2	Rated Capacity	500 MVA
4.2.3	Rated voltage	12 kV
4.2.4	Service voltage	11 kV
4.2.5	Short circuit breaking current	25 kA
4.2.6	Short Time withstand capacity	25 kA for 3 sec.
42. 7	Peak withstand current rating	66 kA
4.2.8	Rated current for Incomer & Bus Coupler VCB	2000 A (For 20/25 MVA PTR)
4.2.9	Rated current for Outgoing & Capacitor feeder VCB	630 A
4.2.10	Isolation	Horizontal
4.2.11	Mechanical endurance	10,000 operations
4.2.12	AUXILIARY VOLTAGES	
	For circuit-breaker charging	240V AC
	For protection relays	48 VDC / 24 VDC (TBD in detailed engineering)
	For anti-condensation Heaters	240V AC

Item/Panel reference			Incomer	Bus-coupler
4.3	Circuit Breaker Type/Rating(A)		VCB 2000A	VCB 2000A
4.4	Copper Busbar Rating (A)		2000A	2000A
4.5	Details of XLPE cables		2/3 runs of single core 630 Sqmm per phase. TBD during detail engg.	
4.6.1	CTs (Cast Resin type)	Quantity	3 Nos.	3 Nos.
		Thermal Withstand Capacity	25 kA for 3 sec	25 kA for 3 sec
		Ratio (TBD During Detailed Engineering)	800-1200-1600/ 5-5-5A	800-1200-1600/ 5-5-5A
		Core-1 (metering)	10VA, Isf<5,	10VA, lsf<5,
			0.2S	0.2S
		Core2 (protection)	10VA, 5P20	10VA, 5P20
		Separate CT Class PS	PS, Vk>5OOV,	-
			Imag<=30mA at Vk/2	-
			Rct< 6 Ohm	-
4.7	CB control switch, ON/OFF push buttons Indication lamps, Auto trip, L/R switch, TNC switch, Heater, Trip Coils, Closing coils, Operation counter & spring charged mechanism etc.		To be provided for each Switchgear Panel	

4.8	Bay Control & Protection Unit .(BCPU) CB Control function and. Measurement of Three phase currents & voltages, PF, Active, Reactive (Import & export Lag & Lead) & Apparent energy and power, Frequency etc .		1 no. as per:ENG-ELC-033 ENG-ELC-028 Also separate static energy meter (TVM) of class 0.2S for reading through MRI shall be provided	1 no. Combined BCPU as per Clause ENG-ELC-033 ENG-ELC-028
4.9	Analog Voltmeter		1	-
4.10.	Protection relays (TCS Pre Close /Post Close Supervision)	Numerical communicable relay with over current, earth fault, sensitive earth fault, breaker failure, negative sequence current and overload	Required	Required
		DC fail back-up with additional trip coils in CB	1	-
		Anti-pumping relay	1	1
		Electrically reset type high' speed relay for tripping. (The trip relay Shall be	1	1

		supervised).		
4.11	Trip Alarm scheme with Hooter, Accept/Reset PB		-	1
4.12	Cable charged indication		To be provided by the Bidder	To be provided by the Bidder
4.13	Panel illumination in Relay compartment		To be provided by the Bidder	To be provided by bidder
4.14	Circuit Name-Plate		To be provided by the Bidder	To be provided by bidder
Bus PT Panel				
4.15	Bus PT	Quantity	3 Nos. (1-ph)	
		Primary windings	11000V/rt3	
		Secondary winding(s)	110V/rt3-110V/rt3	
		Core-1	110V/rt3, 50VA,3P	
		Core-2	110V/rt3,50VA,0.2	
Item / Panel reference			**Outgoing Feeder**	**Capacitor Bank**
4.16	Ckt. Breaker Type/Rating(A)		VCB 630A	VCB 630A
4.17	Copper Bus bar - Rating(A)		1250A	1250A
4.18	Details of XLPE cables		During detailed Engineering	During detailed Engineering
4.19	CTs (Cast Resin type)	Quantity	3 Nos.	3 Nos
		Thermal withstand capacity	25 kA for 3sec	25 kA for 3sec

		Ratio	600-300 / 5-5A (TBD during detail engg.)	600-300 / 5-5A (TBD during detail engg.)
		Burden/Class		
		Core-1	15VA, Isf<5, CIass 0,2S	15VA, Isf<s, class 0.2S
		Core-2	10VA, 5P20	10VA, 5P20
4.2	LV components - CB control switch, ON/OFF push buttons Indication lamps, Auto trip, L/R switch, TNC switch, Heater, Trip Coils, Closing coils, Operation counter & spring charged mechanism etc		To be provided by the Bidder	
4.21	**Bay Control & Protection Unit (BCPU)** CB control and protection function & Measurement of Three phase currents & voltages, PF, Active, reactive (Import & export Lag & Lead) & Apparent energy and power, Frequency etc		As per ENG-ELC-033 ENG-ELC-028 Also separate Digital energy meter (TVM) of class 0.2s with optical port and communication port for remote reading.	As per ENG-ELC-033 ENG-ELC-028 Also separate Digital energy meter (TVM) of class 0.2s with optical port and communication port for remote reading.
4.22	Analog Ammeter			1
4.23	Protection relays	Numerical communicable relay with over- current, earth fault,sensitive earth fault, breaker failure, negative sequence & overload	1 (Combined BCPU as above)	1 (Combined BCPU as above) Also: Under voltage, over voltage, neutral current unbalance & delay timer shall be provided.
		Anti-pumping	1	1
		Electrically reset type: high- speed relay for tripping. (The trip relay shall be supervised).	1	1
4 24	Cable charged indication		To be provided by Bidder	

4.25	Panel illumination in Relay Compartment	To be provided by Bidder
4.26	Circuit Name-Plate	To be provided by Bidder

5 GENERAL CONSTRUCTION

5.1 SWITCHGEAR

Configuration:

19 panel configuration comprising of:

2 Incomers of 2000Amp, Bus Coupler of 2000Amp, 2 Bus PT and 14 Outgoings of 630 Amp.

a) The switchgear panel shall be of sheet steel construction and shall be dust and vermin proof. The panels shall be of Metal Clad compartmentalized design with all the High voltage compartments viz, circuit breaker, bus bar, current transformers and voltage transformers separated by metallic partitions. These compartments must have pressure relief flaps for the exit of gas due to internal arc to ensure operator's safety. The switchgear panels shall be rigid without using any external bracing. The switchboard panels should comply with relevant IS/IEC and revision thereof and shall be designed for easy operation maintenance and further extension. Bus bar, metering, circuit breaker chamber, cables and cable box chamber should have proper access for maintenance, proper interlocks should be provided. Metal enclosed switchgear shall be so designed that normal service, inspection and maintenance operations including visual checking of phase sequence, earthing of connected cables, locating of cable faults, voltage tests on connected cables can be carried out safely.

b) Panels shall have structural steel framework enclosed on all sides and top by CRCA sheet steel of minimum thickness as specified below:

- Frame: 3 mm
- Doors & Covers: 2 mm
- Removable gland plate: 3 mm

c) Panels shall consist of a front portion with equipment mounted on it and wiring access from rear. All doors, cutouts and removable covers shall be gasketed all round by neoprene cork

gaskets. Each panel section shall be provided with thermostat controlled space heater with ON/OFF switch and 5 A single phase plug point with 'ON/OFF switch, LED Lamp shall be provided with door switch for each panel for cubicle interior illumination.

d) Panels shall be mounted and bolted to a common base channel. The channel in turn shall be fixed to the foundation bolts at site. All foundation equipment, anchor bolts etc. including the supporting channel shall be furnished by successful bidder in advance for completion of Civil Works prior to dispatch of panels. The bottom plates of the panels shall be fitted with removable gland plates of not less than 3mm in thickness, for fixing the cable glands, the size of which shall suit the purchaser's external cables to the panels. The gland plates for the panels with Single core cables shall be made of Aluminum with split arrangement so as to avoid eddy currents. Cable glands shall be of double compression type 'and made of brass.

e) Indicating instruments and meters shall be at a suitable height so that the lettering on the dials can be easily read. Control switches/push buttons and relay resetting knobs shall be conveniently located for ease of operation. The center lines of the switches, push buttons and indicating lamps shall be not less than 900 mm from the bottom of the panel. The center lines of relays, meters etc. shall be not less than 450 mm from the bottom of the panel. Top lines of relays, meters shall be matched. Isolating switch fuse units shall be provided at the panel for incoming AC and DC supplies. Push buttons shall be made of non-hygroscopic material with shrouds. All other insulators shall also be made of non-hygroscopic material.

f) All components of the same rating and construction which may be needed to be replaced shall be interchangeable. If there are removable parts with different ratings and if parts are interchangeable within the assembly of metal enclosed switchgear and control gear, any possible combination of removable and fixed parts shall withstand the rated insulation level specified for fixed parts concerned.

g) Interlocks between different components shall be provided for safety and ease of operation. The withdrawal or engagement of a circuit breaker shall be impossible unless it is in open position. All instruments shall be non draw-out type and safeguard in every respect from damages. The operation of a circuit breaker shall be impossible unless it is in service,

disconnected, removed, test or earthing position. It shall be impossible to close the circuit breaker in service position unless it is connected to auxiliary circuit.

h) All the HV design shall ensure conformity to Annex- A of IEC-62271-200 and must be Type tested for Internal Arc Test. The supplier shall submit Type Test report from CPR I/ERDA to prove the above. Auxiliary and control equipments installed on the panel shall be suitably protected against disruptive discharge from main circuit. Buses shall be insulated with insulating sleeves, wherever bare conductor is employed. The switchgear panel shall be IAC- AB as per IEC 62271-200 and shall withstand 25kA for 1 sec.

i) Degree of Protection for the enclosure and the partitions shall be IP4X. The covers and doors should only be opened when the part of main circuit contained in the compartment being made accessible is dead. Partitions of metal-clad switchgear and control gear shall be metallic and earthed. All the meters, detachable units of relays, relays and BCU shall be minimum IP5X or with an equivalent provision to completely protect it against dust ingress. Meters/ relay shall be protected in such a way that the performance does not get affected due to small dust also. Provision of louvers for air circulation shall be provided.

j) It is preferred to have condition based monitoring in switchgear using Heat and Humidity sensors in Bus-Bar , Breaker and Cable Compartments. These sensors should be integrated with RTUs/ SCADA using wireless communication.

k) All indicating lamps shall be provided with suitable series resistors and bulbs shall be replaceable from the front of the panel. All indicating lamps shall be of LED type and suitable for continuous operation at 85% to 110% of their rated voltage. The following indicating lamps with color shall be mounted over switchgear to indicate important status/alarm of breaker:

- 'Breaker close- Red
- Breaker open - Green
- DC Healthy -Yellow.
- Space heater not healthy-Blue
- Spring Charge - White
- Trip coil healthy- Blue

- Auto trip -Amber

All color caps shall be Similar and interchangeable and all LEDs shall be of same type and ratings. The LED lamps shall be furnished 20% in excess of actual numbers required and colour caps shall be furnished 10% in excess of actual numbers used for each colour.

l) DC fail supervision relay (80) shall be provided on all control and relay panels. DC fail annunciation shall be provided 'on each pane| and loss of DC & trip circuit fail alarm will be suitably annunciated and spare contact of the same should be wired to SCADA. Arrangement for inter-tripping wiring from primary side of transformer to 11 kV, incomer switchgear and vice versa should be there. Identification of Components shall be in agreement- with the indication on the wiring diagrams and. drawings. If a component is of the plug-in type, an identification mark should be placed on the component and on the fixed part where it is to be plugged-in. Control cables are to be placed in trunking and it should be suitable to accommodate 20% wiring for future modifications

m) Control supply in individual bay shall to be distributed through MCBs of suitable rating for individual control function like:

- Protection Relay
- Trip circuit
- Close circuits
- Spring charging circuit
- Heating and lighting circuit

n) MCB shall be rated for 10kA short circuit rating. It shall be quick make, quick break, and independent manual type with trip glee feature. PCB shall have the following:

- Over current protection
- ON/OFF Trip position indicators
- Auxiliary contact block (Wherever required)

o) Wherever CB contacts are to be multiplied, latch type relay shall be used for contact multiplication. Auxiliary contact multiplier relays shall be reputed make and selected on the

basis of continuous current carrying capacity and rated voltage. The fluctuation in voltage level shall be accounted for (4-1) 10% continuously.

p) Fuse failure relay and trip circuit supervision relay shall be suitably selected, considering burden and auxiliary voltage. External circuitry like compensating resistances will not be accepted

q) Capacitor bank switching device shall be provided with suitable gate interlock mechanism with castle key along with timer to ensure safety. Provision of 0-500 mA analog ammeter on Capacitor Bank along with Push Button shall be made for monitoring 'Unbalance Capacitor Current

r) Each switchgear panel shall have 20% spare terminals. All equipment's mounted on front side of panel shall have individual nameplates with equipment designation engraved. Alarms for. Trip & non-trip should be separate. The termination links for cables shall be segregated in vertical plane. The bidder shall deliver to site completely assembled, wired, tested panels and only the interconnecting cables shall be connected at site

s) The bidder shall deliver to site completely assembled, wired, tested panels and only the interconnecting cables shall be connected at site. The bidder shall further refer ENG-ELC-033 & ENG-ELC-028 for constructional and other requirements.

5.2 CIRCUIT BREAKER

a) The circuit breaker shall be VCB, draw out type in horizontal position. The circuit breaker chamber shall have metallic safety shutters, which will close in the event of breaker withdrawal and ensure that no live components inside the 11 kV switchgear panels should be accessible. Withdrawal of the breaker should not be possible in ON position. CB shall have TEST & SERVICE positions. it shall be possible to test the circuit breaker in "TEST' position inside the panel with the entire auxiliary and control circuit connected and Power contacts isolated. Comprehensive interlocking system to prevent any dangerous or inadvertent operation shall be provided. Isolation of CB from bus bar or insertion into bus bar shall only be possible when the breaker is in the open position. Control switch for circuit breaker shall be of spring return to

normal type with pistol grip handle. The CB chamber & other live parts accessible from a distance are to be provided with suitable locking arrangement. The circuit breakers compartment is to be provided with hinged doors and proper access to be provided for racking mechanism without opening the CB compartment door. For Safety Purpose, Breaker rack-in/ Rack-out (Isolation) shall be possible with closed door only. The spare contact of breakers, Test/ service switches to be wired up to terminals.

b) The CB shall be spring operated, motor charged, and manually released spring closing mechanism with three pole simultaneous operations. The speed of closing operation shall be independent of the hand-operating lever. The indicating device shall show the OPEN and CLOSE position of breaker visible from front of the cubicle. The spring charging time of the motor shall not exceed 15 sec. The
"TRIP™ and "CLOSE' coils shall be of reliable design and low consumption preferably less than 200W.
Anti-pumping relays & T-N-C switch shall be provided for each panel.

c) The CB shall be capable of making & breaking the short time current in accordance with the relevant IS/ 1EC and shall have 3 phase rupturing capacity of 500 MVA at 11kV. It shall be possible to Interchange vacuum interrupters of incomer CB with other outgoing CB & vice versa. For each Switchboard one no.1250A &.one no, 630A CB handling trolleys shall be supplied.

d) Vacuum Interrupter, Breaker and Switchboard should be of same make.

5.3 BUS-BARS

Bus bars and all other electrical connections between' various components shall be made of copper of rectangular cross-section. The bus bars shall-be insulated with heat shrinkable insulating sleeves, except at the points of connections. The bus bar section shall be of ample capacity to carry the rated current of 2000A continuously in Main Busbar and 1250 Amp in Dropdowns without excessive heating and for adequately meeting the thermal and dynamic stresses in the case of short circuit in the system up to full MVA. All bus bars shall be rigidly and firmly mounted and shall be capable of withstanding short circuit stresses and vibrations. Bidder

should specify current density for Cu bus bars. The bus bars shall be extensible on both sides depending upon layout.

Adequate clearance between 11 kV point and Earth and between phases shall be provided to ensure safety as per provision in Indian electricity rule 1956 and its amendment thereof and also in accordance with the relevant latest Indian standard specification. The same shall be capable of withstanding the specified High Voltage tests as per IEC-62271/ 80060 and its amendments thereof.

The interlocking facility should be provided between incomers and Bus couplers. Scheme will be finalized during detail engineering. The insulators shall be made of non-hygroscopic material.

5.4 CURRENT TRANSFORMER

The Current. Transformers shall be of Epoxy Cast Resin Type with Window type construction and rated for 500 MVA (3 sec) with details as per General technical requirements of Clause no. 4.0. For CT/PT circuits, drop type links to be provided and lugs shall be round type. The control wiring shall be of 4 sq. mm. multi stranded copper with 1.1 kV insulation grade. The physical location of CT core for differential protection shall be near BUS to have overlapping protection different zone. The additional auxiliary CTs and related wiring work required to match existing Trf. Differential Protection shall be part of this tender specification. Al current transformers shall be designed to carry continuously a current of 120% of the rated current.

5.5 VOLTAGE TRANSFORMER

The Voltage Transformer shall be of Epoxy cast resin type with details as per General technical requirements of clause no 4.0. It shall be mounted on a draw-out type trolley and protected by HRC fuses on both primary and secondary sides. VT’s mounted on circuit breaker truck shall not be accepted. Bus VT shall be provided in each section. In addition VTs shall be provided on incomer lines as per TPCODL requirements. The VT shall have Metallic safety shutters, which will close in the event of VT withdrawal and ensure that no live components inside the 11 kV switchgear panels are accessible. The VT shall be of the single-phase type, with separate core for metering and separate core for protection. The control wiring shall be of 4 sq. mm. multi stranded copper with-1.1 kV grade insulation. All voltage transformers shall be designed to

carry continuously 1.2 times the normally rated voltage and 1.9 times the normally rated voltage for continuous operation upto 30 sec.

5.6 RELAYS

a) The switchgear shall have numerical communicable relays designed to disconnect fault circuits with speed and discrimination and shall confirm to IEC 60255-3/IS 3231 or latest revision thereof regarding accuracy and other features.

b) The relay resetting should be such that resetting of the main protection relay should reset all the other auxiliary relays. All the relays shall be communicable with suitable protocol so as to provide all the I/O signals required by the Purchaser

c) Relays shall support Purchaser's protection philosophy as per ENG-ELC-028 & ENG-ELC-033. However, the substation operation shall comply to the integrated automation requirements with the MASTER SCADA.

d) All plugs in heavy current modules that carry CT circuits shall be equipped with CT shorting features when the module is withdrawn. Suitable facilities shall be provided on each measuring relay to' disconnect trip outputs and then short and disconnect the IT circuits.

The bidder shall further refer to TPCODL protection and automation philosophy ENG-ELC-028 & ENG-ELC-033.

5.7 DC SELECTOR SWITCH

There shall be three position DC selector switch i.e neutral, DC1 &DC2. In normal supply condition the left side panel & bus section is fed by DC1 Source .and right side panel is fed from DC2 Source. In case of failure of DC2 source, all panels will be fed by DC1 source. Similarly In case of failure of DC1 source, all panels will be fed by. DC2 source. Cabling required from DCDB to DC selector switch is included in vendor serve. DC MCB of 25 A rating with 'CAC characteristics shall be preferred

5.8 TERMINAL BLOCKS

a) The terminal blocks shall be 1100 V grade, 10 Amps rated, one piece moulded, complete with insulated barriers, stud type terminals, washers, nuts and lock nuts and identification strips. Markings on the terminal strips shall correspond to wire numbers on the wiring diagrams. The

terminal blocks shall be fully enclosed with easily removable covers and made of moulded non-inflammable plastic material.

b) A minimum clearance of 250 mm between the first row of terminal blocks and the associated cable and plate shall be ensured. Also the minimum clearance between two rows of terminal blocks shall be 150mm.

c) AII spare contacts and terminals of the panel mounted equipment and devices shaft be wired to terminal blocks. AII the TB's shall be of single Decker type.

The bidder shall further refer to TPCODL protection and automation philosophy ENG-ELC-028 & ENG- EHV-106.

5.9 SPACE HEATERS

a) Strip type space heaters of adequate capacity shall be provided inside each panel to prevent moisture condensation on the wiring and panel mounted equipment. Space heaters shall be rated for 240 V, 1 phase, 50 Hz supply. Heaters inside the panels shall not be mounted close to the wiring or any panel mounted 'equipment. Heaters shaft be complete with either miniature circuit breakers or with isolating switches, HRC fuse on phase and link on the neutral of the heater supply

b) An adjustable type thermostat shall be provided in the heater control circuit with temperature range of 0-90 degree C.

5.10 INTERIOR LIGHTING AND RECEPTACLES

a) Each panel shall be provided with a LED fixture rated for 240 V, 1 phase, 50 Hz supply for the interior illumination of the panel during maintenance. The fitting shall be complete with switch-fuse unit and the switching of the fitting shall be controlled by the respective panel door switch.

d) Each panel shall be provided with a 240 V, 1 Phase, 50 Hz, S Amps, S Pin receptacle with switch.The receptacle with switch shall be mounted inside the panel at a convenient location.

5.11 POWER & CONTROL SUPPLIES

a) Each control panel shall be provided with necessary arrangement for receiving, distributing, isolating and fusing of DC and AC supplies for various control, signaling, lighting and space heater circuits.. The incoming and sub-circuits shall be separately provided with switch-fuse

units. Supply monitoring arrangement shall be provided. Selection of the main and sub-circuit fuse ratings shall be such as to ensure selective clearance of sub-circuit faults. Potential circuits for relaying and metering shall be protected by fuses. DC MCB of 25 A rating with ”C/K' characteristics shall be preferred.

b) If auxiliary voltages other than those specified are required, then necessary arrangement shall be made by the bidder within the panel to obtain the desired voltages by providing step-down transformers and inverter/converter, etc.

c) All fuses shall be HRC cartridge type conforming to relevant standards, mounted on plug-in type fuse bases and Siemens type of bases and cover with locking arrangement for fuse link. All accessible 'live connection to fuse bases shall be adequately 'shrouded. Fuses shall have operation indicators for

indicating blown fuse condition. Fuse carrier base shall have imprints of the fuse rating and voltage.

5.12 PANEL WIRING

a) Panels shall be supplied completely wired internally to equipment and terminal blocks and ready for the Purchaser's external cable connections at the terminal blocks. Panel wiring shall be securely supported, neatly arranged by lacing and tying, readily accessible and connected to equipment terminals and terminal blocks. Flame retardant, plastic wiring channels/troughs with strap on plastic covers shall be used for this purpose. When panels are arranged to be mounted adjacent to each other all inter-panel wiring and connections between panels shall be provided by the Bidder.

b) All wiring shall be carried out with 1100 V grade, single core stranded copper conductor wires with PVC insulation. The minimum number of strands per conductor shall be seven. Extra flexible wires shall be used for Wiring of devices mounted on moving parts such as swinging panels and doors. The minimum size of the stranded copper conductor used for panel wiring shall be as follows:

i) All circuits except CT circuits: 2.5 mm2 per lead

ii) CT circuits: 4 mm2 per lead

iii) PT circuits: 4 mm2 per lead

c) Longitudinal troughs near the top, extending throughout the full length of the panels shall be provided for inter panel wiring, for AC and DO supplies, PT circuits, and other common services. Interconnections to adjacent panels shall be brought out to a separate set of terminal blocks located near the slots or holes meant for taking the interconnecting wires. Arrangements shall permit easy inter-connections to adjacent panels at site and wires for this purpose shall be provided by the bidder looped and bunched properly inside the panels.

d) If accidental short circuiting of certain wires is likely to result in malfunction of equipment, such as closing or tripping of a breaker or positive and negative wires, these wires shall not be terminated on adjacent terminal blocks. The unused instrument space on the front or rear of the panels shall be kept clear of wiring, to ’facilitate addition of devices without rewiring associated portion of the panels.

e) Wire terminations shall be made with solder less crimping type of (ring type lugs for all CT and PT circuits and pin type lugs for other circuits) tinned copper lugs which firmly grip the conductor and insulation. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules, marked to correspond with panel wiring diagram shalt be fitted at both ends of each wire: Ferrules shall fit tightly on the wires and shall not fall off when the wire is disconnected. Lock in type ferrule shall be provided.

f) Bidder shall be solely responsible for looping all protection relays up to the Bat or DC as per the requirement. Network cable required to communicate BCIPBCPUs with DC shall be under bidder's scope. Looping and networking cable shall be CAT-5 type. The Bidder shall be solely responsible for the completeness and correctness of the internal wiring and for the proper functioning of the connected equipment. In case the cables are to be routed through trenches, necessary metal clad conduits shall be used.

g) Internal wiring to be connected to external equipment shall terminate on terminal blocks. The terminal blocks for CTs and VTs shall be provided with test links and isolating facilities. The CT terminal blocks shall be provided with short circuiting and earthing facilities. Change of CT cores should be possible by linking & delinking of terminals. Switchgear shall have 20% terminals as spare terminals in each panel & should be uniformly distributed in all the blocks,

5.13 CABLE TERMINATION ACCESSORIES

a) The purchasers external cable connections will be terminated on the terminal blocks provided in the control panel. All necessary cable terminating accessories such as gland plates, cable glands, crimp type tinned copper lugs, supporting clamps and brackets, wiring ° lugs and gutters etc. for cables shall be included in the bidder's scope of supply.
b) All cater caps shall be similar and interchangeable and all lamps be of same type and ratings lamps shell be furnished 20% in excess of actual numbers required and colour caps shall be furnished 10% in excess of actua] numbers used for each colour.

5.14 LABELS

a) All equipment mounted on front and rear side as well as equipment mounted inside the panels shall be provided with individual labels with equipment designation engraved. Also on the top of each panel on front as well as rear side, large and bold nameplates shall be provided for circuit/ feeder designation. The labels shall be mounted directly below the respective equipment.
b) All front mounted equipment shall be provided, at the rear also with individual labels engraved with tag numbers corresponding to the ones shown in the panel internal wiring to facilitate easy tracing of the wiring.
c) Each IED and meter shall be prominently marked. All relays and other devices shall be clearly marked with manufacturer's name, type, serial number and electrical rating data.
d) Labels both external & internal shall be made on non-rusting metal preferably Aluminium anodized one. Labels shall have white letters on black background. The lettering size shall be 6 mm for panel designation and minimum 3mm for device labels. The label designations shall be subject to the Purchaser's approval.
e) Each switch shall bear clear inscription identifying its function e.g. 'BREAKER' 52A' etc. Similar inscription shall also be provided on each device whose function is not otherwise defined. If any switch device doesn't bear this inscription, separate name plate giving its function shall be provided for It. Switch shall also have clear inscription for each position indication e.g. 'Trip-Neutral-Close', 'ON-OFF', 'R-Y-B OFF'

5.15 EARTHING

a) All panels shall be equipped with a separate earth bus securely fixed along with the inside base of panels. When several panels are mounted adjoining each other, the earth bus shall be made continuous. Provision shall be made for future extension of the earth bus. Provision shall be made on the earth bus bars of the end panels for connecting the same to the earthing grid.

b) An earthing conductor of 40x10 sq mm Cu (minimum), shall be provided extending the whole length of switchgear and control gear to sustain the Rated short time withstand current. Each equipment mounted in the panel shall be directly earthed to this earth bus by distinct connections. Separate earth busbar to be run along switchgear for protection earthing of relays and communication equipments and to be insulated from the frame.

c) Earthing trolley shall be provide separately to earth the bus bar and cables adequate interlocking facilities such that earthing trolley can't be 'ON' when bus bar I cable is energized and it should have only mechanical closing facility. The offered trolley shall.be of sufficient capacity to carry the current. One bus bar earthing truck & one cable earthing truck shall be supplied per switchboard. In case the sizes are different for Incoming and Outgoing, separate earthing trucks shall be provided.

d) All metallic cases of relays, instruments and other panel mounted equipments shall be connected to the earth bus by independent copper wires of size not less than 2.5 sq.mm. The colour code for earthing wires shall be green. VT and CT secondary neutral or common lead shall be earthed at one place only or the terminal blocks where they enter the panel. Bidder shall provide separate electronic earthing for all IEDs.

e) Looping of earth connections, which would result in loss of earth connection to the other devices when the loop is broken, shall not' be permitted. However, looping of earth connections between equipment to provide alternative paths to earth bus shall be-provided. -

The bidder shall further refer to ENG-ELC-028 & ENG-ELC-033.

5.16 PAINTING

All sheet steel work shall be phosphate in accordance with the IS: 6005 "Code of practice for phosphating iron and steel". It should follow the seven tank process. Oil, grease, dirt and scarf shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling

with dilute acid followed by washing with running water rinsing with a slightly alkaline hot water and drying. After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying. The phosphate waling shall be sealed with application of two coats of ready mixed, stoved type zinc chromate primer. The first coat may be "flash dfied" while the second coat shall be stoved. Thereafter an established painting procedure like electrostatic painting
shall be followed for powder coating the panel. The colour shade shall be Siemens grey RAL 7032.

5.17 GALVANIZING

a) All galvanizing shall be carried out by the hot dip process, in accordance with Specification ISO:1460 or IS: 2629 amended to date. However, high tensile steel nuts, bolts and spring washers shall be electro -galvanized to service condition four. The zinc coating shall be smooth, continuous and uniform. It shall be free from acid spots and shall not scale, blister or be removable by handling or packing. There shall be no impurities in the zinc or additives to the galvanic bath, which could have a detrimental effect on the durability of the zinc coating,
b) After galvanizing no drilling or welding shall be performed on the galvanized parts of the equipment except that nuts may be threaded after galvanizing.
c) To avoid the formation of white rust, galvanized material shall be stacked during transport and stored in such a manner as to permit adequate ventilation. Sodium dichromate treatment shall be provided to avoid formation of white rust after hot dip galvanization. The galvanized steel shall be subjected to tests as per IS-2633 and BS:729 amended to date.

5.18 SYSTEM ARCHITECTURE AND COMMUNICATION -

The bidder shall refer to ENG-ELC-033 & ENG-ELC-028 (protection & automation specifications of TPCODL for new grids based on IEC-61850 protocol for System architecture and communication requirements.

5.19 DATA CONCENTRATOR

The bidder shall refer ENG-ELC-033 & ENG-ELC-028 (protection & automation specifications of TPCODL for new grids based on IEC-61850 protocol for Data concentrator requirements.

5.20 CONTROL, METERING AND PROTECTION

Incomer switchgears should be provided with separate protection unit and separate metering & control unit. Outgoing feeder switchgears (including switchgears for capacitor & local transformer) should be provided with combined protection, metering & Control unit. All these units shall be communicable with Purchaser's SCADA on IEC-61850 protocol without any change & modification of hardware,

The bidder shall further refer ENG-ELC-033 & ENG-ELC-028 (protection & automation specifications of TPCODL for new grids based on IEC-61650 protocol for Control, metering and protection requirements.

5,21 REMOTE MONITORING AND MAINTENANCE STATION

The bidder shall refer to ENG-ELC-033 & ENG-ELC-028 (protection & automation specifications of TPCODL for new grids based on IEC-61850 protocol for Remote monitoring and maintenance requirement

5.22 CONTROL PHILOSOPHY

The bidder shall refer to ENG-ELC-033 & ENG-EHV- 105 (protection & automation specifications of TPCODL for new grids based on IEC-61850 protocol for Control philosophy requirement.

5.23 OPERATIONAL PHILOSOPHY

The bidder shall refer to ENG-ELC-033 & ENG-ELC-028 (protection & automation specifications of TPCODL for new grids based on IEC-61850 protocol for Control philosophy requirement.

5.24 PROTECTION PHILOSOPHY

The bidder shall refer to ENG-ELC-033 & ENG-ELC-028 (protection & automation specifications of TPCODL for new grids based on IEC-61850 protocol for Protection philosophy requirement.

6 NAMEPLATE & MARKINGS

All the component and operating devices of the switchgear shall be provided with durable, and legible nameplates containing all technical parameters. Name plate shall be embossed with "PO no. with date,"Property of TPCODL", along with the following information:

i) Manufacturer's Name or Trade Mark

ii) Type designation or serial no.

iii) Applicable rated values

iv) No. of the relevant standard..

v) Name of the substation and feeder and reference drawing number

The name plate of each functional unit shall' be legible during normal service. The removable parts, if any shall have a separate nameplate with the data relating.to the functional units they belong to, but this nameplate need only be legible when the removable parts is in removed Position.

CT & PT details to be mentioned at the rear cover of the switchgear panel

7. TESTS

All the Routine and acceptance tests shall be carried out in accordance with the relevant IS/IEC standards. All routine/acceptance tests shall be witnessed by the Purchaser / his authorized representative, Also all components & tools should have been type tested as per relevant IEC/IS. All the Type Tests as per latest IS / IEC should have been carried on the switchgear. For Type test of Numerical relays, control IEDs, and communication equipment, and Factory acceptance test, Hardware Integration test and Integration System tests, kindly refer Clause No- 19, 25, 26, 27 and 28 of Automation Philosophy for new grids based on IEC-61850 protocol', Document no- W03-Aut- Gen- 61650-01. For type tests of meters, relevant IS has to be followed. Following tests shall be carried out on the switchgear in addition to any other specified in the IS/IEC:

Routine Test:

Dielectric Test on main and control circuits.

Dimensional and visual checks

Mechanical Operation tests:

Tests of auxiliary electrical devices

Verification of correct wiring

Measurement of resistance of main circuit

Partial Discharge Measurement

Tests after erection on site.

Type Tests

a) Tests to verify the Insulation level of the equipment including tests at power frequency test voltages on auxiliary circuits: (Dielectric Tests)
b) Tests to prove the temperature rise of any part of the equipment and measurement of resistance of the main circuit.
c) Tests to prove the capability of the main and earthing circuits to be subjected to the rated peak and the rated short-time withstand currents.
d) Tests to prove the making and breaking capacity of the included switching devices.
e) Tests to prove the satisfactory operation of the included switching devices and removable parts. (Mechanical Operation tests)
f) Tests to verify the protection of persons against approach to live parts and contact with moving parts.
g) Tests to verify the protection of persons against dangerous electrical effects.
h) Electromagnetic Compatibility- Emission and Immunity tests (for secondary system)

Special Type Test

a) Tests to verify protection of the equipment against external effects due to weather.
b) Tests to verify the protection of the equipment against mechanical damage.
c) Tests to assess the effects of arcing due to an internal fault. It shall withstand fault current of 25 kA for 1 sec.
d) Tests to detect certain defects in the solid Insulation of the equipment by the measurement of partial discharges.
e) However, in case any type test is not carried out/ carried out at In-house laboratories, the same shall be decided for acceptance as per the mutual agreement between the Purchaser and Bidder

8. TYPE TESTS CERTIFICATES

The bidder shall furnish the type test certificates for the tests as mentioned above as per the corresponding standards. All the tests shall be conducted at CPRI/ ERDA/International Labs as per the relevant standards. Type test should have been conducted in certified Test Laboratories during the period not exceeding 5years 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 TPCODL.

9. PRE-DISPATCH INSPECTION

Equipment shall be subject to inspection by a duly authorized representative of the purchaser. Inspection may be made at any stage of manufacture at the option of the purchaser and the equipment it found unsatisfactory as to workmanship or material is liable to rejection. Supplier shall grant free access to the places of manufacture to Purchaser's representatives at all times when the 'work is in progress. Inspection by the Purchaser or its authorized representatives shall not relieve the supplier of his obligation. of furnishing equipment in accordance with the specifications. Material shall be dispatched after specific MDCC (Material Dispatch Clearance Certificate) is issued by Purchaser.

Following documents shall be sent along with material

i. Test reports
ii. MDCC issued by Purchaser
iii. Invoice in duplicate
iv. Packing list
v. Drawings & catalogue
vi. Guarantee / Warrantee card
vii. Delivery Challan
viii. Other Documents was applicable)

10 INSPECTION AFTER RECEIPT AT STORE

The material received at Purchaser store will 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.

11 GUARANTEE

Supplier 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 Company 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 later, supplier 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 Company, falling which the Company will be at liberty to get it replaced/rectified at supplier's risks and costs and recover all such expenses plus the Company's own charges(20% of expenses incurred), from the supplier or from the "Security cum Performance Deposit‘ as the case may be.

Supplier 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.

Also refer ENG-ELC-033 & ENG-ELC-028 (protection & automation specifications of TPCODL for new grids based on IEC-61850 protocol

12 PACKING

Supplier shall ensure that all equipment covered under this specification shall be prepared for rail/road transport (local equipment) and be packed in such a manner as to protect it from damage in transit

13 TENDER SAMPLE

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. .

The Purchaser's/ Consultant's engineer shall have free access to the manufacturer's/sub-supplier's works to carry out inspections.

15. MINIMUM TESTING FACILITIES

Supplier / Manufacture shall have adequate in house testing facilities for carrying out all routine tests & acceptance tests as per relevant International / Indian standards.

16. MANUFACTURING ACTIVITIES

The successful bidder will have to submit the bar chart for various manufacturing activities clearly elaborating each stage, with quantity. This bar chart should be in line with the Quality assurance plan submitted with the offer. This bar chart will have to be submitted within 15 days from the release of the order.

17. SPARES, ACCESSORIES AND TOOLS

17.1 SPARES:

Bidder should quote unit rates for following mandatory spares along with the bid. However, the exact quantity of these shall be as per the BO attached with the tender.

Description

a) Trip Coil
b) Closing coil
c) Spring charging motor
d) Vacuum interrupter
e) T-N-C Switch
f) Local / remote selector switch

g) Tulip/ Finger contact

h) Indication lamps

i) Auxiliary switches

j) LED for cable charge indication

In addition to above bidder shall submit recommended list of spares for 3 years of operation, if any with unit prices and recommended quantity.

For other requirements of Training, Support, Services, Maintenance and Spares, bidder shall refer ENG-ELC-033 & ENG-ELC-028 (protection & automation specifications of TPCODL for new grids based on IEC-61850 protocol

17.2 SPECIAL TOOLS & GAUGES:

A list of complete set of special tools and gauges required for erection & maintenance and installation procedure should be submitted.

The Bidder shall give an assurance that special maintenance tools & tackles and spares will continue to be available through the life of the equipment, which shall be 25 years minimum. However, the supplier shall give a minimum of 12 months notice in the event of plan to discontinue manufacture of any component used in this equipment.

Any special maintenance tools & tackles 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 plant and must be suitably marked and numbered for identification. Spanners and other maintenance equipment provided under this contract shall not be used for the purpose of erection

18 DRAWINGS:

Following drawings & Documents shall be prepared based on Purchaser's specifications and statutory requirements and shall be submitted with the bid:

a) Completely filled-in Technical Parameters.

b) General description of the equipment and all components including brochures

c) General arrangement drawings

d) Single Line Diagram

e) Bill of material

f) Type Test Certificates

g) Experience List

h) Foundation fixing drawings.

Drawings/documents to be submitted after the award of the contract:

Sl No	Description	For Approval	For Review Information	Final Submission
1	Technical Parameters	✓		✓
2	General Arrangement drawings	✓		✓
3	Single Line including Instrument Transformers Diagram	✓		✓
4	Typical Mimic diagram	✓		✓
5	Schematic / inter logic diagrams	✓		✓
6	Bill of Material and description of system components	✓		✓
7	Foundation Plan & loading details	✓		✓
8	Technical Brochures/Manual/Catalogues/drawings for DC,BCU meters, relays, switches, lamps etc.	✓	✓	✓
9	Control and Operational Philosophy of Automation		✓	✓
10	Input / Output List		✓	✓
11	Cable Schedule, Wiring Interface diagrams & interconnection diagram		✓	✓
12	Programming language manual		✓	✓
13	Details of the Communication protocol & interoperability list for the future interfacing,		✓	✓
14	Equipment wide detailed circuit diagram		✓	✓
15	Electronic earthing scheme		✓	✓
16	Configuration diagram with functional write up		✓	✓
17	I/O mapping		✓	✓
17a	Building requirement and earth math design	✓	✓	✓
18	3 nos. of working drawings		✓	✓
19	6 No of as built drawing		✓	✓
20	Relay Coordination Scheme		✓	✓
21	Installation/Commissioning Manual		✓	✓
22	Instruction for use		✓	✓
23	Transport/Shipping dimension drawing		✓	✓
24	QA/QC Plan	✓	✓	✓
25	Routine, Acceptance and Type Test Certificate	✓	✓	✓

The bidder shall further refer ENG-ELC-033 & ENG-ELC-028 (protection & automation specifications of TPCODL for new grids based on IEC-61850 protocol) for providing documents after award of contract.

All the documents & drawings shall be in English language.

Instruction Manuals: Bidder shall furnish two softcopies and four (4) hard copies 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. GUARANTEED TECHNICAL PARTICULARS

S.No	Description	To be Furnished by Bidder
19.I	SWITCHGEAR PANEL	
19.1.1	Architecture	
19.1. 2	No. of Phases	
19.1.3	Rated Capacity	
19.1.4	Rated Voltage	
19.1.5	Service Voltage	
19.1.6	Rated Frequency.	
19.1.7	Rated impulse withstand voltage	
19.1.8	Rated Power Frequency Withstand Voltage	
19.1.9	Rated short time withstand current	
19.1.10	Peak withstand current rating	
19.1.11	Bus bar continuous rated current	
19.1.12	Bus bar material	
19.1.13	Internal Arc Protection	
19.1.14	Degree of protection for enclosure / partitions/ for meters, relays and BCU	
19.1.15	Normal service condition	
19.1.16	Temperature Rise	
19.1.17	Dimension of Switchboard (Max : W:800mm/D:1850mm	
19.1.18	Internal Arc Protection	
19.1.19	IP Rating (Enclosure/Partition/Meters and Relay)	

Item/Panel reference			Incomer	Bus-coupler
19.3	Circuit Breaker Type/Rating(A)			
19.4	Copper Busbar Rating (A)			
19.5	Detals of XLPE cables			
19.6.1	CTs (Cast Resin type)	Quantity		
		Thermal Withstand Capacity		
		Ratio		
		Core-1 (metering)		
		Core2 (protection)		
		Core 3 (PS Class)		
19.7	CB control switch, ON/OFF push buttons Indication lamps, Auto trip, L/R switch, TNC switch, Heater, Trip Coils, Closing coils, Operation counter & spring charged mechanism etc.			
19.8	Bay Control & Protection Unit .(BCPU)CB Control function and. Measurement of Three phase currents & voltages, PF, Active, Reactive (Import & export Lag & Lead) & Apparent energy and power, Frequency etc .			
19.9	Analog Voltmeter			
19.10.	Protection relays (TCS Pre Close /Post Close Supervision)	Numerical communicable relay with over current, earth fault, sensitive earth fault, breaker failure, negative		

		sequence current and overload		
		DC fail back-up with additional trip coils in CB		
		Anti-pumping relay		
		Electrically reset type high' speed relay for tripping. (The trip relay Shall be supervised).		
19.11	Trip Alarm scheme with Hooter, Accept/Reset PB			
19.12	Cable charged indication			
19.13	Panel illumination in Relay compartment			
19.14	Circuit Name-Plate			
Bus PT Panel				
19.15	Bus PT	Quantity		
		Primary windings		
		Secondary winding(s)		
		Core-1		
		Core-2		
Item / Panel reference			**Outgoing Feeder**	**Capacitor Bank**
19.16	Ckt. Breaker Type/Rating(A)			
19.17	Copper Bus bar - Rating(A)			
19.18	Details of XLPE cables			
19.19	CTs (Cast Resin type)	Quantity		
		Thermal withstand		

		capacity		
		Ratio		
		Burden/Class		
		Core-1		
		Core-2		
19.2	LV components - CB control switch, ON/OFF push buttons Indication lamps, Auto trip, L/R switch, TNC switch, Heater, Trip Coils, Closing coils, Operation counter & spring charged mechanism etc			
19.21	Bay Control & Protection Unit (BCPU) CB control and protection function & Measurement of Three phase currents & voltages, PF, Active, reactive (Import & export Lag & Lead) & Apparent energy and power, Frequency etc			
19.22	Analog Ammeter			
19.23	Protection relays	Numerical communicable relay with over- current, earth fault,sensitive earth fault, breaker failure, negative sequence & overload		
		Anti-pumping		
		Electrically reset type: high- speed relay for tripping.		
		(The trip relay shall be supervised).		
19 24	Cable charged indication			
19.25	Panel illumination in Relay Compartment			

19.26	Circuit Name-Plate	
19.27	**OTHERS**	
a)	Cable charge indication for all panels	
b)	Cable side earthing arrangement	
c)	Busbar side earthing arrangement	
e)	Auxiliary Voltages for charging motor, relays & heaters -50 & 220 V DC	
f)	TNC Switch	
g)	Local / Remote switch	
h)	Indication Lamps CB ON/OFF	
i)	Indication Lamps CB Auto Trip	
i)	Indication Lamps for CB Test / Service positions	
k)	Spring charged indication	
I)	Trip ckt. supervision scheme	
m)	MCB for AC	
n)	MCB for DC	
o)	MCB for space heater	
p	MCB for VT's	
q)	Trip alarm scheme with hooter, Accept/Reset PB etc	
r)	Panel anti-condensation heater with thermostat.	
s)	Panel illumination lamp with switch	
t)	5 A, 3 pin socket.	
u)	Makes of indicating lamps	
v)	Makes of MCB	
w)	Wiring of breaker auxiliary contacts up to terminals	
x)	Makes for Fuses I Fuse bases	
y)	CB handling trolley	

20. SCHEDULE OF 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:

S. 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-HV-2016

Specification Name : Technical Specification For Heat Shrinkable Straight through Joint & Termination for 11KV Power Cable

BARSHA BANDITA	MILAN MAITY	K GOVINDARAJ	Syed Mohammed Yousuf Raja	KHAJAN BHARDWAJ	POURUSH GARG
Prepared by	Reviewed by	Reviewed by	Reviewed by	Approved by	Released by
TPCODL	TPNODL	TPWODL	TPSODL	TPCODL	TPCODL
10-01-2023	10-01-2023	11-01-2023	12-01-2023	12-01-2023	12-01-2023

TPCODL TPNODL TPWODL TPSODL	**Specification No:** ENG-HV-2016 **Specification Name:** Technical Specification For Heat Shrinkable Straight through Joint & Termination for 11kV Power Cable

CONTENTS

1. SCOPE:

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 11 kV Heat Shrink Cable Straight through Joints and Terminations with all accessories and necessary training for trouble free & efficient performance.

2. APPLICABLE STANDARDS:

The equipment covered by this specification shall unless otherwise stated, be designed, manufactured and tested in accordance with latest revisions of relevant Indian Standards/ IEC and shall conform to the regulations of local statutory authorities.

SL. No.	IEC/IS	Description
1	IS-13573(part2): 2011	Test requirements - Cable accessories for extruded power cables (for working voltages 3.3 kV and up to including 33 kV)
2	IS 7098(part2):2011	Cross-linked polyethylene insulated thermoplastic sheathed cables (for working voltages from 3.3 kV up to and including 33 kV)
3	IS 692 : 1994	Paper insulated lead sheathed cables for rated voltages up to and including 33 kV
4	IEC 60502 : 2009	Power cables with extruded insulation and their accessories for rated voltages from 1 kV up to 30 kV
5	ASTM D-2303	Standard Test Methods for Liquid Contaminant, Inclined-plane tracking and Erosion of insulating materials
6	ASTM D-2671	Standard Test Methods for Heat Shrinkable Tubing
7	ENA TS 09-13:1981	High Voltage Heat Shrinkable Components for use with HV solid type cables up to and including 33 kV
8	IEC 61238(part1) : 2003	Test methods and requirements - Compression and mechanical connectors for power cables for rated voltages up to 30 kV
9	IS 8308 : 2003	Compression type tubular in-line connectors for Aluminium conductors of insulated cables
10	IS 8309 : 2003	Compression type tubular terminal ends for Aluminium conductors of insulated cables
11	IS 2633:1986	Method for testing of uniformity of zinc coating
12	IS 4826 : 1979	Hot dipped galvanized coatings on round steel wires
13	IS 12444:1988	Continuously Cast and Rolled Electrolytic Copper Wire Rods for electrical conductors

SL. No.	IEC/IS	Description
14	IS 191	Copper
15	IS 10810	Methods of test for cables
16	IEC 60216 part 2	Determination of thermal endurance properties of electrical insulating materials
17	IEC 60216 part 8	Instructions for calculating thermal endurance characteristics using simplified procedures

3. CLIMATIC CONDITIONS:

SL.NO.	CONDTIONS	VALUES
1	Max. altitude above sea level	1200m
2	Max. Ambient Temperature	50 °C
3	Max. Daily average ambient temp	35 °C
4	Min Ambient Temp	0 °C
5	Maximum temperature attainable by an object exposed tosun	60 °C
6	Maximum Humidity	95%
7	Minimum Humidity	10%
8	Average No. of thunderstorm days per annum	70
9	Average Annual Rainfall	150 cm
10	Average No. of rainy days per annum	120
11	Thermal Resistivity of soil	150 Deg. Ccm/W
12	Wind Pressure	126 kg/sq. m up to an elevation of 10 meter.
14	Earthquakes of intensity in horizontal direction	equivalent to seismic acceleration of 0.3g
15	Earthquakes of intensity in vertical direction	equivalent to seismic acceleration of 0.15g
16	Wind velocity	300 km/hr.

Environmentally, some of the regions, where the work will take place include coastal areas, subject to high relative humidity, which can give rise to condensation. Onshore winds will frequently be salt laden. On occasions, the combination of salt and condensation may create pollution conditions for outdoor insulators. Some places are in heavily industrial polluted areas. Therefore, Outdoor material

and equipment shall be designed and protected for use in exposed, heavily polluted, salty, corrosive and humid coastal atmosphere.

The atmosphere is generally laden with mild acid and dust in suspension during the dry months and is subjected to fog in cold months. The design of equipment and accessories shall be suitable to withstand seismic forces corresponding to an acceleration of 0.1 g.

4. GENERAL TECHNICAL REQUIREMENTS:

4.1 TYPES OF CABLES

A. 11 kV XLPE Insulated Underground Cables as per IS 7098 – 2: 11 kV ('E)

a) A2XCWY- (Aluminium stranded compacted conductor, XLPE insulation, copper tape screen, wire GI armour, PVC sheath)

b) A2XCWaY -(Aluminium conductor, XLPE insulation, copper tape screen, Aluminium wire armour, PVC sheath)

i) 3CX70 sq.mm. A2XCWY/A2XFY
ii) 3CX95 sq.mm. A2XCWY/A2XFY
iii) 3CX120 sq.mm. A2XCWY/A2XFY
iv) 3CX150 sq.mm. A2XCWY/A2XFY
v) 3CX185 sq.mm. A2XCWY/A2XFY
vi) 3CX240 sq.mm. A2XCWY/A2XFY
vii) 3CX300 sq.mm. A2XCWY/A2XFY
viii) 3CX400 sq.mm. A2XCWY/A2XFY
ix) 1CX400 sq.mm A2XCWaY
x) 1CX300 sq.mm A2XCWaY
xi) 1CX630 sq.mm. A2XCWaY
xii) 1CX1000 sq.mm. A2XCWaY
xiii) HT AB- 55/95/120/150 sq.mm. – Straight Through Jointing/ Outdoor Jointing

B. HT Aerial Bunched Cables with Aluminium alloy catenary : 11 kV (E)

a) A2XCY- (Aluminium stranded compacted conductor, XLPE insulation, copper tape screen, PVC sheath)

b) A2XC2Y- (Aluminium stranded compacted conductor, XLPE insulation, copper tape screen, HDPE sheath)

c) A2XWaY- (Aluminium stranded compacted conductor, XLPE insulation, Aluminium wire screen, PVC sheath)

i) 3CX95 sq.mm. A2XCY/ A2XC2Y/ A2XWaY

ii) 3CX150 sq.mm. A2XCY/ A2XC2Y/ A2XWaY

iii) 1CX55 sq.mm. A2XCY/ A2XC2Y/ A2XWaY

iv) 1CX95 sq.mm. A2XCY/ A2XC2Y/ A2XWaY

v) 1CX150 sq.mm. A2XCY/ A2XC2Y/ A2XWaY

C. PILCA Insulated Cables as per IS 692: 11 kV, (E) Belted APLST

(Al stranded sector shaped, paper insulated, lead sheath, steel tape sheath).

i) 3CX150 sq.mm. Belted APLST

ii) 3CX240 sq.mm. Belted APLST

iii) 3CX300 sq.mm. Belted APLST

4.2 According to standard sizes of cables, following types of cable joints and terminations shall be required:

Type & size of cable	Type of Joint	Type of connector
3CX70, 3CX95, 3CX120, 3CX150, 3CX185, 3CX240, sq.mm. XLPE insulated cable	Indoor termination	Compression lug
	Outdoor termination	Compression lug
	Straight through joint	Compression lug
3CX95, 3CX120, 3CX185 sq.mm. XLPE insulated cable	Indoor termination RMU	Mechanical connector
3CX300, 3CX400 sq.mm. XLPE insulated cable	Indoor termination	Mechanical connector
	Outdoor termination	Compression lug
	Straight through joint	Mechanical connector
1CX300, 1CX400, 1CX630, 1CX1000 sq.mm. XLPE insulated cable	Indoor termination	Mechanical connector
	Outdoor termination	Mechanical connector
	Straight through joint	Mechanical connector
1CX55, 1CX95, 1CX150 sq.mm. HT AB insulated cable	Outdoor termination joint	Compression lug
	Straight through joint	Compression lug
3CX185 – 400 sq.mm. XLPE	Straight through joints between XLPE insulated cables	Mechanical connector

4.3 General requirement for Heat Shrinkable Jointing and Termination kit:

a) The jointing kit containing heat shrinkable tubing, mastics and other accessories for making a complete joint and termination shall be designed to meet TPCODL/TPWODL/TPNODL/TPSODL specification, ENA TS 09-13, IEC 60502 and IS 13573, part-2 and other relevant standards.

b) Cable joint and termination material shall not be adversely affected in any manner even after contact with material used in cable construction and material used as accessories in the construction of cable joints and terminations and there will be no chance of corrosion developing on any metal surface.

c) Assembled jointing kit components shall perform without distress in system with parameters (mentioned below):

S. No.	Parameter	Units	Requirement
1	Max. Withstand System Voltage	kV	12
2	Partial Discharge at 1.73 Uo	pC	<10
3	Impulse Peak Withstand	kV	75 kV
4	Continuous operation withstand Temperature	ºC	90
	Short Circuit withstand temperature	ºC	250
5	Withstand short circuit current	kA/1Sec	As per Size of Conductors
6	Storage Temperature Range	ºC	-10ºC to + 45ºC
7	Shelf life of kit components excluding mastic and solution	Years	Min. 5
8	Shelf life of mastic and solution	Years	Min. 2

4.4 General Technical Particulars for Heat Shrinkable Insulation Tubing/ Sleeves/ Wrap around Sleeve:

SL. No.	Parameter	Requirement
1	Visual Examination	Free from protrusions, pinholes, cracks, nicks and other visible defects.
2	Wall thickness Ratio	0.6 or 60% (Minimum at any two points of measurements)
3	Internal diameter of tube after full recovery	Shall not be higher than as specified in approved BOM / GTP
4	Longitudinal change	10% Max.

SL. No.	Parameter	Requirement
5	Electric Strength	10 KV /mm (Minimum)
6	Tensile Strength	10 N/mm2 (Minimum) and (8 N/mm2 for anti-tracking)
7	Ultimate Elongation	200% (Minimum)
8	Heat Shock	No splitting, cracking, dripping or flowing after 30 minutes at 200ºC Min. (For stress control tube: 30 Minutes at 250ºC Min.)
9	Low Temperature Flexibility	No cracking after 4 hrs. at minus -20ºC Max.
10	Volume Resistivity	1x 1010 Ohm- meter (Minimum) (For stress control, tube VR: 1x 10 7 Ohm-meter min.)
11	Tracking resistance	No tracking, erosion to top surface or flame failure after 1hr @ 2.5KV 1hr @2.7KV 1Hr@ 3.0 KV 20 min@ 3.25KV
12	Flame Retardant (Applicable only for Anti tracking Tubes/ sleeves)	After 1-minute burn: Burnt or charred length 250 mm max.

4.5 General Technical Particulars for Heat Shrinkable moulded components/ Breakouts/Weather sheds

Sl. No.	Parameter	Specified limit
1	Visual Examination	Free from protrusions, pinholes, cracks, nicks and other visible defects.
2	Wall thickness Ratio	0.6 or 60% (Minimum at any two points of measurements)
3	Internal diameter of tube after full recovery	Shall not be higher than as specified in approved BOM / GTP.
4	Longitudinal change	25% Max.
5	Dielectric Strength	10 KV /mm (Minimum)
6	Tensile Strength	8 N/mm^2 (Minimum)
7	Ultimate Elongation	200% (Minimum)
8	Heat Shock	No splitting, cracking, dripping or flowing after 30 minutes at 250ºC Min.

Sl. No.	Parameter	Specified limit
9	Low Temperature Flexibility	No cracking after 4 hrs. @ minus -20ºC Max.
10	Volume Resistivity	1x 10^{10} Ohm- meter (Minimum)
11	Flame Retardant (For anti-tracking moulded components)	After 1-minute burn: Burnt or charred length 250mm max.

4.6 Service Support:

Bidder shall have own setup in Odisha for jointing and termination services along with supervision and other necessary allied services for ensuring quality of installed jointing and terminations.

5. GENERAL CONSTRUCTION:

5.1 Components of Indoor/ Outdoor Termination Kit:

Termination kit shall be designed based on heat shrink technology and shall be suitable for installation for 11 kV, three core and single core aluminum conductor, XLPE insulated (in line with TPCODL/TPWODL/TPNODL/TPSODL Specification for underground and AB cable, IS 7098-part 2, and IS 13573 Part 2 &3).

Length of 11KV terminations (from bottom of breakout to center of lughole) shall be:

i) HT ABC - 450mm

ii) 1core cable I/D & O/D - 550 mm

iii) 3 core cable I/D & O/D - 800 mm

iv) 3 core cable I/D RMU - 950 mm

S. No.	Components	Requirement
1	Compression Lugs/ Tinned coated Mechanical Lugs	**Compression Lugs:** a) Material: Aluminium b) All Aluminum lugs with anti-corrosive paste shall be long barrel type as per IS 8309: 2003. c) Dimensions shall be as annexure-I of this specification. d) 1000mm² Aluminum lugs shall be without palm hole. e) Conductivity of ferrule shall be as per IS 8309:2003. **Mechanical Lugs:** a) Tinned coated Aluminium 185-400 mm^2/ 630mm^2/1000mm^2 b) Type Test as per IEC 61238(part1):2003 c) Dimensions shall be as annexure-I of this specification.

<table>
<tr><th>S. No.</th><th>Components</th><th>Requirement</th></tr>
<tr><td></td><td></td><td>d) Approved make NILLED, PFISTERER, NEXANS, TYCO (GERMANY).
e) Dimensions shall be as annexure-I of this specification.</td></tr>
<tr><td>2</td><td>Lug Seal, Anti-tracking tube, weather sheds, Stress control tube</td><td>a) Heat Shrinkable
b) Fire resistant and weather resistant as per ENA TS 09-13 – for lug seals, weather sheds and Anti-tracking tubes
<table>
<tr><th>Sl. no</th><th>Size</th><th>Tube type</th><th>Qty</th><th>Size (min in mm)</th><th>OD (Before/After shrinking) mm</th></tr>
<tr><td>1</td><td>3C 300/400 sqmm I/D & O/D</td><td>Stress control tube</td><td>3</td><td>130</td><td>50/25</td></tr>
<tr><td>2</td><td>3C 300/400 sqmm O/D</td><td>Anti tracking tube</td><td>3</td><td>60</td><td>55/20</td></tr>
<tr><td>3</td><td>1C 630 sqmm O/D & ID</td><td>Stress control tube</td><td>1</td><td>130</td><td>65/30</td></tr>
<tr><td>4</td><td>1C 630 sqmm O/D & ID</td><td>Anti tracking tube</td><td>1</td><td>400</td><td>70/30</td></tr>
<tr><td>5</td><td>1C 630 sqmm O/D & ID</td><td>Insulating tube</td><td>3</td><td>300</td><td>35/12</td></tr>
</table>
For lower sizes length & OD of tubes should be adjusted suitably. BOM approval is mandatory before supply.</td></tr>
<tr><td>3</td><td>Mastic tape</td><td>a) Mastic tape shall be electrically insulating, non-tracking and water/humidity resistant.
b) Volume resistivity of mastic shall not be less than volume resistivity of insulating tube as specified in ENA TS 09-13.
c) Stress grading mastic should be provided for both connector portion and semicon portion.
d) Water resistant sealing mastic shall also be provided.for end sealing in straight through kit and lug sealing in termination kit.</td></tr>
<tr><td>4</td><td>Heat Shrink Breakout & Lug seal</td><td>a) Fire resistant and weather resistant as per ENA TS 09-13.
b) Adhesive coated Breakouts shall be provided on outer sheath of the cable to prevent water ingress.
c) Anti tracking lug seal with adhesive coated, flame retardant.</td></tr>
</table>

S. No.	Components	Requirement
5	Tinned coated copper braid	a) Shall be completely insulated by adhesive coated fire retardant and weather resistant HS tube/sleeve up to copper lug. b) Fire resistant and weather resistant as per ENA TS 09-13. c) Size and length is as follows: d) 25 mm² x 500 mm x 1 Run for 3C 70, 95, 120 &150 mm² cables. e) 50 mm² X 600 mm X 1 Run for above 150 mm² & up to 400 mm² cables. f) 70 mm² X 500 mm X 1 Run for 630 mm² & 1000mm² cables. Additionally 3 nos. X 150mm² Al lugs with sealing sleeves/ mastic for armor back fold earth bonding. For Copper screened HT ABC, continuity of armor shall be through 25 sq.mm. X 500mm insulated tinned copper braid. Additionally 1 no. 95 mm² Al long barrel lugs with sealing sleeves/ mastic shall be provided for armor back fold earth bonding in Aluminum armored 150 mm² HT ABC.
6	Tinned coated copper braid as a Leakage Current Collector	a) Leakage current collector tinned copper braid b) 1R X 7 mm² X 150 mm per core shall be provided for terminations.
7	Tinned copper wire mesh	a) Minimum 2.5mm² tinned copper mesh shall be provided on armour circumference beneath the copper braid. b) For 3 core cable 1R X 0.5mtr c) For 1 core cable 1R X 0.7mtr
8	Sub-kit components	a) GI Solid Collet dia of dia as per cable OD (1no only in 3C cables), b) Worm drive clip/ Jubilee clip of stainless steel (2 nos), c) Compatible support rings (Aluminium for single core and GI for three core cables) d) Soldering on copper screen is not acceptable e) Constant pressure roll spring shall be provided for screen connections as per compatible size. For 3 core- 3nos, for 1C - 1nos. f) Plumb earthing on PILCA side is unacceptable. Constant pressure roll spring should be used for same g) Tinned copper binding wire 20 SWG, qty 50gms h) Nylon string OD 1mm, 2mtr i) Silicone grease, 30 gms j) Cleaning liquid k) Vinyl tape l) Al oxide cloth m) Other necessary items

S. No.	Components	Requirement
9	Submission of BOM and instruction sheet	a) Participating bidder shall submit BOM (during pre-bid) with dimensions of each size and quantity of HS joint and termination. Also instruction sheet shall be provided in each kit. *Note: BOM shall be approved by TPCODL/TPWODL/ TPNODL/TPSODL authorized official at the time of pre-bid.

5.2 Components of Straight Through jointing kit:

<table>
<tr><th>S. No.</th><th>Components</th><th>Requirement</th></tr>
<tr><td>1</td><td>Heat Shrinkable insulating tube/ Sleeve</td><td>a) Surface of material: shall be smooth and free from protrusion, voids and nicks.
b) Recovered thickness: Recovered thickness of insulation tubes over ferrule or connector circumference shall not be less than 4.32 mm at any point of measurement.
c) Wall thickness ratio (before recovery) of all sleeves/ tubes shall not be less than 60% at any two points of measurement.
<table>
<tr><th>Sl no</th><th>Size</th><th>Tube type</th><th>Qty</th><th>Size (min in mm)</th><th>OD (Before/After shrinking) mm</th></tr>
<tr><td>1</td><td>3C 300/400 sqmm</td><td>Stress control tube</td><td>3</td><td>470</td><td>45/20</td></tr>
<tr><td>2</td><td>3C 300/400 sqmm</td><td>Red Insulating tube</td><td>3</td><td>460</td><td>55/20</td></tr>
<tr><td>3</td><td>3C 300/400 sqmm</td><td>Dual wall tube</td><td>3</td><td>450</td><td>65/21</td></tr>
<tr><td>4</td><td>1C 630 sqmm</td><td>Stress control tube</td><td>1</td><td>500</td><td>65/30</td></tr>
<tr><td>5</td><td>1C 630 sqmm</td><td>Red Insulating tube</td><td>1</td><td>490</td><td>70/30</td></tr>
<tr><td>6</td><td>1C 630 sqmm</td><td>Dual wall tube</td><td>1</td><td>480</td><td>85/30</td></tr>
</table>
d) For lower sizes length & OD of tubes should be adjusted suitably. BOM approval is mandatary before supply.</td></tr>
</table>

S. No.	Components	Requirement
2	Compression lugs/ Mechanical Connectors	a) Material : 99% Electrolytic grade Aluminium with Anti-corrosive paste b) Shape: As per IS 8308 c) Dimensions as per Annexure-I of this Specification d) Conductivity of ferrules/mechanical connectors shall be as per IS 8309: 2003. e) Conductivity of Aluminium shall be min. 60% of IACS. **Mechanical Lugs:** a) Tinned coated Aluminium 185-400 mm^2/ 630mm^2/1000mm^2 b) Type Tested as per IEC 61238(part1):2003 c) Dimensions shall be as annexure-I of this specification. d) Approved make NILLED, PFISTERER, NEXANS, TYCO (GERMANY). Dimensions shall be as annexure-I of this specification.
3	Mastic Tape	a) Mastic tape shall be electrically insulating, non-tracking and water/humidity resistant. b) Volume resistivity of mastic shall not be less than volume resisti of insulating tube as specified in ENA TS 09-13. c) Stress grading mastic should be provided for both connec portion and semicon portion. d) Water resistant sealing mastic shall also be provided.for end sealing in straight through kit and lug sealing in termination kit.
4	Tinned coated copper braid for GI armour continuity / Ferrules for Aluminium armour continuity	a) Shall be completely insulated with adhesive coated fire retardant and weather resistant HS tube/sleeve up to copper lug at one end. b) Fire resistant and weather resistant as per ENA TS 09-13 c) Size and length as per below: d) Wrap tinned copper wire mesh with 50% overlap around the joint area and continue 25 mm over the copper screen on both sides. Bind the copper wire mesh on copper screen. e) Uniformly tinned coated copper braid shall be provided for armor continuity f) Size of tinned copper braid shall be: 50 mm^2 x 1 Run for 150-400 sq.mm. three core cables. 25 mm^2 x 1 Run for below 150 sq.mm. three core cables. Ferrules for Aluminum armor continuity: a) In single core cables, 1CX400,1CX630 and 1CX1000 sq.mm., Aluminum armor continuity shall be done using 2 nos. long barrel type of size 150 sq.mm. and 185 sq.mm. ferrules respectively. Additionally 70 mm^2 x 1 Run tinned copper braid to be provided.

S. No.	Components	Requirement
		b) For Copper screened HT ABC, continuity of armor shall be through 2.5 sq.mm. copper wire mesh.
5	Tinned copper wire mesh	a) Uniformly tinned coated copper mesh shall be provided for screen continuity shall be provided on both sides of armor circumference beneath the copper braid. b) For 3C cable: 2.5mm² (2'' X 6mtr) c) For 1C cable: 2.5mm² (2" X 7mtr), (2" X10mtr) & (2"X12mtr)
6	GI wire mesh/ Copper wire mesh	a) Mechanical protection shall be provided in GI armored cables by means of heavily zinc coated GI mesh as per IS 4826. b) Minimum 3" X 15mtr GI wire mesh for 3C cable c) In 1C Aluminium armored cables, for mechanical protection, copper wire mesh shall be provided as mentioned in SL. No 5.
7	Breakouts	a) Adhesive coated Breakouts shall be provided on outer sheath at both sides on the cable to prevent water ingress.
8	Nesting & end sealing tube	a) Hot melted adhesive coated bested end sealing tube for protection of moisture ingress in cores. b) Length 200mm minimum c) 6 nos for 3C, 2 nos for 1C
9	Wrap around insulating tube/Sleeve as outer most tube	a) Material: cross-linked polyolefin (Heat Shrinkable) as a waterproof seal. b) Shape: Wrap around form with hot-melt adhesive liner on the inner surface of the sleeve (Upon heating, the sleeve shrinks and the adhesive melts, creating a water-tight bond between the sleeve and the cable). c) Stainless steel channel shall be provided along the wrap around to close the sleeve during installation. d) Excellent mechanical and corrosion protection, and atmospheric sealing. e) High split resistance. f) *Note: Overlapping of wrap around sleeve is not acceptable. Length of one sleeve: Minimum 1000mm, Qty. 2nos Insulating sleeve of 500 mm should be provided to cover mid joints Portion
10	Sub-kit Components	a) GI Solid Collet dia of dia as per cable OD (2nos only in 3C cables), b) Worm drive clip/ Jubilee clip of stainless steel (3 core- 6nos, 1C 2nos), c) Compatible support rings (Aluminium for single core and GI for three core cables) d) Soldering on copper screen is not acceptable e) Constant pressure roll spring (size 4) shall be provided for screen connections. For 3 core- 6nos, for 1C -2nos

S. No.	Components	Requirement
		f) Plumb earthing on PILCA side is unacceptable. Constant pressure roll spring should be used for same g) Tinned copper binding wire 20 SWG, qty 50gms h) Nylon string OD 1mm, 2mtr i) Silicone grease, 30 gms j) Cleaning liquid k) Vinyl tape l) Al oxide cloth m) Other necessary items
11	Submission of BOM and instruction sheet	a) Participating bidder shall submit BOM (during pre-bid) with dimensions of each size and quantity of HS joint and termination. Also instruction sheet shall be provided in each kit. b) *Note: BOM shall be approved by TPCODL/TPWODL/TPNODL/TPSODL authorized official at the time of pre-bid.

6. MARKING:

Following details shall be printed in the box:

a) Manufacture's name and address.
b) Month & Year of Manufacturing
c) Voltage Grade
d) PO No.
e) "TPCODL/ TPWODL/ TPNODL/ TPSODL" Name

HS Sleeves/tubes and breakout components shall be embossed with:

a. Manufacture's name and address.
b. Month & Year of Manufacturing
c. Batch No. / Lot No.
d. Shrink Ratio
e. Size
f. Type
g. "TPCODL/ TPWODL/ TPNODL/ TPSODL" Name

7. TESTS:

All Routine, Acceptance & Type tests shall be carried out in accordance with the Relevant IS/IEC/ ENA TS 09-13. All the components shall also be type tested as per the relevant

standards mentioned below. Following tests shall be necessarily conducted on the Joint and Termination Kits In addition to others specified in IS/IEC/ENA-TS 09-13 standards:

7.1 ACCEPTANCE TESTS:

Test	Clause No.	Reference Standard
Visual inspection	3.15	ENA -TS 09-13
Physical verification of kit contents and dimensions	As per TPCODL/TPWODL/TPNODL/TPSODL approved BOM	
Electric Strength test	3.4	ENA -TS 09-13
Ultimate Elongation tests	3.12	ENA -TS 09-13
Tensile Strength	3.12	ENA -TS 09-13
Volume Resistivity	3.16	ENA -TS 09-13
Wall thickness ratio	3.3	ENA -TS 09-13
Expanded and recovered diameters	3.3	ENA -TS 09-13
Longitudinal change after recovery	3.3	ENA -TS 09-13
Heat shock test	3.7.1/3.7.2	ENA -TS 09-13
Low temperature flexibility	4.5	ENA -TS 09-13
Insulation build up thickness after shrink on Ferrule	8.1	IS 10810 -6
Flame retardant test on anti-tracking tubes and anti-tracking moulded components and earth braid protective tube after shrink on mandrill for terminations	3.5.1/ 3.5.2	ENA -TS 09-13
Area measurement of tinned copper braids (Area of one wire x no. of wires x no. of carriers)	As per TPCODL/TPWODL/TPNODL/TPSODL approved BOM	
Conductivity test on ferrules/ connectors/ lugs	8.3	IS 8309/ As per IEC 61238 part 1
Uniformity of zinc coating on GI mesh (Manufacturer's TC to be provided)	4.1	IS 2633

7.2 ROUTINE TESTS

Test	Clause No.	Reference Standard
Visual inspection of tubing and moulded components for free from pin holes, cracks, nicks, protrusion and	3.15	ENA -TS 09-13

Test	Clause No.	Reference Standard
other defects		
Dimension check	As per TPCODL/TPWODL/TPNODL/TPSODL approved BOM	
Electric Strength	3.4	ENA -TS 09-13
Ultimate Elongation	3.12	ENA -TS 09-13
Tensile Strength	3.12	ENA -TS 09-13
Volume Resistivity	3.16	ENA -TS 09-13
Wall thickness ratio	3.3	ENA -TS 09-13
Expanded and recovered diameters of tubes	3.3	ENA -TS 09-13

7.3 TYPE TESTS:

(i) Terminations & Straight Through joints

Test	Clause No.	Reference Standard
Conductor resistance with Ferrule/Lugs/Mechanical connectors	4.1	IS 13573(Part-2)
AC Voltage withstand Test (Air)	4.2	IS 13573(Part-2)
AC Voltage withstand test (under wet conditions) (for outdoor termination only)	4.2	IS 13573(Part-2)
Partial Discharge	7.0	IS 13573(Part-2)
Impulse voltage test	6	IS 13573(Part-2)
Heat Cycle test in air and water	9.1 and 9.2	IS 13573(Part-2)
Thermal Short Circuit Test for Screen	10	IS 13573(Part-2)
Thermal Short Circuit Test for Conductor	11	IS 13573(Part-2)
DC Voltage Withstand	5	IS 13573(Part-2)
Dynamic short circuit test	12	IS 13573(Part-2)
Thermal Endurance test	IEC 60216 part 2 & 8	
Salt fog test (Only for Outdoor terminations only)	13	IS 13573(Part-2)

(II) Kit Components

a) For Tubing and Moulded Components

Test	Clause No.	Reference Standard
Corrosion Resistance	3.1	ENA -TS 09-13
Density	3.2	ENA -TS 09-13
Dimensions	3.3	ENA -TS 09-13
Electric Strength	3.4	ENA -TS 09-13
Flame Retardance	3.5	ENA -TS 09-13
Heat Shock	3.7	ENA -TS 09-13
Low temperature flexibility	3.8	ENA -TS 09-13
Relative Permittivity	3.9	ENA -TS 09-13
Tensile strength and Ultimate elongation	3.12	ENA -TS 09-13
Thermal Ageing	3.13	ENA -TS 09-13
Tracking Resistance	3.14	ENA -TS 09-13
Visual Examination	3.15	ENA -TS 09-13
Volume Resistivity	3.16	ENA -TS 09-13
Water Absorption	3.17	ENA -TS 09-13

b) For Compression Lugs, Compression Ferrules and Mechanical connectors

Test	Reference Standard
Mechanical Pull Test	IEC 61238, part - 1
Heat cycle Test (1000 Nos.)	IEC 61238, part - 1
Short circuit Test	IEC 61238, part - 1

8. TYPE TEST CERTIFICATES:

The Bidder shall furnish the type test certificates for the tests as mentioned above as per the corresponding standards. All the tests shall be conducted at **CPRI/ERDA** as per relevant IS. However, TPCODL/ TPWODL/ TPNODL/ TPSODL/ TATA-POWER reserves the right to allow any other NABL accredited/ Govt. lab report/ Lab having accreditation from ILAC Signatory under exceptional circumstances after due diligence/ scrutiny by DISCOM. Type tests should have been conducted 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, same shall be carried out without any cost implication to TPCODL/ TPWODL/ TPNODL/ TPSODL.

9. PRE-DISPATCH INSPECTION:

The material shall be subject to inspection by a duly authorized representative of the TPCODL/ TPWODL/ TPNODL/ TPSODL. Inspection may be made at any stage of manufacture at the discretion of the purchaser and the equipment, if found unsatisfactory as to workmanship or

material, the same is liable to rejection. Bidder shall grant free access to the places of manufacture to TPCODL/ TPWODL/ TPNODL/ TPSODL's representatives at all times when the work is in progress. Inspection by the TPCODL/ TPWODL/ TPNODL/ TPSODL or its authorized representatives shall not relieve the bidder of his obligation of furnishing equipment in accordance with the specifications. Material shall be dispatched after specific MDCC (Material Dispatch Clearance Certificate) is issued by TPCODL/ TPWODL/ TPNODL/ TPSODL.

Following documents shall be sent along with material.

a) Test reports
b) MDCC issued by TPCODL/ TPWODL/ TPNODL/ TPSODL
c) TPCODL/ TPWODL/ TPNODL/ TPSODL Invoice in duplicate
d) Packing list
e) Drawings & catalogue
f) Guarantee / Warrantee card
g) Delivery Challan
h) Other Documents (as applicable).

10. INSPECTION AFTER RECEIPT AT STORE:

The material received at TPCODL/ TPWODL/ TPNODL/ TPSODL store will 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.

11. GUARANTEE:

Bidder shall stand guarantee towards design, materials, workmanship & quality of process / manufacturing of items under this 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 Company up to a period of at least 60 months from the date of commissioning or 66 months from the date of last supplies made under the contract whichever is later.

Further Bidder shall also stand guarantee towards poor workmanship in installation of straight through joint and terminations installed by bidder's jointer up to 60 months from the date of installation.

Bidder shall be liable to undertake to replace/rectify such defects at own costs, within mutually agreed time frame, and to the entire satisfaction of TPCODL/TPWODL/TPNODL/TPSODL, failing which TPCODL/TPWODL/TPNODL/TPSODL shall be at liberty to get it replaced/rectified at bidder's risks and costs and recover all such expenses plus the

Company's own charges (@ 20% of expenses incurred), from the bidder or from the "Security cum Performance Deposit" as the case may be. 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 Company.

12. PACKING AND TRANSPORT:

Supplier shall ensure that all material covered by this specification shall be prepared for rail/road transport (local equipment) and be packed in such a manner as to protect it from damage in transit. The bidder shall provide instructions regarding handling and storage precautions to be taken at site.

13. TENDER SAMPLE:

Bidder shall be submit the sample of material during tender evaluation process with the offer (in case of first supply to TPCODL/TPWODL/TPNODL/TPSODL).

14. QUALITY CONTROL:

The bidder shall submit QAP 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. The Purchaser's engineer or its nominated representative shall have free access to the manufacturer's/sub-supplier's works to carry out inspections.

15. TESTING FACILITIES:

Supplier/ Manufacturer shall have adequate in house testing facilities for carrying out all routine tests & acceptance tests as per relevant Indian standards.

16. MANUFACTURING FACILITIES:

The successful bidder shall submit the bar chart for various manufacturing activities clearly elaborating each stage, with quantity. This bar chart should be in line with the Quality assurance plan submitted with the offer.

17. SPARES, ACCESSORIES AND TOOLS

Not applicable.

18. DRAWINGS AND DOCUMENTS:

Following drawings and documents shall be submitted in line with the requirement of Tender specifications:

a) Completely filled in Schedule "A" Guaranteed Technical Particulars & Schedule "B" Deviations
b) BOM
c) Work Experience details
d) Type test certificates.
e) Drawing 1 Set of Hard Copy & Soft Copy PDF File containing complete information about manufacturing.

19. SCHEDULE- "A" GUARANTEED TECHNICAL PARTICULARS:

S. No.	Parameter	Units	To be Furnished by Bidder
1	Max. Withstand System Voltage	KV	
2	Partial Discharge at 1.73 Uo	pC (Pico-coulombs)	
3	Impulse Peak Withstand	KV	
4	Continuous operation withstand Temperature	°C	
	Short Circuit withstand temperature	°C	
5	Withstand short circuit current	KA/1Sec	
6	Storage Temperature Range	°C	
7	Shelf life of kit components excluding mastic and solution	Years	
8	Shelf life of mastic and solution	Years	

A. General Technical Particulars for Heat Shrinkable Insulation Tubing/ Sleeves/ Wrap around Sleeve:

S.No.	Parameter	To be Furnished by Bidder
1	Visual Examination	
2	Wall thickness Ratio	

S.No.	Parameter	To be Furnished by Bidder
3	Internal diameter of tube after full recovery	
4	Longitudinal change	
5	Electric Strength	
6	Tensile Strength	
7	Ultimate Elongation	
8	Heat Shock	
9	Low Temperature Flexibility	
10	Volume Resistivity	
11	Tracking resistance	
12	Flame Retardant (Applicable only for Anti tracking Tubes/ sleeves)	

B. General Technical Particulars for Heat Shrinkable moulded components/ Breakouts/ Weather sheds

Sl.No.	Parameter	To be Furnished by Bidder
1	Visual Examination	
2	Wall thickness Ratio	
3	Internal diameter of tube after full recovery	
4	Longitudinal change	
5	Dielectric Strength	
6	Tensile Strength	
7	Ultimate Elongation	
8	Heat Shock	
9	Low Temperature Flexibility	
10	Volume Resistivity	

Sl.No.	Parameter	To be Furnished by Bidder
11	Flame Retardant (For anti-tracking moulded components)	

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:

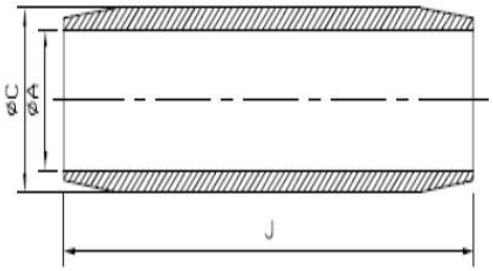
Signature

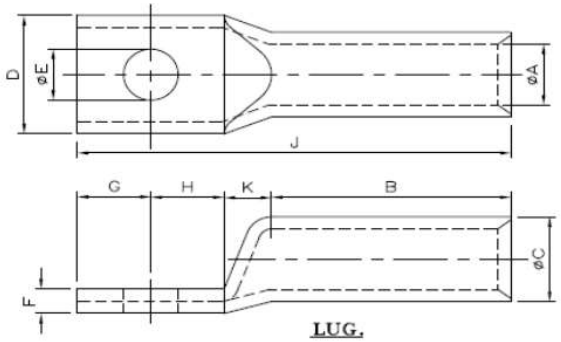
Designation

Annexure- Dimensions Ferrules & Lugs HT

Dimensional details of Aluminum ferrules for HT AL circular stranded compacted XLPE cables			
Cable Size in MM²	φA (mm) +0.3mm	φC (mm) +0.3 mm	J (mm) ±3mm
95	12	16.9	108
150	15.1	21.2	116
300	21.8	30.2	150
400	25	34.8	150
630	31.7	44.4	200
1000	41	56	250

Dimensional details of Aluminum Lugs for HT circular stranded compacted XLPE cables							
Cable Size in MM²	ΦE (mm) ±0.1mm in centre of palm	ΦA (mm) +0.5mm	ΦC (mm) +0.5 mm	D (mm) ±1.5mm	F (mm) ±0.5mm	B±3.0mm	J (mm) ±5mm
95	13	12	16.9	23.5	4.9	73	109
150	13	15.1	21.2	29.5	6	83	128
300	17	21.8	30.2	42	8.4	89	157
400	17	25	34.8	48	9.8	113	187
630	17	31.7	44.4	61	12.7	140	225
1000	-	41	56	77.5	15	160	280





For remaining cable sizes, dimensions of Ferrules & Lugs shall be as per IS.

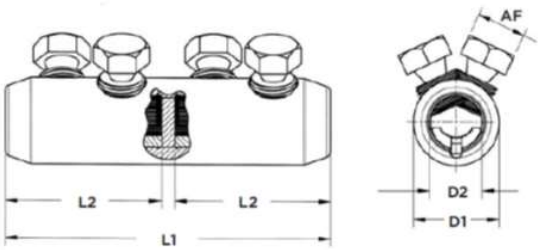
Annexure- Dimensions Mechanical connectors & Mechanical Lugs

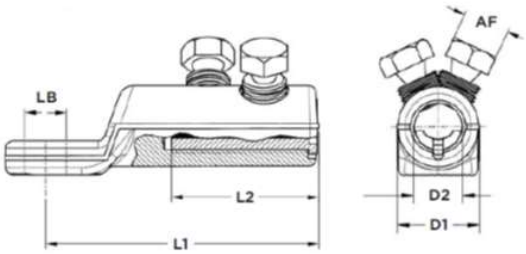
Aluminium Mechanical connectors

Cable Size in MM²	ΦD1 (mm)	ΦD2 (mm)	L (mm)
185-400	50	25.5-26	440- 450
185-400	42	25.5-26	170-200
500- 630	50	33- 33.5	180-230
1000	60	40	180-230

Tinned Aluminium Mechanical Lugs

Cable Size in MM²	ΦLB (mm)	ΦD1 (mm)	ΦD2 (mm)	L (mm)
185-400	17	42	25.5-26	137-150
500- 630	17	50	33- 33.5	150-180
1000	2x17	60	40- 40.5	180- 240





CONTENTS

1. SCOPE

The scope of this specification covers the technical requirements of design, manufacture, testing atmanufacturer's works, packing, forwarding, supply and unloading of Panels, IEDs, relays and all other items & tools required for protection of 33kV/11kV power system as mentioned in the specification, at site/stores complete with all accessories including supply, installation, testing and commissioning of efficient and trouble free protection system. The specific requirements are covered in the enclosed technical data sheet.

2. APPLICABLE STANDARDS

The equipment covered by this specification shall unless otherwise stated, be designed, constructedand tested in accordance with latest revisions of relevant Indian/EEC/other applicable standards shall confirm to the regulations of local statutory authorities.

IS 9000: Basic Environmental testing procedure for electrical and electronic items

IS 3231:Part 3 Sec 1 : Specification for Electrical Relays for Power System Protection Part 3 : Requirements for Particular Group of Relays - Section 1: Non-specified Timeor Independent Specified Time Measuring Relays

1S 3231:Part 3:Sec 2 : Specification for Electrical Relays for Power System Protection Part 3 :Requirements for Particular Group of Relays Section 2 : Dependent Specified Time Measuring Relays

IS 3231:Part 3:Sec 3: Specification for Electrical Relays for Power System Projection - Part 3 : Requirements for Particular Group of Relays - Section 3 : Biased (Percentage)Differential Relays

IEC 60255 :Measurine Relays and Protection Equipment

IS 694-1990 :PVC insulated cables for working voltage up to and including 1100V

IEC 60529 :Degrees of Protection provided by enclosures (IP Code)

JEC 62052-11 :Electricity metering equipment (a.c.) - General requirements, tests & test conditions

IEC 62053-22 : Static meter for active energy (Class 0.2S and 0.5S)

IEC 61850: Communication networks and systems in substations (all parts including IEC 61850-8-1, IEC 61850-9-2)

IEC 60870-103-1 Communication Protocol

IEC 61869-9 :Digital Interface for Instrument Transformers

IEC 61869-13 : Stand-alone Merging Units

IEC 61588/IEEE : Precision clock synchronization protocol for networked measurement and1588v2 control systems

IEC 62351 : Power systems management and associated information exchange - Data andcommunications security

3. CLIMATIC CONDITIONS OF THE INSTALLATION:

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	150cm
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 thedry months and is subjected to fog in cold months.

4. GENERAL TECHNICAL REQUIREMENTS

a) The supplier should have at least 30 years of experience in design and supply of control and protection systems for electricity transmission and distribution applications.

b) The manufacturer, whose protection system is offered, should have designed, manufactured, tested, installed and commissioned such a system for electricity transmission and distribution for at least two decades. The conditions in this document is applicable for a single IED or multiple IED, new commissioning and retrofitting jobs.

c) The manufacturer needs to submit the proof of completing such tasks with other utilities/concerns and sister utilities as its experience certificate for last 3 years.

d) The Business Associate can offer an innovative and advanced system. The offer is subjected to an approval from TPCODL/TPNODL/TPSODL/TPWODL after a thorough discussion between the BA and TPCODL/TPNODL/TPSODL/TPWODL. In case,an approval is not awarded to the BA's offered innovative system,TPCODL/TPNODL/TPSODL/TPWODL's existing/desired infrastructure prevails and the BA shall provide the system accordingly.

e) The BA should optimize on the cost of software products offered to TPCODL/TPNODL/TPSODL/TPWODL considering already available licenses with TPCODL/TPNODL/TPSODL/TPWODL. The BA should clearly indicate licensing policy for the software tools offered.

f) The BA should provide necessary training to the personnel recommended by TATA POWER - CODL to maintain the system and troubleshooting reports which is not less than 3 days.

g) The BA should provide the MIB Files of all Numerical Protection IEDs to integrate the SNMP Traps with Network Management System

h) The numerical relay must have an IEC 61850 Edition 1, Edition 2 level

i) A certification from DNVGL / KEMA and Relay shall also support site selectable minimum RSTP.

4.2 General System Design

a) Protection and Control IEDs respond to the signals of currents and voltages

b) Design measured at certain points of the power system, and assess the state of the protected power system component. The System shall he suitable for operation and monitoring of the complete substation including future extensions and shall works on]EC 61850. The offered IEDs shall be compliant to EEC 61850 Edition-2 with backward compatibility to Edition-1,

c) Conventionally, analog values are injected directly into the IFD through instrument transformers.IEDs combine analog-to-digital conversion of the signals with their analysis (digital filtering) and decision-making algorithms.

d) The IEC 61850 standard, which becomes more and more popular, allows digital exchange of data between merging units and protection devices. Merging Units (MUs), being an integral part of the digital substation, repeatedly digitize the analog signals and transfer them to the process bus as packets ensuring labelling and integrity of data during the transfer. The process bus represents acommunication network, interconnecting data publishers and subscribers. Protection and control IEDs receive digital packets and process currents and voltages. The transfer of the instantaneous values of currents and voltages is required for the performance of all range of functions available in the relays. Thus, protection and control devices connected to the process bus

register electric processes as sampled signals of currents and voltages in the same way as if the analog-to-digitalconversion was carried out directly in the relay. The digital communication is realized through redundant fiber optic LAN.

e) According to IEC 61850-9-2LE, the packet transmitted includes one sample of each of the three phase currents and three phase voltages, as well as current and neutral voltage. Most filtering algorithms are designed for equal distribution of samples on the time axis and are very sensitive to the loss of even one of them, Under such conditions the relay must take special actions likecomputing the sample missed.

f) Packet delivery time drift leads to irregularities in the flow of data to the protection equipment and to cope with packet delays in the communication channel and to keep the required regularityof data processing, a buffer of samples is created, thus enabling delayed data delivery to the protection functions. Buffer time should provide for the maximum possible time of data delivery in the communication channel without affecting the overall relay tripping time

g) It is important to ensure synchronous time-stamping of the samples using Precision Time Protocol (PTP). If the measuring equipment is not synchronized, the collected samples cannot be correctly aligned. The relay functions are then blocked, and an alarm condition is indicated to the maintenance personnel via Station Bus to the RTU/DC and to Integrated Network Management System.

h) The loss of connection with a MUs for the process bus in terms of its impact on the protection relay performance is similar to damage of current and voltage secondary circuits. Such a loss is detected after the packet delay exceeds a preset threshold, which enables a timely reaction of the relay. The relay functions requiring data from the failed source are then blocked, and the loss of connection is indicated to the maintenance personnel via Station Bus to the RTU/DC and to Integrated Network Management System.

i) Merging units shall perform the diagnostics of their state. In case of internal failure, samples are marked with a poor quality attribute according to IEC 61850, and each measurement has its own quality attribute. If a poor quality sample is received, protection and control functions depending onthis data are blocked, and the relay should inform the maintenance personnel via Station Bus to the RTU/DC and to Integrated Network Management System about the failure.

j) There shall be different login privileges, role based, for Protection Team and Automation Team to access all Protection IED.s and Merging Units.

4.3 Intentionally Kept Blank

4.4 Protection and Control Philosophy:

4.4.1 Each 11kV and 33kV Incoming and Tie Lines shall be provided with :

O/C & E/F Protection: Shall be provided. A 5P20 CT shall be provided for the O/C and E/F protection IED. Details are mentioned in clause No 4.4.1.2

4.4.1.1 Intentionally Kept Blank

4.4.1.2 Detailed Technical Specifications of Protections (0/C and E/F] of 11kV & 33kVLines, Transformers, Bus Couplers And Bus Sections

A numerical three phase Directional O/C and E/F IED shall be used as a backup of main protection of Line, Transformers, Bus Couplers & Bus Sections.

i. Protection IEDs supplied shall have the following features:
ii. Both Non Directional (50/51 & 50N/51N) & Directional O/C and E/F (each element shallhave one IDMTL and three high set definite time relay) (67 R, Y, B and 67N)

features
shall be available.

iii. Negative sequence current (unbalance current) (46)
iv. Overload relay (49)
v. VT supervision relay and Trip circuit supervision relay.
vi. Integrated CB failure protection.
vii. Configurable LEDs shall also be provided to indicate the 1ED operation and the alarm /status change of a bay equipment e.g. Phase Fault operated / Earth Fault operated / CB Open / CB Close / Spring charged etc.
viii. Auto Reclose (79) Protection element feature to be incorporated.
ix. The LED should have Circuit Breaker monitoring >1 KA square for online monitoring o Breaker
x. The IED shall have synch-check facility.
xi. The IED should have Graphical Display Unit to display bay level information
xii. Electrically reset type high speed, heavy duty relay (master trip 86) shall be used for tripping on operation of main and BCPU IEDs. The two trip coils where ever provided shall be provided with independent potential free contacts from different fused DC supplies. The trip relay shall be supervised. Master trip relay should be such that on resetting its flag should be automatically reset.
xiii. Breaker counter logic shall be there on fault opening
xiv. The lED must have broken conductor and fault locator facility
xv. IED of Bus Coupler/Bus Section Bay should have minimum of 15 Digital Inputs and Digital Output Channels for Substation and other Aux. Signals,

Protection for 11kV/33kV Power Transformer

Each Power Transformer shall be provided with:

Main Protection Relay : One Current Differential IED as a Main Protection. PS class CT shall be used for Transformer Differential Protection. Details are mentioned in Clause No,4.4.2.1

Back-up Protection Relay: Directional 0/C & E/F Numerical lED shall provide the as the backup protection for HV side of Transformer. A 5P20 class CT shall be used for 0/C and E/F Protection. Details are mentioned in Clause No. 4.4.1.2

4.4.2.1 Detailed Technical Specifications of 33kV & 11kV Power Transformer Main Protection — Transformer Differential Protection (871) shall be follows:

i. The lED shall have biased current differential numerical protection with REF, SEF and Directional O/C & E/F protection. It should include the following features:

a. Vector group compensation.
b. CT ratio correction.
c. Biased differential protection.
d. High-set. Element of suitable setting range
e. 2nd and 5th Harmonic restrains,

ii. Transformer trouble alarm/ Trip e.g. Bucholz PRO / Winding Temp / Oil Temp etc. shall be taken

asbinary inputs in the differential IED as a common input indicating "Transformer trouble" through TMU.However, auxiliary Flag relays / TMU (Transformer monitoring unit) shall be provided independently for Transformer trouble and trip along with the panel.

IED shall be able to display all the Alarms and field status change on the LCD panel of the IED at the time ofoccurrence and it should be possible to accept the alarms locally from the IED and through the station controller PC.

4.4.3 Intentionally Kept Blank

4.4.4 Intentionally Kept Blank

4.4.5 Detailed Technical Specification of 11 KV O/G Feeder

A Directional Numerical 3 Phase 0/C and E/ F Protection IED shall be used as Bay control and protection

i. This IED shall be able to give a trip command through a high speed electrically reset type trip !ED to theshunt trip coil of CB.

ii. This IED shall have the following inbuilt function:

a) Directional 3 phase 0/C and E/F (each element shall have one IDMTL three high-set definite timeIED
b) Negative sequence current (unbalance current)(46)
c) Overload protection (49).
d) CB Failure protection.

This Numerical O/C Protection may be provided with inbuilt in the Bay Control Unit of the 11kVFeeders

e) Reverse blocking and CBFP shall be implemented for all 11.10/1/C & O/G Breakers.
f) Auto recluse (79) Protection element feature to be incorporated in the IED.
g) The IED shall provide all necessary interlocking for Grid station within the bay.
h) The IED should have Circuit Breaker monitoring 1KA square feature for online monitoring of the breaker.
i) The IED should have Graphical Display Unit to display feeder level information
j) The IED must have broken conductor and fault locator facility

iii. Electrically reset type high speed, heavy duty relay (master trip relay 86)) shall be used for tripping on operation of protection IEDs .Trip relay along with tripping circuit shall be supervised. Master trip relay should be such that on resetting its flag should be automatically reset.

4.4.6 Detailed Technical Specification of 33kV/11KV Capacitor Bank Protection:

Each Capacitor feeder shall be provided with following:

A dedicated high speed Numerical Current operated Neutral Unbalance / Displacement lED with Provision oftwo stages of definite time elements shall be provided as Main Protection.
A composite numerical capacitor bank protection IED with the following features shall be provided as back up and additional Protection:

i. These above mentioned two LEDs shall be of same order codes.
ii. One directional 3 phase O/C and E/F, each element shall have one IDMTL and two high set definitetime IED
iii. Negative sequence current (unbalance current) and unbalance voltage
iv. Over voltage function
v. Under voltage function
vi. Efficacy time (5 min) to be provided in the Capacitor bank relay and during this period there should be closing interlock and no closing command be executed either from Relay or TNC inservice position.
vii. The lED should have Graphical Display Unit to d4lay bay/feeder level information
viii. In Cap bank relay, it will be mandatory to provide 10% Spare I/0's by the vendor withproper wiring up to terminal blocks
ix. Door OPEN tripping to be provided in the relay via status input and tripping will be extended.
x. CAP BANKS may be dual star fixed type or auto switched type but the requirement for IEDs will betwo (NUBR for double star and NDR for auto switched type) and that too of same order codes.

Automatic power factor controller module embedded in the 1ED for auto switching of breaker shall take into consideration the bus voltage & pf. 11KV I/C current Input to the Neutral current unbalance 1ED shall be from CT installed on the connection between two star points of the capacitor bank. Electrically reset type high speed relay shall be used for tripping & the trip relay shall be supervised.

4.5 Detailed Requirement of Hardware & Software of the Numerical Protection IEDs:

i. All numerical IEDs, auxiliary IEDs and devices comprising the Bay Protection Units shall be of types, proven for the application, satisfying the requirements specified in technical specifications and shall be subject to the Owner's approval. Numerical IEDs shall have appropriate setting ranges, accuracy, resetting ratio, transient overreach and other characteristics to provide the required sensitivity to the satisfaction of the Owner.
ii. All IEDs must have conformal coating for protection against harsh environments.
iii. The Protection IED offered shall be suitable for both IA and 5A analogue inputs, also the offered IEDs should be based on IEC 61850 standard Edition-2 series with backward compatibility to Edition 1 series preferably. Bidder shall provide necessary certificates to ascertain the communication capability (Interoperability) with other make LED in 61.8S0 standard for interlocks/logic through GOOSE messaging. The relays provided for any project must have self-diagnostic feature to enable us to know about

component failure. if not possible then necessary software to detect the same must be provided.

iv. Equipment shall be designed for a working life of at least fifteen years in the specified environment and application. Components, component ratings and all other factors determining equipment life shall take this into account. Normal routine and breakdown maintenance shall be assumed and it is accepted that certain consumable components and modules may need periodic replacement or adjustment. However, the Bidder shall state in his bid, the expected frequency of such replacement or adjustment and life expectancy.

v. Numerical IEDs shall be suitable for efficient and reliable operation of the protection scheme. The necessary auxiliary relays, trip relays, etc. required for complete scheme, interlocking, alarm, logging, etc. shall be provided. No control IED, which shall trip the circuit breaker when the IED is de-energized, shall be employed in the circuits. Any connectors, terminals, switches required to extend or isolate the wiring to IEDs to be provided by bidder.

vi. IEDs shall be provided with self-reset contacts except for the trip lockout, which shall have contacts with an electrical reset feature.

vii. Suitable measures shall be provided to ensure that transients present in CT & VT connections due toextraneous sources in the HV system do not cause damage to the numerical and other IEDs. CT saturation shall not cause mal-operation of numerical IEDs.

viii. Hardware selection should be done in such a manner that all power supply requirements could be met with the available grid voltages (48V/24V DC for grid station).

ix. DC batteries in protective IEDs necessary for IED operation shall not be acceptable. Equipment shallbe protected against voltage spikes in the auxiliary DC supply. Auxiliary supply supervision and necessary alarm generation to SCADA be possible.

x. The numerical IEDs shall have continuous self-monitoring & cyclical test facilities. The internal clock of the system shall be synchronized through the GPS Time Synchronizing System to be provided byOwner at later date.

xi, Each numerical IED shall have a serial interface on the front for local communication to Personal Computer and Printer. Facilities shall be provided to access each discrete protection function including modification in IED settings and monitoring of. the IED from a HMI. A print out of all settings, scheme logic, event records etc. shall be accessible through the HMI. The display of various measured parameters during normal as well as fault conditions on a segregated phase basis shall be provided. LEDs and a backlit LCD screen shall be provided for visual indication and display of messages related to major trips / alarms. Necessary multilevel password protection shall be provided.

xii. The sampling rate of analog inputs, the processing speed and processing cycle of digital values shall be selected so as to achieve the operating times of various protection functions specified. In case the Bidder does not have all the protection functions specified as a part of the standard numerical !ED, separate discrete numerical IEDs can be provided for such protection. The reasons for providing such discrete IEDs shall be clearly outlined in the bid.

xiii. The numerical IEDs shall be provided with built-in disturbance recording functionality. The data from DR function shall be available in IEEE/COMTRADE format and shall be compatible with the dynamic IED test system being supplied under this Contract.

xiv. The manufacturer of the numerical protection system offered shall carry out the complete engineering, testing and commissioning on site of the offered protection equipment including the associated IEDs and protection panels. The testing and commissioning protocols for the numerical protection systems offered shall be approved by the owner before commissioning on site.

xv. The numerical IEDs offered shall have self-diagnostic features to reduce the down time of the IED and to provide useful diagnostic information upon detection of an internal fault so as to speed up the maintenance. The necessary support documentation explaining in detail the self-diagnostic features of the numerical IEDs shall be furnished for the Owner's use, Self-diagnostic feature to meet clause 7.1.2.4 of IEC 61850-4.

xvi. There should also be separate logic in IED to cater breaker operation counter on faults only

xvii. PRP/RSTP to be made available by default in relay with Dual RJ45 ..

xviii. Fault currents sensed by relay to be.mapped to SCADA. Proper programming to be done for the same.

xix. All the protection signals along with corresponding LEDs to be latched at SCADA, so suitable logic to be built in the relay.

xx: On resetting the BCPU/PU from SCADA or Locally from relay all the protection signals must be get reset both at SCADA and at relay with relay outputs in one go. if separate logics required to meet the same, then same can be formulized.

xxi: Device order code of 11kV 1EDs (BCPUs & PUs) must have same order codes irrespective of panel types for better 1EC61850 project management and one to one replacement. For 111(V panels both BCPU and PU order code will be the same. Device order code of 33kV & 11kV BCPUs must have same order code for better IEC 61850 project management and one to one replacement.

xxii. The number of inputs & outs of BCPUs and Pus are given below

Voltage Level	Conventional Substation		Digital Substation	
	BCPU	PU	BCPU	PU
11kV	BI-20 BO-10	BI-20 BO-10	BI-20 BO-10	BI-20 BO-10
33kV	BI-24 BO-12	BI-16 BO-10	BI-24 BO-12	BI-16 BO-10

Note : For GIS Panel BI/BO requirement may be higher and OEM shall provide accordingly.
GIS Bus PT and Bus Earthing Switches shall have its control from BCPU of Bus Coupler CRP Only.

The bidder shall provide all software licenses for all the software being used in Protection IED offered for engineering, IED setting uploading and FDR downloading etc. The license shall be provided on a site license basis and shall be valid for the plant / Equipment life cycle. In the case of anti-virus software, the license shall include regular updates. The Bidder Shall guarantee that all software are defect free and meet the System specifications, and undertake to fix any defects Which may arise during the life of the system at no cost to the Owner.

xxv. In case offered IEDs require any additional software for its integration to RTU then the bidder

shall provide the same.

xxvi. All software versions in components shall be the latest official releases as on the date of shipment from works and shall include all software updates etc. released till that date. A certificate to this effect shall be furnished by the bidder at the time of pre-dispatch inspection for each software package. All new software revisions and/or

patch updates that are released before the end of the warranty period which addresses system defects shall be implemented on site and the system re-tested to validate system integrity by the bidder at no cost to the owner (This excludes new revisions which provides additional functionality). The bidder shall periodically inform the designated officer of the Owner about software updates / new releases that would be taking place after the system is commissioned.

xxvii. Bidder shall train our engineers to guide the upgrading procedures of project files with respect to latest releases.

xviii. Two nos. of communication cords for each type of relay uploading and clown loading

data from front and rear port of Protection lED shall be supplied by the bidder. One no. of Serial to USE Converter to be supplied by bidder.

xxix. Station Project Files shall be ready before raising inspection call & submission of the internal testreport by the vendor,

xxx. Vendor shall submit 2 copies of as built drawings & station project files in soft format.

4.6 GPS Clock

The offered GPS Clock should meet the following requirements:

- Redundant GPS based Time Synchronization Server with Antenna
- Tracking: 12 Satellites in parallel
- LCD Display with Status LED's
- Redundant Ethernet Port
- NTP v2/v3/v4
- IPv4, lPv6, UDR, TCP, SNMP, SSH, SCP, HTTP, HTTPS, SYSLOG, Telnet, FTP networkingprotocols
- Remote Alarm notifications via SNMP, SYSLOG
- Remote configuration using SSH, Web, SNMP, Telnet
- USB Port
- Supports synchronization of IFC61850 compliant devices via NTP/SNTP/PTP protocol
- Mounting Type: 19" Rack Mountable
- NTP Client Synchronization software
- Diagnostic Relay outputs
- Supporting Timing Protocols:
  - (a) NTP/SNTP
  - (b) PTP v2
  - (c) IRIG-B Modulated

(d) IRIG-E3T11

- Power Supply: Redundant, 48VDC ± 15% or 24VDC ± 15%
- Operating Temperature: 0° C to +55° C
- Alarms:
  (a) GPS Lost
  (b) Watchdog
  (c) Power Fail
- Antenna: Coaxial Cable with 360 Degree Coverage

4.17 Facia

a) The fascia of the IED should have a clear and bright LCD display where SLD can be seen clearly of the respective bay along with following parameters clearly from 1 meter distance

Name of the bay

Date and time running

CT ratio

All three phase current

All three phase voltage in phase to phase basis

b) The display should have minimum 4 pages to cater sequential values (positive, negative and zero) of voltages and current along with other important displayable parameters like total harmonic distortion of electrical parameters. Tactile keypad or navigation keys for browsing and setting the relay menu.

c) There should be user configurable LEDs (minimum 10) in the relay fascia for suitable annunciation configuration as per site suitability. The LED marking style should not be permanent type, there should be LED strip which can be easily changed as per the need of the user. The LED strip required to be printed out (hard copy or software configured) to be provided. There should be a LED in green color to indicate device is working and healthy.

d) The relay fascia also should contain dedicated close and open button for CBs or any other switches which a user wish to control. Minimum number of such switches is 5 including CB which can be configured in the IED.

e) The front fascia of the IED should contain a communication port to get connected with the device. The details of the port feature will be given in the communication part.

f) There should a reset button which by default clears all the LEDs (programmable and non-programmable) and reset all the outputs in one go. If any button can be configured for the same purpose then same feature is also acceptable.

4.18 CAT-VI

4 Pairs, 23 AWG Solid Bare Copper Conductor, PE Insulation, Unshielded Twisted Pair (UTP) with separatorand PVC Outer Jacket

It should be designed to the ANSI/TIA-568-C.2 ISO IEC 11801 Category 6 requirements and transmit data at 1000 M bps (-1 Gigabit per second} with a frequency of 250 MHz and suitable for 1OBASE-T, 100BASE-TX Fast Ethernet and 1000BASE-T 100013ASE-TX (Gigabit Ethernet).

4.19 **Diagnosis capability of IED :**

- The numerical IEDs shall have continuous self-monitoring & cyclical test facilities. The internal clock of the system shall be synchronized through the GPS Time Synchronizing System to be provided by Owner at later date.
- Should tell about the internal and hardware problem by its diagnosis tool. Thediagnosis tool may be the software for its configuration or other than configuration software.
- Forcing of all kinds of inputs and outputs.
- Forcing of all kinds of protection functions
- Forcing of all LED's.
- Relay should be reboot from the relay key and through software also
- Diagnosis tool/ software to declare pattern of failure or pre failure conditions
- List of frequent failure error codes and their meaning and proper preventive action

4.20 Oscillography:

- Waveform generation option shall be different (On which functions waveform will be generated shall be selected by user)
- What an waveform will show shall be different from above (Including all current channels and voltage channels, digital channels minimum 24)
- Transformer differential relay should have all HV and LV analogue channels, biasing current, restraint current.
- Phasor with sequential values
- Sequential values in any representation (value in A, V or percentage of positivesequences)
- With two or more cursor availability in DR software to facilitate cleardemarcation of pre fault, fault and post fault behavior.
- Transient play back facilities in the IED softwareAny configurable protection characteristics
- Any program generated outputAny DI & DO
- Any program generated input
- Store Any waveform even if dc fails.Any goose sending signals
- Any goose receiving signals

- The oscillogrphic record can be exported to comtrade format. Nature of storage is FIFO minimum 20 sec (configuration should be possible as per user selectable choice like window for the record, number of records etc.)

4.21 System Events:

- 600 Events minimum Time resolution of 1ms
- Can be read from relay fascia as well as from software.
- Events of a single change be it bi, bo, program generated IP, op, protection signal, GOOSE signals etc to be either automatically come or user configurable.
- Events should be downloadable from front and back ports with out changing a single configuration of the device
- All event shall be readable from relay fascia also
- Fault events are different than system events and shall be downloadable from relay fascia as well as from software.

4.2.2 Software:

- Maximum number of software to interface with relay will be 2 in number to engineer relay from device and IEC 61850 system point of view. These 2 number software required for device configuration, system configuration of IED, waveform uploading/ downloading/ viewing.
- Device engineering and IEC 61850 system configuration to be done from the same software
- Software to have every function of configuration and parameterization that is available from relay fascia
- Device to have minimum 3 level of security with user ID and password protection to access device from configuration, parameterization, accessibility, 61850 configuration & event or oscillography downloading
- Software restart facility for the device
- Software testing facility for the device (when device is protecting, necessary point to point testing can be done by simulating wanted signals from software.
- The relays provided should comply with Indian or international standards of cyber security like NERC CIP / BDEW / IEEE 1686 or equivalent for cyber security to provide protection against unauthorized disclosure, transfer, modification, or destruction of information and/or information systems, whether accidental or intentional.

- There should also be separate logic in IED to cater breaker operation counter on faults only. This counter should not be reset to zero upon device rebooting or accidental relay power off.

- On resetting the BCPU/PU from SCADA or Locally from relay all the protection signals must be get reset both at SCADA and at relay with relay outputs in one go. If separate logics required to meet the same, then same can be formulized.

- Device order code of 11kV IEDs (BCPUs & PUs) must have same order codes irrespective of panel types for better IEC61850 project management and one to one replacement. For 11kV panels both BCPU and PU order code will be the same. Device order code of 33kV BCPUs must have same order code for better IEC 61850 project management and one to one replacement.

- The bidder shall provide Any software licenses for Any the software being used in Protection IED offered for engineering, IED setting uploading and FDR down loading etc. The license shall be provided on a site license basis and shall be valid for the plant / Equipment life cycle. In the case of anti-virus software, the
- license all include regular updates. The Bidder All guarantee that Any software
- are defect free and meet the System specifications, and undertake to fix any defects Which may arise during the life of the system at no cost to the Owner.

- Any software versions in components all be the latest official releases as on the date of shipment from works and all include Any software updates etc. released till that date. A certificate to this effect all be furnished by the bidder at the time of pre-dispatch inspection for each software package. Any new software revisions and/or patch updates that are released before the end of the warranty period which addresses system defects all be implemented on site and the system re-tested to validate system integrity by the bidder at no cost to the owner (This excludes new revisions which provides additional functionality). The bidder all periodically inform the designated officer of the Owner about software updates / new releases that would be taking place after the system is commissioned.

- **Bidder all train our engineers to guide the upgrading procedures of project files with respect to latest releases.**

- Two nos. of communication cords for each type of relay uploading and down loading data from front and rear port of Protection IED all be supplied by the bidder. One no. of Serial to USB Converter to be supplied by bidder.

- Station Project Files all be ready before raising inspection call & submission of the internal test report by the Bidder.
- Bidder all submit 2 copies of as built drawings & station project files in soft format in a pen drive.
- The technical key should be as per provided SLD like 11KVIC2, 33KVIC1, 33KVPTR2 etc. The same shall be elaborated at the stage of detailed engineering and finalization of order code.
- Report control blocks to be configured during initial programming of the relays. The desired signals and their types will be provided in detailed engineering stage.
- IP address will be provided along with SNTP sever address at the time of detailed engineering
- CT PT ration to be provided at the time of detailed engineering
- Successful bidder will ask user on which software platform necessary relay files will be made, it's not in scope of bidder, however bidder may suggest.
- All protection functions and control functions to be made off with appropriate settings adopted discussed in detailed engineering stage.
- Bidder to propose type of IEDs (like latest released version) they are providing at the time of detailed engineering.
- There should be feature for digital/ binary input sensing delay in the relay which can be adjusted through the software and relay fascia.
- Transient play back facilities in the IED software
- Virtual simulation of all kinds of inputs and outputs (while relay is online and working and in service)
- Virtual simulation of all kinds of protection functions (while relay is online and working and in service)
- Virtual simulation/ forcing of all Led's (while relay is online and working and in service)

- Relay should be reboot from the relay key and through software also

- The number of program generated input and output to be framed by bidder. Minimum number for both are 32 respectively.

- The number of Goose input and output to be framed by bidder, however minimum number for both are 20 respectively.

- Protection and Control IEDs respond to the signals of currents and voltages measured at certain points of the power system, and assess the state of the protected power system component. The System shall be suitable for operation and monitoring of the complete substation including future extensions and shall works on IEC 61850. The device shall be freely configurable to both IEC 61850 edition 1 and edition 2. The device shall be capable to report to 6 clients minimum.
- It should be compatible with SCL/SCD files generated by a third-party system.

- Being new installation or retrofitting activity there should be always presence of OEM engineer though OEM or any party may put in third party for the said job.

4.2.3 SNMP

Shall be made available in each IED.

- The IED should be communicated by remote servers through the gateway configured in the IED.
- Web HMI should be made available in the relay so that relay can be accessed from remote from computer browser.
- The web HMI should facilitate every possible access which can be done from relay fascia
- In the relay front there shall be a must control authority in terms of LOCAL and REMOTE either by lock and key or by any fascia button (which can also be initiated by Binary or digital input) so that on choosing LOCAL it does not accept any remote command.

5 GENERAL CONSTRUCTIONS

General Construction of CRP

General Switchgear panel construction is governed by individual specification in minimum.
Additionally following protection related construction features to be provided. For 11K V/ 33KV control and relay panel. Following features to be ensured.

5.1 Simplex Panel

Simplex panel with dust proof design shall consist of a vertical front panel with equipment mounted thereon and having wiring access from rear for control panels & either front or rear for relay panels. In case of panel having width equal to or more than 800mm, double leaf-doors shall be provided. Doors shall have handles with either built-in locking facility or will be provided with pad-lock.

5.2 Constructional features

Control and Relay Board shall be of panels of simplex type design as indicated in bill of quantity. It is the responsibility of the BA to ensure that the equipment specified and such unspecified complementary equipment required for completeness of the protective/control schemes is properly accommodated in the panels without congestion and if necessary, provide panels with larger dimensions. No price increase at a later date on this account shall be allowed. However, the width of panels that are being offered to be placed in existing switchyard control rooms, should be in conformity with the space availability in the control room.

Panels shall be completely metal enclosed and shall he dust, moisture and vermin proof. The enclosure shall provide a degree of protection not less than IP-54 in accordance with IS: 2147. Panels shall be free standing, floor mounting type and shall comprise structural frames completely enclosed with specially selected smooth finished, cold rolled sheet steel of thickness not less than 3 mm for weight bearing members of the panels such as base frame, front sheet and door frames, and 2.0mnri for sides, door, top and bottom portions. There shall be sufficient reinforcement to provide level transportation and installation. All doors, removable covers and panels shall be gasketed all around with synthetic rubber gaskets Neoprene/EPDIV1 generally conforming to provision of IS 11149. However, XLPE gaskets can also be used for fixing protective glass doors. Ventilating louvers, if provided shall have screens and filters, The screens shall be made of either brass or GI wire mesh. Design, materials selection and workmanship shall be such as to result in neat appearance, inside and outside with no welds, rivets or bolt head apparent from outside, with all exterior surfaces tune and smooth. Panels shall have dual exhaust fan at its rear end for dissipation of heat.

Panels shall have base frame with smooth bearing surface, which shall he fixed on the embedded foundation channels/insert plates. Anti-vibration strips made of shock absorbing materials that shall be supplied by the contractor, shall be placed between panel gt base frame, Cable entries to the panels shall be from the bottom. Cable gland plate fitted on the bottom of the panel shall he connected to earthing of the panel/station through a flexible braided copper conductor rigidly.

Relay panels of modern modular construction would also be acceptable.

5.3 Mounting

All equipment on and in panels shall be mounted and completely wired to the terminal blocks ready for-external connections. The equipment on front of panel shall he mounted flush. Equipment .shall be mounted such that removal and replacement can be accomplished individually without interruption of

service to adjacent devices and are readily accessible without use of special tools. Terminal marking-on the equipment shall be clearly visible.

The BA shall carry out cut out, mounting and wiring of the free issue items supplied by others which are to be mounted in his panel in accordance with the corresponding equipment manufacturerdrawings. Cut outs if any, provided for future mounting of equipment shall be properly blanked off with blanking plate.

The centre lines of switches, push buttons and indicating lamps shall be not less than 750mm from the bottom of the panel. The centre lines of relays, meters and recorders shall be not less than 450mm from the bottom of the panel.

The centre lines of switches, push buttons and indicating lamps shall be matched to give a neat and uniform appearance. Likewise the top lines. of all meters, relays and recorders etc. shall be matched.

No equipment shall be mounted on the doors. At existing stations panels shall be matched with other panels in the control room in respect of dimensions, colour, appearance and arrangement of equipment (centre lines of switches, push buttons and other equipment) on the front of the panel.

5.4 Panel internal Wiring

Panels shall be supplied complete with interconnecting wiring provided between all electrical devices mounted and wired in the panels and between the devices and terminal blocks for the devices to be connectedto equipment outside the panels. When panels are arranged to be located adjacent to each other all inter panel wiring and connections between the panels shall be furnished and the wiring shall be carried out internally, this is in the BA's scope.

All wiring shall be carried out with 1100V grade, single core, stranded copper conductor wires with PVC insulation. The minimum size of the multi-stranded copper conductor used for internal wiring shall be as follows:

Internal wiring to be connected to external equipment shall terminate on terminal blocks.

The terminal blocks for CTs VT's shall be provided with test links and isolating facilities, The CT terminal blocks shall be provided with short circuiting and earthing facilities.

Shall have 20% terminals as spare terminals in each panel. All equipment mounted on front of the panels shall have individual name-plates with equipment designation engraved. Each panel shall also have circuit/feeder designation name plate.

All wiring shall be with 1100 V grade, single core, PVC insulated stranded copper conductor.

Wires shall be vermin proof. Minimum size of conductor shall be 2.5 sq. mm in general, but for CT & VTcircuits it shall be 4 sq.mm.

Contractor shall be solely responsible for completeness and correctness of all the wiring, and for proper functioning of the connected equipment.

Specification for Auxiliary relays /MCB's

- Fuse Failure relay and trip Circuit Supervision relay shall be suitably selected, considering

burdenand auxiliary voltage. External circuitry like compensating resistances will not be accepted.

- Auxiliary contact multiplier relays should be of reputed make and selected on the basis of continuous current carrying capacity and rated voltage. The fluctuation in voltage level must be accounted for (+/-) 10% continuously.
- DC MCB's should not be substituted by AC MCB's for DC-Distribution, irrespective ofmanufacturer's individual multi usage Recommendations.
- DC Fail Supervision relay (80) shall be provided on all control and IED panels.

Spare I/Os wiring shall be brought upto terminal block for future use.

All internal wiring shall be securely supported, neatly arranged, readily accessible and connected to equipment terminals and terminal blocks. Wiring gutters & troughs shall be used for this purpose. Auxiliary bus wiring for AC and DC supplies, voltage transformer circuits, annunciation circuits and other common services shall be provided near the top of the panels running throughout the entire length of the panels.

Wire termination shall be made with solder less crimping type and tinned copper lugs, which firmly grip the conductor. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wire and shall not fall off when the wire is disconnected from terminal blocks. All wires directly connected to trip circuit breaker or device shall be distinguished by the addition of red coloured unlettered ferrule .

Longitudinal troughs extending throughout the run length of the panel shall he preferred for inter panel wiring. Inter-connections to adjacent panel shall be brought out to a separate set of terminal blocks located near the slots of holes meant for taking the inter-connecting wires

BA shall be solely responsible for the completeness and correctness of the internal wiring and for the proper functioning of the connected equipment.

5.5 Terminal Blocks

All internal wiring to be connected to external equipment shall terminate on terminal blocks. Terminal blocks shall be 11..00 V grade and have 10 Amps. Continuous rating, moulded piece, complete with insulated barriers, stud type terminals, washers, nuts and lock nuts. Markings on the terminal blocks shall correspond towire number and terminal numbers on the wiring diagrams. All terminal blocks shall have shrouding with transparent unbreakable material.

Disconnecting type terminal blocks for AC/DC, current transformer and voltage transformer secondary leads shall be provided. Also current transformer secondary leads shall be provided with short circuiting and earthing facilities.

At least 20% spare terminals shall be provided on each panel and these spare terminals shall be uniformlydistributed on all terminal blocks.

Unless otherwise specified, terminal blocks shall be suitable for connecting the following conductors of external cable on each side

- All CT &PT circuits: minimum of two of 4 sq. mm copper.
- AC/DC Power Supply Circuits: One of 6 sq. mm Copper.
- All other circuits: minimum of one of 2.5 sq. mm Copper.

There shall be a minimum clearance of 250 mm between the f irst row of terminal blocks and the associatedcable gland plate or panel side wall. Also the clearance between two rows of terminal blacks edges shall be minimum of 150mm.

Arrangement of the terminal block assemblies and the wiring channel within the enclosure shall be such that arow of terminal blocks is run in parallel and close proximity along each side of the wiring-duct to provide for convenient attachment of internal panel wiring. The side of the terminal block opposite the wiring duct shall he reserved for the Owner's external cable connections. All adjacent terminal blocks shall also share this field wiring corridor. All wiring shall be provided with adequate support inside the panels to hold them f irmly and to enable free and f lexible termination without causing strain on terminals.

The number and sizes of the TPCODL/TPNODL/TPSODL/TPWODL s multi core incoming external cables will be furnished to the BA after placement of the order. All necessary cable terminating accessories such as gland plates, supporting clamps & brackets, wiring troughs and gutters etc. (except glands & lugs) for external cables shall be included the scope of supply.

5.6 Painting

All sheet steel work shall be phosphate in accordance with the IS: 6005 "Code of practice for phosphate iron and steel". It should follow the seven tank process. Oil, grease, dirt and swarf shall be thoroughly removed by emulsion cleaning. Rust and scale shall he removed by pickling with. dilute acid followed by washing with running water rinsing with a slightly alkaline hot water and drying. After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying. The phosphate coating shall be sealed with application of two coats of ready mixed, staved type zinc chromate primer. The f irst coat may be "flash dried" while the second coat shall be staved. Thereafter an established painting procedure like electrostatic painting followed for powder coating the panel. The colour shade shall be Siemens grey RAL 7032.

5.7 Miscellaneous Accessories

Plug Point: 24011, Single phase 50Hz, AC socket with switch suitable to accept 5 Amps and 15Amps pinround standard Iridian plug, shall be provided in the interior of each cubicle with ON-OFF switch.

Interior Lighting: Each panel shall be provided with an LED: lighting fixture rated for 240 Volts, single phase, 50 Hz supply for the interior illumination of the panel controlled by the respective panel door switch.

Switches and Fuses: Each panel shall be provided with necessary arrangements for receiving, distributing and isolating of DC and AC supplies for various control, signaling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with miniature circuit breakers (MCB). Selection of the main and sub-circuit MCB rating shall be such as to ensure selective clearance of sub-circuit faults. MCBs shall confirm to IS: 13947. Each IVICB shall be provided with one potential free contact and thesame shall be wired for annunciation purpose. However voltage transformer circuits for relaying and metering shall be protected by fuses. All fuses shall he HRC cartridge type conforming to IS: 13703 mounted on plug-in type fuse bases.. Fuse carrier base as well as MCBs shall have imprints of the fuse `rating' and 'voltage'.

Space Heater: Each panel shall be provided with a space heater rated for 240V, single phase, 50 Hz Ac supply for the internal heating of the panel to prevent condensation of moisture. The fittings shall be complete with switch unit.

5.8 Earthing: All panels shall be equipped with an earth bus securely fixed. Location of earth bus shall ensure no radiation interference for earth systems under various switching conditions of isolators and breakers. The material and the sizes of the bus bar shall be at least 25 X 6 sq. .mm perforated copper with threaded holes at agap of 50mm with a provision of bolts and nuts for connection with cable armors and mounted equipment etc for effective earthing, When several panels are Mounted adjoining each other, the earth bus shall be made continuous and necessary connectors and clamps for this purpose shall be included in the scope of supply of the Contractor. Provision shall he made for extending the earth bus bars to future adjoining panels on either side.

Provision shall be made on each bus bar of the end panels for connecting Substation earthing grid. Necessary terminal clamps and connectors for this purpose shall be included in the scope of supply of BA.

All metallic cases of relays, instruments and other panel mounted equipment including gland plate, shall be connected to the earth bus by copper wires of size not less than 2.5 sq, mm. The colour code of earthing wires shall he green.

Looping of earth connections, which would result in loss of earth connection to other devices when the loop is broker, shall not be permitted. However, looping of earth connections between equipment to provide alternative paths to earth bus shall he provided.

VT and CT secondary neutral or common lead shall be earthed at one place only at the terminal blocks wherethey enter the panel. Such earthing shall be made through l inks so that earthing may be r emov ed from one group without disturbing continuity of earthing system for other groups.

5.9 Switches

Control and instrument switches shall be rotary operated type with escutcheon plates clearly marked to show operating position and circuit designation plates and suitable for f lush mounting with only switch front plate and operating handle projecting out.

The selection of operating handles for the different types of switches shall be as follows:

- Breaker, Isolator: Pistol grip, black control switches
- Selector switches: Oval or knob, black
- Instrument switches: Round, knurled, black

The control switch of breaker and isolator shall be of spring return to neutral type. The switch shall have spring return from close and trip positions to "after close" and "after trip" positions respectively.

Instrument selection switches shall be of maintained contact (stay put) type. Ammeter selection switches shall have make-before-break type contacts so as to prevent open circuiting of CT secondary when changing the position of the switch. Voltmeter transfer switches for AC shall be suitable for reading all line- to-line and line-to-neutral voltages for non-effectively earthed systems and for reading all line to line voltages for effectively earthed systems.

Lockable type of switches which can be locked In particular positions shall be provided when specified. The key locks shall be fitted on the operating handles.

The contacts of all switches shall preferably open and close with snap action to minimize arcing. Contacts ofswitches shall he spring assisted and contact faces shall be with rivets of pure silver or silver alloy. Springs shall not be used as current carrying parts

The contact combination and their operation shall be such as to give completeness to the interlock and function of the scheme.

The contact rating of the switches shall be as follows:

Description	24 VDC	48 VDC	240 VAC
Make and Carry	10	10	10
Continuously Make and Carry for 0/5 Sec	30	30	30
Break for resistive Load	3	20	7
Inductive Load for L/R=40ms	0.2		

5.10 Indicating Lamps

Indicating lamps shall he of cluster LED type suitable for panel mounting with rear terminal connections. Lamps shall be provided with series connected resistors preferably built in the lamp assembly. Lamps shall have translucent lamp covers to diffuse lights colored red, green, amber, dear white or blue as specified The lamp cover shall be preferably of screwed type, unbreakable and moulded from heat resisting material.

The lamps shall be provided with suitable resistors. Lamps and lenses shall be interchangeable and easily replaceable from the front of the panel. Tools, if required for replacing the bulbs and lensesshall also be included in the scope of the supply.

The indicating lamps with resistors shall withstand 120% of rated voltage on a continuous basis.

Colour Coding:

CB Open : Green, CB Closed : Red, Auto Trip: Amber, Spring Charge: , etc

5.11 Dust Proof Environment

All the panels in the control room and switchgear room have to be in a dust proof environment. Civilworks have to be taken care in the same directions.

6. MARKING

All equipment mounted on front and rear side as well as equipment mounted inside t he panels shall be provided with individual name plat es with equipment designation engraved. Also on the top of each panel on front as well as rear side, large and bold nameplates shall be provided for circuit/feeder designation.

All front mounted equipment shall also be provided at the rear with individual name plates engraved with tag numbers corresponding to the one shown in the panel internal wiring to facilitate easy tracing of the wiring.

Each IED and meter shall be prominently marked. All relays- and other devices shall be clearly marked withmanufacturer' s name, manufacturer's type, serial number and electrical rating data.

Name Plates shall be made of anodized aluminium. Name plates shall be black with white engraving lettering. Each switch shall bear clear inscription identifying its function e.g. 'BREAKER"52A', "SYNCHRONISING" etc. Similar inscription shall also be provided on each device whose function is not other-wise identified. If any switch device does not bear this inscription separate name plate giving its function shall be provided for it. Switch shall also have clear inscription for each position indication e.g. "Trip- Neutral-Close", "ON-OFF% "R-Y-B-OFF" etc.

All the panels shall be provided with name plate mounted inside the panel bearing PO No & Date, Name ofthe Substation & feeder and reference drawing number,

7. TESTS

Factory Acceptance Test:

The manufacturing phase of the C&R Panel shall be concluded by the factory acceptance test (FAT). The purpose is to ensure that the Contractor has interpreted the specified requirements correctly and that the FAT includes checking to the degree required by the user. The general philosophy shall be to deliver a system to site only after it has been thoroughly tested and its specified performance has been verified, as far as site conditions can be simulated in a test lab. If the FAT comprises only a certain portion of the system for practical reason, [ED Configuration and Database shall be prepared completely as per actual site requirement and it will submit to TPCODL/TPNODL/TPSODL/TPWODL for validation. An integrated-FAT shall be conducted as per the TPCODL/TPNODL/TPSODL/TPWODL Guidelines. If the complete system consists of parts from various suppliers or some parts are already installed on site, in such case supplier will arrange the intra-communication between RTLVDC and such IEDs to meet the requirement.

Hardware Integration Tests shall be performed on the specified systems to be used for Factory tests when the hardware has been installed in the factory. The operation of each item shall be verified as an integral partof system. Applicable hardware diagnostics shall be used to verify that each hardware component is completely operational and assembled into a configuration capable of supporting software integration and factory testing of the system. The equipment expansion capability shall also be verified during the hardware integration tests.

Integrated System Tests shall verify the stability of the hardware and the software. During the tests all functions shall run concurrently and all equipment shall operate a continuous 100 Hours period. The integrated system test shall ensure the IEDs is free of improper interactions between software and hardwarewhile the system is operating as a whole.

8.0 Type test Certificate

Test reports for following type tests shall be submitted for the Protection IED along with the Bid

Tests must be done from CPRI/ERDA/KEMA/CESI/Reputed International Labs.

		S. No.	Description	Standard
8.1	Insulation test	1	Dielectric Withstand Test	IEC 60255-5
				ANSI/IEEE C37.90-1989
				2kV rms for 1 minute between all case terminals connected together and the case earth

				2kV rms for 1 minute between all terminals of independent circuits with terminals on each independent circuit connected together.
				1KV rms for 1 min across the open contacts of the witchdog IED
				1KV rmsfor Minute across open contacts of the changeover output IEDs
				1.5KV rms for 1 minute across open contacts of normally open output IEDs
		2	High Voltage Impulse Test,class III	IEC 60255-5
				5kV peak; 1.2/50 sec; 0.5J; 3 positive and 3 negative shots at intervals of 5s
8.2	Electrical Environment Tests	1	DC Supply Interruption	IEC 60255-11
				The unit will withstand a 20ms interruption in the auxiliary supply, in its quiescent state, Without de-energizing.
		2	AC Ripple on DC supply	IEC 60255-11The unit will withstand a 12% ac ripple on the dc supply.
		3	AC voltage dips and short Interruptions	IEC 61000-4-11 20ms
				interruptions/dips.
		4	High Frequency Disturbance	IEC 60255 22 1, class III
				At 1MHz, for 2s with 200 ohms source impedance:2.5kV peak; 1 MHz; T = 15 sec; 400
				shots/sec;duration 2 sec between independent circuits and independent circuits and case earth. 1.0kV peak across terminals of the same circuit.
		5	Fast Transient Disturbance	IEC 60255-22-4, class IV
				4kV, 2.5kHz applied directly to auxiliary supply 4kV, 2.5kHz applied to all inputs.
		6	Surge Withstand Capability	IEEE/ANSI C37.90.1 (1989)
				4kV fast transient and 2.5kV oscillatory applied directly across each output contact, optically isolated input and power supply circuit.
		7	Radiated Immunity	C37.90.2: 1995
				25MHz to 1000MHz, zero and 100% square wave modulated. Field strength of 35V/m.
		8	Electrostatic Discharge	IEC 60255-22-2 Class 4
				15kV discharge in air to user interface, display and exposed metal work.
				IEC 60255-22-2 Class 3

				8kV discharge in air to all communication ports. 6kV point contact discharge to any part of the front of the product.
		9	Surge Immunity	IEC 61000-4-5: 1995 Level 4
				4kV peak, 1.2/50ms between all groups and case earth.
				2kV peak, 1.2/50ms between terminals of each group.
		10	Capacitor Discharge	No change of state or any operation shall occur when a capacitor of capacitance shown below, charged to 1.5 Vn volts, is connected between any combination of terminals and any combination of terminals and ground.
				Master trip circuits - 10 F Other protection & control circuits - 2 F
				Carrier/channel interface - 0,2 F
8.3	EMC Test	1	Radio- Frequency Electromagneti c Field, Non-Modulated	IEC 60255 22 2, class III
				10 V/m; 27 MHz to 500 MHz
		2	Radio- Frequency Electromagnetic Field, Amplitude Modulated	ENV 50140, class III
				10 V/m; 80 MHz to 1000 MHz;
				80% AM; 1 kHz
		3	Radio- Frequency Electromagneti c Field, Pulse Modulated	ENV 50140/ENV 50204
				10 V/m; 900 MHz; repetition frequency 200 Hz; duty cycle 50 %
		4	Disturbances Induced by Radio Frequency fields,Amplitude Modulated	ENV 50141, class III
				30 A/m continuous; 300 A/m
				for 3 sec; 50 Hz
		5	Power Frequency Magnetic Field	EN 61000-4-8, class IV
				30 A/m continuous; 300 A/m
				for 3 sec; 50 Hz
		6	Interference Voltage,	EN 50081-*

			Aux.Voltage	150 kHz to 30 MHz
		7	Interference Field Strength	EN 50081-*
				30 MHz to 1000 MHz
8.4	Atmospheric Environment Test	1	Temperature	IEC 60255-6
				Operating 25 ^{o} C to +55 C
				Storage and transit 25 ^{o} C to
				+70 C
				IEC 60068-2-1 for Cold
				IEC 60068-2-2 for Dry heat
		2	Humidity	IEC 60068-2-3
				56 days at 93% RH and +40^{o}C
8.5	Mechanical Stress Test	1	Vibration (during Operation & Transportation)	IEC 255-21-1; IEC 68-2-6
				Response Class 2
				Endurance Class 2
		2	Shock (during Operation and Transportation)	IEC 255-21-2, class 1, IEC 68-
				2-27 Shock response Class 2 Shock withstand Class 1 Bump Class 1
		3	Seismic Vibration (during Operation)	IEC 60255-21-3 Class 2
		4	Continuous Shock (during Transportation)	IEC 255-21-2, class 1, IEC 68-2-27

9. PRE DISPATCH INSPECTION

Equipment shall be subject to inspection by a duly authorized epresentative of the Purchaser as detailed at Clause No.6.0. 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.

Bidder shall grant free access to the places of manufacture to Purchaser's representatives at all times when thework is in progress. Inspection by the Purchaser or its authorized representatives shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specifications Material shall be dispatched after specific MDCC (Material Dispatch Clearance Certificate) is issued by the Purchaser.

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 / Warranty card
g) Delivery Challan
h) Other Documents (as applicable)

10. INSPECTION AFTER RECEIPT AT STORES

Equipment/material received at shall be inspected by Stores liable for rejection, if founddifferent from pre despach inspection report

One copy of the Inspection Report shall be sent to the Plant Engineering and Protection & Testing Departments.

11.GUARANTEE

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 Company up to a period of 60 months from the date of commissioning supplier shall be liable to undertake to replace/rectify such defects at his own costs within the mutually agreed timeframe, and to the entire satisfaction of the Company, failing which the Company will be at liberty to get it replaced/rectified at supplier's risks and costs and recover all such expenses plus the Company's own charges (@ 20% of expenses incurred), from the supplier or from the "Security cum Performance Deposit" as the case may be.

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 Company

12.PACKING

Bidder shall ensure that all equipment covered by this specification shall be prepared for rail/road transport (local equipment) and be packed in such a manner as to protect it from damage in transit.

13.TENDER SAMPLE : NA

14. TRAINING :

The successful Bidder shall provide training for relay configuration with goose messaging, data concentrator at supplier's works - 4 persons 3 days minimum to Owners Engineers before dispatch. Venue of the training shall be Bidders works or TPCODL/TPNODL/TPSODL/TPWODL Office and same shall be finalized by TPCODL/TPNODL/TPSODL/TPWODL at the time of project closure/completion of SAT. The training shall cover Engineering configuration of the IED. IED setting calculations, training However, lodging/boarding/transportation of trainees shall be borne by TPCODL/TPNODL/TPSODL/TPWODL.

Supplier per sonnel w ho are exp erienced instructor s and who speak understandable English shall conduct training. The Supplier shall arrange on its own cost all hardware training platform required for successful training and understanding in India at manufacturer' s work. The Supplier shall provide all necessary training material including configuration document in advance. Each trainee shall receive individual copies of all technical manuals and all other documents used for training. Class materials, including the documents sent before the training courses as well as class handouts, shall become the property of Employer. Employer reserves the right to copy such materials, but for in- house training and use only. Hands-on training shall utilize equipment identical to that being supplied to Employer. For all training courses, the travel (e.g., airfare) and per-diem expenses will borne by the participants. The schedule, location, and detailed contents of each course will be finalized during Employer and Supplier discussions.uploading/downloading, secondary injection testing on computerized IED testing kit, checking of DC logic etc. No extra charges shall be payable for

15.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 after finishing, bought out items and fully assembled component and equipment including drives. As part of the plan, a schedule for stage and final inspection within the parameters of the delivery schedule shall be furnished. The purchaser's engineer or its nominated representative shall have free access to the manufacturer/sub-supplier's works to carry out inspections.

16.MINIMUM TESTING FACILITIES

The Bidder shall have in house testing facilities for carrying outall routine tests and acceptance tests as per relevant international/Indian standards.

17.MANUFACTURING ACTIVITIES

The successful bidder will have to submit the bar chart for various Activities manufacturing activities clearly elaborating each stage, with quantity. This bar chart shall be in line with the Quality assurance plan submitted with the offer. The bar chart will have to be submitted within 15 days from the release of the order

18.SPARES, ACCESSORIES AND TOOLS of the order.

Bidder need to furnish the expected life of IEDs While submitting the Accessories and performance reports of the concerned IEDs. Bidders need to provide life cycle Tool support and supplies to ensure Necessary support in terms of services an d spares for next 15 years regarding discontinuation OEM must need to follow clauses 3.15 & 6 of IEC 51850-4. The example cases should be taken as reference.

Vendor need to provide life cycle support and supplies to ensure necessary support in terms of services and spares for next 15 years from date of Purchase Order. Vendor shall provide expected life of IEDs in writing.

Vendor shall conform to the following guideline to mitigate failure, To provide immediate support in case of failure of IED. The vendor shall always maintain 2 Nos. of IEDs as spare at their India office/ TPCODL/TPNODL/TPSODL/TPWODL Office.

- Vendor shall report to site within 48 hours of receipt of reporting of the failure occurrence.
- Vendor shall provide replacement of the faulty IEDs within 7 days after confirmation of the fact that the IED can' t be repaired at site.

- Vendor shall provide detailed root cause analysis report of the faulty IEDs within 30 days from the date of the IED receipt.
- Any spare IED replacement, testing and its commissioning to be done by vendor only without any cost implications. Any equipment, any software or any hardware to test the IEDs to be borne by vendor only.
- Any up gradation in application software and IED (except hardware) will be informed to us and necessary upgradation to be carried out by vendor without any cost implications.

Spares for Project job for New Grids/Bay Extension

Same MLFB No/ Order Code across 11kV Board including PU. BCPU MLFB No / Order Code shall remain same across 33kV/66kV Board.				
Relays for 11kV panels				
Total No. of (main & backup) relays in Panel board to be supplied	No. of Spare relays			
1-10	1			
11-20	2			
21-30	3			
31-40	4			
33kV/66kV panel				
No. of Panels	No. of Spare Relays			
	BCPU	Line PU	Transformer PU	
2 Line, 2 Trafo, 1 B/C	1	1	1	1
4 Line, 2 Trafo, 1 B/C	1	1	1	1
4 Line, 3 Trafo, 1 B/C	2	1	1	1
6 Line, 3 Trafo, 1 B/C	2	1	1	1
1 line, 1 Trafo, 1 B/C	1	1	1	1
2 line, 1 Trafo, 1 B/C	1	1	1	1

Master Trip Relay (86) common for 66kV/33kV and 11kV	
No. of relays in Panels	No. of Spare relays
1-10	1
11-20	2
21-30	3
31-40	4

Services to be included during tender

i. Tri- party agreement to be made to have protection against quitting of executing vendor.

ii. In case total failure of IEDs during the warranty period exceeds 20% of the installed quantity of respective type at a particular station then vendor to configure these as some latent defect and configure replacement of all IEDs in TPCODL/TPNODL/TPSODL/TPWODL

i, Preferably All the IEDs shall any external environmental its scope without any cost implication to have conformal coating to take care of polluting effect etc. TPCODL/TPNODL/TPSODL/TPWODL shall not be responsible if any such reason causes failure of cards/IEDs and each shall be vendor's responsibility to replace IED without any cost implication to TPCODL/TPNODL/TPSODL/TPWODL

19.DRAWINGS AND DOCUMENTS

Following drawings and documents shall be prepared on Purchaser's specifications and statutory requirements and shall be submitted with the bid:

1. Completely filled in Technical Particulars
2, General description of the equipment and all components including brochures
3. Bill of material
4. Type test certificates
5. Hardware Specification
6. Sizing Calculations of various component
7. Standard Drawings
8. ICD/C1D Cite (IED capability description file)
9. SCD file (substation configuration description)
10. MIB Files of IEDS

After the award of the contract four (4) copies of drawings, drawn to scale, describing the equipment in detail shall be forwarded for approval and shall subsequently provide four (4) complete sets of final drawings, one of which
shall be auto positive suitable for reproduction, before the dispatch of the equipment. Soft copy (Compact Disk CD) of all the drawing, GTP, Test certificates shall be submitted after the final approval of the same to purchaser.

All the documents & drawings shall be in English language.

Instruction Manuals Bidder shall furnish two softcopies (CD) and four (4) hard copies 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.

20. GUARANTEED TECHNICAL PARTICULARS
Bidder shall submit separate sheet showing compliances on all other clauses of the specification

21. SCHEDULE OF 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:

We confirm that there are no deviations apart from those detailed above.

S. No	Clause No.	Details of deviation with justifications

Seal of the Company: Signature Designation

STANDARD TECHNICAL SPECIFICATION COVER SHEET

Specification No. : ENG-LV-3004

Specification Name : 1.1kV ARMOURED CONTROL CABLES

JYOTIPRAKASH MOHANTY	SATYA PRASAD NAYAK	Vijender Goyal	SHANTAPRIYA JENA	ANUP JAWASE	VARUN BHATNAGAR
Prepared by	Reviewed by	Reviewed by	Reviewed by	Approved by	Released by
TPWODL	TPCODL	TPSODL	TPNODL	TPWODL	TPWODL
02-01-2023	03-01-2023	03-01-2023	03-01-2023	03-01-2023	04-01-2023

CONTENTS

1. SCOPE:

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 1.1kV FRLSH Armoured Control Cables for trouble free and efficient operation.

2. APPLICABLE STANDARDS:

The equipment covered by this specification shall unless otherwise stated, be designed, manufactured and tested in accordance with the latest editions of the following Indian, International Standards and shall conform to the regulations of the local authorities:

Ref IS/IEC	Description
IS-1554 (Part-I)	PVC insulated (heavy duty) electric cables
IS-8130:1984	Conductor for insulated electric cables & flexible cords
IS-5831:1984	PVC insulation and sheath of electric cables
IEC-60228/3-2004	Conductor of insulated cables
IEC 60332-1:1993	Flame retardant, characteristics of electrical cables.
IS-3975:1979	Mild steel wires strips and tapes for armoring cables.
IS:3961-(Part-2)	Recommended current ratings for cables
IS 10418: 1982	Drums for Electric Cables

3. CLIMATIC CONDITIONS OF THE INSTALLATION:

SL.NO.	CONDTIONS	VALUES
1	Max. altitude above sea level	1200m
2	Max. Ambient Temperature	50 °C
3	Max. Daily average ambient temp	35 °C
4	Min Ambient Temp	0 °C
5	Maximum temperature attainable by an object exposed to sun	60 °C
6	Maximum Humidity	95%
7	Minimum Humidity	10%
8	Average No. of thunderstorm days per annum	70
9	Average Annual Rainfall	150 cm

10	Average No. of rainy days per annum	120
11	Thermal Resistivity of soil	150 Deg. Ccm/W
12	Wind Pressure	126 kg/sq. m up to an elevation of 10 meter.
14	Earthquakes of intensity in horizontal direction	equivalent to seismic acceleration of 0.3g
15	Earthquakes of intensity in vertical direction	equivalent to seismic acceleration of 0.15g
16	Wind velocity	300 km/hr.

Environmentally, some of the regions, where the work will take place include coastal areas, subject to high relative humidity, which can give rise to condensation. Onshore winds will frequently be salt laden. On occasions, the combination of salt and condensation may create pollution conditions for outdoor insulators. Some places are in heavily industrial polluted areas. Therefore, Outdoor material and equipment shall be designed and protected for use in exposed, heavily polluted,salty, corrosive and humid coastal atmosphere. The atmosphere is generally laden with mild acid and dust in suspension during thedry months and is subjected to fog in cold months. The design of equipment and accessories shall be suitable to withstand seismic forces as mentioned above.

4. GENERAL TECHNICAL REQUIREMENTS:

Sr. No	General Technical Particulars	UNITS	DESIRED VALUE			
1	Reference Standard		IS:1554, Part-1/1988 in General			
2	Voltage grade		1.1 KV			
3	Type of cable		Control Cable			
A	**Size of cable**	**sq.mm**	**4CX2.5**	**7CX2.5**	**10CX2.5**	**12CX2.5**
1	**Conductor**					
a.	Conductor Material		Plain Annealed Copper	Plain Annealed Copper	Plain Annealed Copper	Plain Annealed Copper
b.	No. of cores	Nos.	4	7	10	12
c.	Size of conductor	sq.mm.	2.5	2.5	2.5	2.5
d.	Shape of conductor		Multi Stranded circular	Multi Stranded circular	Multi Stranded circular	Multi Stranded circular

Sr. No	General Technical Particulars	UNITS	DESIRED VALUE			
e.	No. & diameter of each wire in conductor		Minimum size shall be corresponding to meet the requirement of conductor resistance as per relevant clause of IS:8130-1984	Minimum size shall be corresponding to meet the requirement of conductor resistance as per relevant clause of IS:8130-1984	Minimum size shall be corresponding to meet the requirement of conductor resistance as per relevant clause of IS:8130-1984	Minimum size shall be corresponding to meet the requirement of conductor resistance as per relevant clause of IS:8130-1984
2	**Insulation**					
a.	Material		PVC insulation conforming to type C as per IS: 5831:1984 applied by extrusion process	PVC insulation conforming to type C as per IS: 5831:1984 applied by extrusion process	PVC insulation conforming to type C as per IS: 5831:1984 applied by extrusion process	PVC insulation conforming to type C as per IS: 5831:1984 applied by extrusion process
b.	Nominal thickness	mm	0.9	0.9	0.9	0.9
c.	Core identification		Red, Yellow, Blue & Black	All cores white with core numbers printed in black ink as per clause 10.3 of IS:1554(Part-I)/1988	All cores white with core numbers printed in black ink as per clause 10.3 of IS:1554(Part - I)/1988	All cores white with core numbers printed in black ink as per clause 10.3 of IS:1554(Part-I)/1988
3	**Inner sheath**					
a.	Material		PVC conforming to type ST-2 as per IS:5831-1984	PVC conforming to type ST-2 as per IS:5831-1984	PVC conforming to type ST-2 as per IS:5831-1984	PVC conforming to type ST-2 as per IS:5831-1984
b.	Minimum thickness (at any point of measurement)	mm	0.3	0.3	0.3	0.3
4	**Armour**					
a.	Material		Galvanized Steel round wire confirming to IS:3975-1999	Galvanized Steel round wire confirming to IS:3975-1999	Galvanized Steel round wire confirming to IS:3975-1999	Galvanized Steel round wire confirming to IS:3975-1999

Sr. No	General Technical Particulars	UNITS	DESIRED VALUE			
b.	Nominal Diameter	mm	1.4	1.4	1.6	1.6
c.	Type		Wire	Wire	Wire	Wire
5	**Outer Sheath**					
a.	Material		FRLSH PVC Type ST-2, extruded type as per IS:5831-1984 (With FRLSH Properties)	FRLSH PVC Type ST-2, extruded type as per IS:5831-1984 (With FRLSH Properties)	FRLSH PVC Type ST-2, extruded type as per IS:5831-1984 (With FRLSH Properties)	FRLSH PVC Type ST-2, extruded type as per IS:5831- 1984 (With FRLSH Properties)
b.	Color		Blue	Blue	Blue	Blue
c.	Minimum thickness (at any point of measurement)	mm	1.24	1.24	1.4	1.4
6	**Diameter**					
a.	Approx. overall diameter	mm	17	20	22	25
b.	Tolerance of diameter	mm	±3	±3	±3	±3
7	Short circuit capacity for one second	kA	0.2875	0.2875	0.2875	0.2875
8	Approx. Weight of cable	Kg/km	600	750	1100	1200
9	Standard length of cable drum with tolerance	m	500±5% / 1000±5%	500±5% / 1000±5%	500±5% / 1000±5%	500±5% / 1000±5%
10	Allowable conductor temperature at continuous current	ºC	85	85	85	85
11	Allowable conductor temperature during short circuit	ºC	160	160	160	160
12	Max. DC resistance at 20ºC – Main	Ohm/km	7.41	7.41	7.41	7.41
13	Max. AC resistance at max. Operating temp.	Ohm/km	8.89	8.89	8.89	8.89
14	Guaranteed value of min oxygen index at 27ºC	%	29	29	29	29
15	Guaranteed value of min. temp. index	ºC	250	250	250	250
16	Smoke Density Rating		Max. average 60 SDR	Max. average 60 SDR	Max. average 60 SDR	Max. average 60 SDR

5. GENERAL CONSTRUCTION:

i) The PVC Insulated Cable shall be manufactured and tested strictly in accordance with the IndianStandard IS 1554 (Part – I):1988 and its latest amendments.

ii) All material used in the manufacturing of cables shall be new and shall be selected as the bestavailable for the intended use and shall withstand the requirement of following tests:

- Tensile test & Wrapping test
- Annealing test (for copper)

iii) 1.1 kV stranded copper conductor, PVC Insulated type-C, extruded PVC inner sheath, galvanizedround wire armoured, extruded outer sheathed FRLSH type cable conforming to IS:1554 (Part-I) with latest amendment. Overall outer sheath in blue color.

5.1 ARMOURING

The armouring shall be with galvanized steel wires for multi core cables. The galvanized steel wiresshall comply with the requirements of IS: 3975 with latest amendments

5.2 OUTER SHEATH:

The Outer Sheath shall be of polyvinyl chloride (PVC) compound confirming to the requirements of Type ST2 of IS: 5831 with FRLSH properties with latest amendments. The outer sheath shall be applied by extrusion process.

The thickness of the outer sheath shall be as per IS: 1554(Part – I). No tolerance on the negative side shall be acceptable

5.3 CORE IDENTIFICATION:

Individual core of multi-core cable shall be colour-coded and/or numbered for proper identification in accordance with relevant IS/manufacturer's standard.

5.4 REELS/DRUMS:

Cables shall be supplied in the wooden drums in specified length. Wooden drums shall be strong, weatherproof, and non-returnable. The ends of the cable shall be sealed by means of non-hygroscopic sealing material as per PO terms and conditions.

6. MARKING:

Wooden drums shall be of good quality. It shall be free from any damages & sharp edges of nails/ hardware inside the drums. A protective covering of polymeric sheet shall be applied inside the drum before winding the cable on the drum.

I. **The drum shall carry the following information stenciled on both sides of the drum:**

a) Manufacturer's name
b) Type of Cable
c) Size of Cable
d) Voltage Grade
e) Length of the cable on the drum
f) Direction of the rotation of the drum
g) Gross mass
h) Country of manufacture
i) Year and month of manufacturing
j) Purchase Order no.
k) Drum No.

II. **Following details shall be embossed on the outer sheath of the Cable at regular intervals every meters**

i) Manufacturer's name
ii) Voltage grade
iii) Number of cores, size, type
iv) FRLSH
v) TPCODL/TPNODL/TPSODL/TPWODL
vi) ISI Mark
vii) PO Number
viii) Material code
ix) Year of manufacturing
x) Sequential length marking shall be provided on the outer sheath of the cable byprinting

7. TESTS:

The bidder shall be required to submit complete set of the following test reports along with theoffer: -

7.1 ACCEPTANCE TESTS

i) Tensile Test
ii) Annealing test (for copper)
iii) Wrapping Test
iv) Conductor Resistance Test
v) Test for thickness of insulation and sheath

vi) Tensile strength and elongation at break test for insulation and sheath

vii) High Voltage test at room temperature

viii) Insulation resistance test

7.2 ROUTINE TESTS

i) Conductor Resistance test.

ii) High Voltage test at room temperature

7.3 TYPE TESTS

a) Tests on Conductor

- Conductor resistance test

b) Test for round steel wires/armouring wires

c) Test for thickness of insulation and sheath (outer and inner)

d) Physical tests for insulation & outer sheath

- Tensile strength and elongation at break
- Ageing in air oven
- Hot deformation
- Shrinkage test
- Loss of mass in air oven
- Heat shock test
- Thermal stability

e) Insulation Resistance test

f) High voltage test (water immersion test) – AC & DC

g) High voltage test at room temperature

h) Flammability test

8. TYPE TEST CERTIFICATES:

The Bidder shall furnish the type test certificates for the tests as mentioned above as per the corresponding standards. All the tests shall be conducted at **CPRI / ERDA/ Approved Govt. Labs by TATA ODISHA DISCOM** as per relevant IS. Type tests should have been conducted during the period not exceeding 10 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, same shall be carried out without any cost implication to TPCODL/TPNODL/TPSODL/TPWODL.

9. PRE-DISPATCH INSPECTION:

The material 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 discretion of the purchaser and the equipment, if found unsatisfactory as to workmanship or material, the same is liable to rejection. 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. Inspection by the TPCODL/TPNODL/TPSODL/TPWODL or its authorized representatives shall not relieve the bidder of his obligation of furnishing equipment in accordance with the specifications. 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) TPCODL/TPNODL/TPSODL/TPWODL Invoice in duplicate
d) Packing list
e) Drawings & catalogue
f) Guarantee / Warrantee card
g) Delivery Challan
h) Other Documents (as applicable).

10. INSPECTION AFTER RECEIPT AT STORE:

The material received at TPCODL/TPNODL/TPSODL/TPWODL, Odisha store will be inspected for acceptance and shall be liable for rejection, if found different from the reports of the pre-dispatch inspection and one copyof the report shall be sent to Engineering department.

11. GUARANTEE:

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 Company up to a period of 60 months from the date of commissioning or 72 months from the date of last supplies made under the contract, whichever is earlier, supplier 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 Company, failing which the Company will be at liberty to get it replaced/rectified at supplier's risks and costs and recover all such expenses plus the Company's own charges (@ 20% of expenses incurred), from the supplier or from the "Security cum Performance Deposit" as

the case may be.

12. PACKING:

The cable shall be wound on strong weatherproof and non-returnable wooden drums packed in coil lengths of 500 meters/1000 meters in line with the requirement of IS 10418 — 1982 and its latest amendments. The ends of the cable shall be sealed by means of non-hygroscopic sealing material.

Bidder shall ensure that cable covered under this specification shall be prepared for rail/roadtransport in a manner so as to protect the equipment from damage in transit.

13. TENDER SAMPLE:

Bidders shall have to submit the sample of material (1 meter length) with the offer to TPCODL/TPNODL/TPSODL/TPWODL.

14. QUALITY CONTROL:

The bidder shall submit QAP 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. The Purchaser's engineer or its nominated representative shall have free access tothe manufacturer's/sub-supplier's works to carry out inspections.

15. TESTING FACILITIES:

Supplier/ Manufacturer shall have adequate in-house testing facilities for carrying out all routine tests & acceptance tests as per relevant Indian standards.

16. MANUFACTURING FACILITIES:

The successful bidder shall submit the bar chart for various manufacturing activities clearly elaborating each stage, with quantity. This bar chart should be in line with the Quality assurance plan submitted with the offer.

17. SPARES, ACCESSORIES AND TOOLS

Not applicable.

18. DRAWINGS AND DOCUMENTS:

Drawings and documents shall be submitted in line with the requirement of Tender specifications:

a) Completely filled in Schedule "A" Guaranteed Technical Particulars & Schedule "B" Deviations

b) Work Experience details

c) Type test certificates.

d) Drawing 1 set of Hard Copy & Soft copy PDF File containing complete information aboutmanufacturing.

19. SCHEDULE- "A" GUARANTEED TECHNICAL PARTICULARS:

Sr. No	General Technical Particulars	UNITS	To Be Furnished by the Bidder			
1	Reference Standard					
2	Voltage grade					
3	Type of cable					
A	**Size of cable**	**sq.mm**	**4C*2.5**	**7C*2.5**	**10C*2.5**	**12C*2.5**
1	**Conductor**					
a.	Conductor Material					
b.	No. of cores	Nos.				
c.	Size of conductor	sq.mm.				
d.	Shape of conductor					
e.	No. & diameter of each wire in conductor					
2	**Insulation**					
a.	Material					
b.	Nominal thickness	mm				
c.	Core identification					
3	**Inner sheath**					
a.	Material					
b.	Minimum thickness (at any point of measurement)	mm				
4	**Armour**					
a.	Material					
b.	Nominal Diameter	mm				
c.	Type					
5	**Outer Sheath**					
a.	Material					
b.	Color					
c.	Minimum thickness (at any point of measurement)	mm				
6	**Diameter**					
a.	Approx. overall diameter	mm				
b.	Tolerance of diameter	mm				
7	Short circuit capacity for one second	kA				
8	Approx. Weight of cable	Kg/km				
9	Standard length of cable drum with tolerance	m				
10	Allowable conductor temperature at continuous current	ºC				

Sr. No	General Technical Particulars	UNITS	To Be Furnished by the Bidder			
11	Allowable conductor temperature during short circuit	ºC				
12	Max. DC resistance at 20ºC – Main	Ohm/km				
13	Max. AC resistance at max. Operating temp.	Ohm/km				
14	Guaranteed value of min oxygen index at 27ºC	%				
15	Guaranteed value of min. temp. index at 21 oxygen index	ºC				
16	Smoke Density Rating					

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 thisschedule. 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-LV-3021-R-01

Specification Name : SPECIFICATION FOR 415V ACDB

Revision	Prepared by	Reviewed by	Reviewed by	Reviewed by	Approved by	Released by
R-01	Jyoti Ranjan Sahu	SATYA PRASAD NAYAK	JYOTIPRAKASH MOHANTY	SHANTAPRIYA JENA	Shailendra Kumar Jaiswal	SHIRISH SHARAD DIKAY
	TPSODL	TPCODL	TPWODL	TPNODL	TPSODL	TPSODL
	09-03-2023	09-03-2023	09-03-2023	13-03-2023	15-03-2023	24-03-2023
ENG-LV-3021	Jyoti Ranjan Sahu	SATYA PRASAD NAYAK	JYOTIPRAKASH MOHANTY	SHANTAPRIYA JENA	Shailendra Kumar Jaiswal	Shirish Sharad Dikay
	TPSODL	TPCODL	TPWODL	TPNODL	TPSODL	TPSODL
	04-02-2023	04-02-2023	04-02-2023	06-02-2023	06-02-2023	07-02-2023

CONTENTS

1.0 SCOPE

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 415Volts ACDB with all accessories and necessary training for trouble free & efficient performance. It is not the intent to specify completely herein all the details of tech design and construction of material. However, the material shall conform to practices consistent with sound environmental management and local statues. It is also expected that equipment shall comply in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation in manner acceptable to the TPCODL/TPNODL/TPSODLTPWODL, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance therewith. The offered material shall be complete with all components necessary for their effective and trouble-free operation. Such components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in this specification and/or the commercial order or not.

2.0 APPLICABLE STANDARDS

The equipment covers by this specification shall unless otherwise stated, be designed, manufactured & tested in accordance with the latest edition of the following standards /IEC and shall conform to the regulation of local statutory authorities.

a)	IS 13947 / IEC 60947	:	Specification for Low voltage Switchgear and Control gear
b)	IS 2705	:	Current transformer
c)	IS 694-1990	:	PVC insulated cables for working voltage upto and including 1100V
d)	IS 2629-1985	:	Recommended practice for Hot Dip Galvanizing of Iron & Steel.
e)	IS 2633-1986	:	Tests for uniformity of zinc coating
f)	IS 5578-1984	:	Guide for marking of insulated conductors
g)	IS 11353-1985	:	Guide for uniform system of marking and identification of conductors and apparatus terminals.
h)	IEC 60060	:	High-voltage test techniques
i)	IEC 61010-1	:	Safety requirement for electrical equipment for measurement and laboratory use.
j)	IEC 62052–11	:	Electricity metering equipment (a.c.) – General requirements, tests and test conditions
k)	IEC 62053–22	:	Static meters for active energy (Class 0.2 S and 0.5 S)
l)	IS 14697	:	AC Static Transformer Operated Watt-hour and Var-hour Meters, Class 0.2S and 0.5 S - Specification
m)	IS 12063 / IEC 60529	:	Classification of degrees of protection provided by enclosures of electrical equipment
n)	IS 8623	:	Specification for Low-Voltage Switchgear and Control gear Assemblies
o)	IEC 60664	:	Insulation co-ordination within low voltage systems including clearances & creepage distances for equipment.
p)	IS 14772-2000	:	General requirements for enclosures for accessories for household and similar fixed electrical installation.

3.0 CLIMATIC CONDITIONS OF THE INSTALLATION:

The material shall be suitable for following 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	150cm
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 up to 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.

4.0 GENERAL TECHNICAL REQUIREMENTS

Sl no	Description	Requirement
4.1	Switchgear Panel	
4.1.1	Architecture	Metal-clad air insulated
4.1.2	Normal Service condition	Indoor
4.1.3	No of phases	Three
4.1.4	Rated Voltage	415
4.1.5	Rated Frequency	50 Hz
4.1.6	Rated Impulse withstand Voltage	8 kVP
4.1.7	Rated insulation voltage	690 V
4.1.8	Main Bus Bar Continuous rated current	400A
4.1.9	Busbar Material & Current Density	Aluminium, 1.0A/Sqmm
4.1.10	Degree of protection for enclosure for meters	IP 54
4.1.11	Temperature Rise	The maximum permissible temperature rise for bus bar and terminals shall be 45 deg C & 65 deg C at an ambient temperature not exceeding 50 deg C

Sl no	Description	Requirement				
4.2	Item/ Panel Reference	Incomer	Outgoing			
4.2.1	Circuit Breaker Type/ Rating (A)	MCCB 250A (with rotary rod system for operation)	TPN MCCB 100A	63A	TPN MCB 32A	16A
4.2.2	Quantity (Nos.)	2 (out of which one will be Considered as spare)	1	2	4	16
4.2.3	Nos of Poles	3	3	3	3	2
4.2.4	Type of release	TMD as well as E/F Protection(CBCT)	Thermal Magnetic release (TMD)		Only Magnetic (only Short circuit)	
4.2.5	O/L Releases Setting	80%-100%				
4.2.6	Rated Voltage	400 V				230V
4.2.7	Rated Ultimate Short circuit breaking Capacity (Icu)	35 KA	10KA			10KA
4.2.8	Rated Service short circuit breaking capacity (Icu)	100% of Icu	50% of Icu		50% of Icu	
4.2.9	Utilization Category	C				
4.2.10	Rated Insulation Voltage	690V				500V
4.2.11	Rated Impulse withstand voltage	8kVp				6kVP
4.2.12	1.1KV Al, XLPE cables (sqmm)	4CX300/150 -	4CX50	4CX25	4CX25	2CX10
4.2.13	Cast Resin type CT (3 Nos/ Incomer) -ratio, Burden	400/5A 15VA, Cl-0.5S -	-	-	-	-
c)	For anti-condensation heaters	230V AC				
4.2.14	Metering	Multi-function meter (to be decided at the time of engineering)	Not required			
4.2.15	Panel illumination and space heating	To be provided by the bidder in each cable alley				
4.2.16	Feeder Description Name plate	To be provided by the bidder for each feeder.				
4.2.17	Make	MCCB- Siemens, L&T, ABB, C&S, Schneider, Havells MCB- Siemens, ABB, Legrand, Schneider, Havells				

5.0 GENERAL CONSTRUCTION

5.1 SWITCHGEAR

The switchgear panel shall be of sheet steel construction and shall be dust and vermin proof and shall be suitable for indoor installation. The panels shall be of Metal Clad compartmentalized, free standing, continuous from rear, modular type. The switchgear panels shall be rigid without using any external bracing. The switchboard panels should comply with relevant IS/IEC and revision thereof and shall be designed for easy operation maintenance and further extension. Bus bar, metering, circuit breaker chamber, cables and cable box chamber should have proper access for maintenance, proper interlocks should be provided. Metal enclosed switchgear shall be so designed that normal service, inspection and maintenance operations including visual checking of phase sequence, earthing of connected cables, locating of cable faults, voltage tests on connected cables can be carried out safely.

Panels shall have structural steel frame-work enclosed on all sides by CRCA sheet steel of minimum thickness as specified below:
Frame: 2 mm
Doors & Covers: 2 mm
Removable gland plate: 3 mm
Panels shall consist of a front portion with equipment mounted on it and wiring access from rear. All doors, cut-outs and removable covers shall be gasketed all round by neoprene cork gaskets. Each panel section shall be provided with thermostat-controlled space heater with ON/OFF switch. CFL Lamp shall be provided with door switch for each panel for cubicle interior illumination.
Panels shall be mounted and bolted to a common base channel of height 75mm. The channel in turn shall be fixed to the foundation bolts at site. All foundation equipment, anchor bolts etc. including the supporting channel shall be furnished by successful bidder in advance for completion of Civil Works prior to dispatch of panels. The bottom plates of the panels shall be fitted with removable gland plates of not less than 3mm in thickness, for fixing the cable glands, the size of which shall suit the purchaser's external cables to the panels.
Height of the panel should be limited to 2100mm. Each Indicating instruments and meters shall be at a suitable height so that the lettering on the dials can be easily read. Control switches/push buttons shall be conveniently located for ease of operation. The centre lines of the switches, push buttons and indicating lamps shall not be at a height more than 1800mm also shall not be less than 300mm that of the lowest unit. MCB with neutral link shall be provided at the panel for incoming AC supplies. Push buttons shall be made of non-hygroscopic material. All other insulators shall also be made of non-hygroscopic material.
All components of the same rating and construction which may be needed to be replaced shall be interchangeable. If there are removable parts with different ratings and if parts are interchangeable within the assembly of metal enclosed switchgear and control gear, any possible combination of removable and fixed parts shall withstand the rated insulation level specified for fixed parts concerned. While making the general arrangement, consideration will be given to the place of sectionalizing to select the location where the minimum electrical connections are transferred from one section to other section.
All the components of a module will be mounted on a component plate using machine screws and taped holes (except the components mounted on the door) to ensure vibration free operation. Circuit breakers shall be mounted such that they are accessible from the front of the panel. These components plates should be fixed with bolts for easy replacements. Standardization will be adopted while making these plates so that the component plates of the same size modules. can be changed from one module to other.
Interlocks between different components shall be provided for safety and ease of operation. The withdrawal or engagement of only incomer and bus coupler circuit breaker shall be impossible unless it is in open position. All instruments shall be non-draw-out type and safeguard in every respect from damages. The operation of a circuit breaker shall be impossible when it is in closed position. It shall be impossible to close the incoming and bus coupler circuit breaker in service position unless it is connected to auxiliary circuit.
The rear of the ACDB shall have bolted covers in sections except cable chamber. Single line diagram for power distribution and wiring diagram for power and control shall be provided inside the panel. All retaining catches, screws and bolts for doors and covers shall be hot dip galvanized screws and bolts shall be captive. All hardware for the complete equipment including foundation bolts, lifting lugs & cable termination lugs etc. shall be supplied along with the panels.
All LT design shall ensure conformity to IEC-60947. The supplier shall submit Type Test report from CPRI/ERDA to prove the above. Auxiliary and control equipment installed on the panel shall be suitably protected against disruptive discharge from main circuit. Buses shall be insulated with insulating sleeves, wherever bare conductor is employed. The switchgear panel shall withstand 50KA for 1 sec.
Degree of Protection for the enclosure shall be IP54 and that of partitions shall be IP4X. Compartment shall have its own front located, outward opening lockable hinged door with concealed hinges and bolted back cover. The door shall have interlocking facility with the MCCB or its handle such that the door can be opened only if the MCCB is in 'OFF' position. De- interlocking arrangement shall also be provided. Partitions of metal-clad switchgear and control gear shall be metallic and earthed.
Control supply in individual bay shall to be distributed through MCBS of suitable rating for individual control function like:
Trip Circuit (Only for U/CS & B/C)
Close Circuit (Only for I/Cs & B/C)
Spring charging circuit (Only for I/Cs & B/C)
Heating and Lighting Circuit

MCB shall be rated for 10kA short circuit rating. It shall be quick make, quick break, and independent manual type with trip free feature. MCB shall have the following:

Over current protection

ON/OFF Trip position Indicators Auxiliary contact block (Wherever required)
Wherever CB contacts are to be multiplied, latch type relay shall be used for contact multiplication. Auxiliary contact multiplier relays shall be reputed make and selected on the basis of continuous current carrying capacity and rated voltage. The fluctuation in voltage level shall be accounted for (+/-) 10% continuously.
Each switchgear panel shall have 20% spare terminals. All equipment mounted on front side of panel. shall have Individual nameplates with equipment designation engraved. The termination links for cables shall be segregated in vertical plane. The bidder shall deliver to site completely assembled, wired, tested panels and only the interconnecting cables shall be connected at site.
Cable entry arrangement shall be from bottom and suitable for 1.1KV XLPE armored external cables of sizes as mentioned in the specification. Removable CRCA gland plate of 3mm with cable holes to suit the cable sizes and with 2mm neoprene type gasket of non-inflammable and insulating vermin proof material shall be provided. A minimum distance of 250mm will be provided between the gland plate and the nearest terminal for proper dressing and termination of the cable.

5.2 Circuit Breaker

a) The circuit breaker shall be MCCB. The I/Cs and B/C MCCBS shall be strictly withdraw able type, rest MCCBs/MCBS shall be fixed type and Electrical & Mechanical interlocks shall be provided for only incomers & bus couplers. Detail scheme shall be finalized during engineering. Comprehensive interlocking system to prevent any dangerous or inadvertent operation shall be provided. The spare contact of breakers, Local/ Remote switches to be wired up to the terminals.

b) The CB shall be spring operated, motor charged, and manually released spring closing mechanism with three pole simultaneous operations. The speed of closing operation shall be independent of the hand-operating lever. The indicating device shall show the OPEN and CLOSE position of breaker visible from front of the cubicle. The spring charging time of the motor shall not exceed 15 seconds.

5.3 BUSBAR

a) Bus bars and all other electrical connections between various components shall be made of Aluminium of rectangular cross-section with current density of 1 A/mm2, shall be suitable for 3 phase, 4 wire, 400 volts 50 Hz AC supply and have a fault withstanding capacity of 50 KA for 1 second. The bus bars shall be insulated with heat shrinkable and colour coded insulating sleeves, except at the points of connections. The Main bus bar shall be of ample capacity to carry the rated current of 400A continuously without excessive heating and for adequately meeting the thermal and dynamic stresses in the case of short circuit in the system. Neutral Bus bar shall have a rating of not less than that of the associated phase bus bars. All bus bars shall be rigidly and firmly mounted and shall be capable of withstanding short circuit stresses and vibrations. The bus bars shall be extensible on both sides depending upon layout.
b) Minimum electrical clearances shall be maintained between phases, neutral and body as per relevant IS however the minimum clearance between phase to phase and phase to ground shall be 25.4mm & 19.4mm respectively.
c) The Bus bars shall run in a separate bus bar chamber using suitable Bus bar support of non-hygroscopic, non-combustible, material such as DMC/ SMC at sufficiently close intervals to prevent bus bar sag. All bus bar joints. shall be provided with high tensile steel bolts (electro plated with suitable metal such as Nickel Cadmium), spring washer and nuts so as to ensure good contact. Alternatively, electroplated/ tinned brass bolts shall be used. The joints shall be formed with fish-plates on either side of bus bar to provide adequate contact area. Bus supports shall be provided on either side of joints. Max. Unsupported distance from the joints and between two supports shall not exceed 450mm.

5.4 CURRENT TRANSFORMER

The Current transformer shall be Epoxy Cast resin type and rated for 50KA (1 Sec) with details as given in GTP. The CT control wiring shall be of 4 mm2 multi stranded copper wire with 1.1KV insulation grade. Al CTS shall be designed to carry continuously a current of 120% of the rated current.

5.5 METERING. INSTRUMENTATION AND CONTROL DEVICES

5.5.1 MEASURING INSTRUMENTS

3-phase, 4-wire LT CT operated static multifunction meter with associated CT's (400/5 A, Class 0.5S, 15 VA) shall be provided for only incomers to record Current reading (Range -400A), voltage reading (Range 0-500V) and energy consumption. The multifunction meter shall necessarily have RS 485 Modbus serial port for communication with Purchaser SCADA. All meters shall be of flush mounting type with 96x96 sq. mm. The meter shall be enclosed in a dust tight housing providing IP5X or an equivalent provision to completely protect it against dust ingress, and shall protect in a way that performance doesn't get effected due to small dust also The design and manufacture of the meters shall ensure the preventing of fogging of instrument glass. Instrument meters shall be sealed in such a way that access to the measuring element and to the accessories within the case shall not be possible. Inbuilt selector switches shall be provided to be used on three phase supply The make of Energy meter & CT shall be duly approved by the Purchaser.

5.5.2 INDICATING LAMPS

The indicating lamps used in the panel will be pleasant looking, LED type indicating lamps in round shape and suitable for continuous operation at 85% to 110% of their rated voltage. They shall be provided with suitable series resistor and the bulb shall be replaceable from the front of the panel.
The selection of the colours of the indicating lamps will be as follows:

Red - MCCB ON
Green MCCB OFF
Amber MCCB TRIP
Red, Yellow and Blue for incoming 3-ph supply indication.

The various feeders shall be assigned the indicating lamps as mentioned:
I/Cs – ON ,OFF,TRIP and 3-ph supply indications
B/C – ON, and OFF indications only
O/Gs- ON indication only
All color caps shall be similar and interchangeable and all LEDs shall be of same type and ratings. The LED lamps shall be furnished 20% in excess of actual numbers required and color caps shall be furnished 10% in excess of actual numbers used for each.

5.5.3 SELECTOR SWITCHES

Selector switches shall be of non-hygroscopic rotary type with enclosed contacts adequately rated for the purpose intended (min. acceptable rating is 10A continuous at 240V AC).
It shall be provided with escutcheon plates clearly marked to show the following three positions first one for 'LOCAL' second 'REMOTE' and the third being the 'OFF' position. Selector switches shall be provided with pistol grip type handles and shall be of the maintained contact stay put type.

5.6 PANEL WIRING

a) Panels shall be supplied completely wired internally to equipment and! terminal blocks and ready for the Purchaser's external cable connections at: the terminal blocks. The control wiring will be done with PVC single core flexible copper wires and properly dressing all the wires either in a PVC duct of liberal size or bunched together by PVC strapping taps and thereafter fastened to steel members of the panel. When panels are arranged to be mounted adjacent to each other all inter-panel wiring and connections between panels shall be provided by the Bidder.
b) All wiring shall be carried out with 1100 V grade, single core stranded copper conductor wires with PVC insulation. Extra flexible wires shall be used for wiring of devices mounted on moving parts such as swinging panels and doors. The minimum size of the stranded copper conductor used for panel wiring shall be as follows:
CT circuits: 4mm2 per lead
All circuits except CT circuits: 2.5mm2 per lead

c) Interconnections to adjacent panels shall be brought out to a separate set of terminal blocks located near the slots or holes meant for taking the interconnecting wires. Arrangements shall permit easy inter-connections to adjacent panels at site and wires for this purpose shall be provided by the bidder looped and bunched properly inside the panels. The unused instrument space on the front or rear of the panels shall be kept clear of wiring, to facilitate addition of devices without rewiring associated portion of the panels.
d) Wire terminations shall be made with solder less crimping type of (ring type lugs for all CT and pin type lugs for other circuits) tinned copper lugs which firmly grip the conductor and insulation. Insulated sleeves shall be provided at all the wire terminations. Printed type PVC ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of all the control, instrumentation, and protection wiring. Ferrules shall fit tightly on the wires and shall not fall off when the wire is disconnected.
e) Internal wiring to be connected to external equipment shall terminate on terminal blocks. The terminal blocks for CTS shall be provided with test links and isolating facilities. The CT terminal blocks shall be provided with short circuiting and earthing facilities Switchgear shall have 20% terminals as spare terminals in each panel & should be uniformly distributed in all the blocks.
f) The Power interconnections shall be carried out by means of bolted connections with washers. The wiring shall be terminated by using crimping sockets. Under no circumstances the wiring should be under any kind of stress for which sufficient length of control wiring should be provided.

5.7 TERMINAL BLOCKS

a) The terminal blocks shall be 1100 V grade, 10 Amps rated, one piece. moulded, complete with insulated barriers, stud type terminals, washers, nuts and lock nuts and identification strips. Markings on the terminal strips shall correspond to wire numbers on the wiring diagrams. The terminal blocks shall be fully enclosed with easily removable covers and made of moulded non-inflammable plastic material.
b) All spare contacts of the panel mounted equipment and devices shall be wired up to terminal blocks. All the TB's shall be of single Decker type. ASB shall be provided with potential free contacts for Mains ON, I/C 1 ON, I/C 1 OFF, I/C 2 ON, I/C 2 OFF, B/C ON & B/C OFF etc. for Purchaser's SCADA. Supplier will provide wiring of these contacts up to terminal block in ASB.

5.8 Space Heaters

a) Strip type space heaters of adequate capacity shall be provided inside each panel to prevent moisture condensation on the wiring and panel mounted equipment. Space heaters shall be rated for 240V, 1Phase 50hz supply. Heaters inside the panels shall not be mounted close to the wiring or any panel mounted equipment. Heaters shall be complete with miniature circuit breaker on the phase and link on the neutral of the heater supply.
b) An adjustable type thermostat shall be provided in the heater control circuit with temperature range of 0-90 deg C.

5.9 Interior Lighting

Each Panel shall be provided with a 8W, 230, 1ph, 50hz CFL for the illumination of the panel during maintenance. The fitting shall be complete with switch-fuse unit and the switching of the fitting shall be controlled by the respective panel door switch.

5.10 Power & Control Supplies

The ASB shall be provided with necessary arrangement for receiving, distributing, isolating and fusing of AC supply for various control, Signaling, lighting and space heater circuits.

5.12 CABLE TERMINATION ACCESSORIES

The Purchaser's external cable connections will be terminated on the terminal blocks provided in the control panel. All necessary cable terminating accessories such as gland plates, cable glands, crimp type tinned copper lugs, supporting clamps and brackets, wiring troughs and gutters etc for cables shall be included in the bidder's scope of supply.

5.13 Labels

a) All equipment mounted on the front and rear side as well as equipment mounted inside the panels shall be provided with individual labels equipment designation. Also on the top of each bay on front as well as rear side , large and bold nameplates shall be provided for bay designation.

b) All front mounted equipment feeders shall be provided, at the rear also with individual labels engraved with tag numbers corresponding to the ones shown in the panel internal wiring to facilitate easy tracing of the wiring.
c) Lables both external & internal shall be made on non-rusting metal preferably Aluminium anodized one. Labels shall have white letters on black background. The lettering size shall be 6 mm for panel designation shall be subject to the purchaser's approval.
d) Each switch shall bear clear inscription identifying it's function e.g. 'BREAKER' 52A' etc. Similar inscription shall be also be provided on each device whose function is not otherwise defined. If any switch device doesn't bear this inscription, separate name plate giving its function shall be provided for it. Switch shall also have clear inscription for each position indication e.g. 'Local-Remote-OFF', 'ON-OFF', 'R-Y-B-OFF' etc. Each IED and meter shall be prominently marked.
e) Description of the feeder name plates shall be as follows:
16A DP: for Lighting & 1-Ph supply loads.
32A TP: for battery charger, Sump Pump, Station lightings, C & R panels etc.
63A TP: for transformer cooler supply, Yard lighting etc.
100A TP: for Oil filter machine etc.

5.14 EARTHING

a) All panels shall be equipped with a separate earth bus securely fixed along with the inside base of panels. When several panels are mounted adjoining each other, the earthy bus shall be made continuous. Provision shall be made on the earth bus bars of the end panels for connecting the same to the earthing grid.
b) An earthing conductor of 50X6 mm2 Al. (minimum) shall be provide extending the whole length of switchgear and control gear to sustain the rated short time withstand current. Every equipment mounted in the panel shall be directly earthed to this earth bus by distinct connections.
c) The earth bus shall be located at sufficient height from the gland plate and shall not be removable from the outside of cubicle. Door earthing shall also be provided with bolted lugs. The earth bus shall be identified by means of the sign I marked on the outer surface of ASB in a legible and indelible manner on the both side.

5.15 GALVANISING

a) All galvanizing shall be carried out by the hot dip process, in accordance with Specification ISO: 1460 or IS: 2629 amended to date. However, high tensile steel nuts, bolts and spring washers shall be electro-galvanized to service condition four. The zinc coating shall be smooth, continuous and uniform. It shall be free from acid spots and shall not scale, blister or be removable by handling or packing. There shall be no impurities in the zinc additives to the galvanic bath, which could have a detrimental effect on the durability of the zinc coating.
b) After galvanizing no drilling or welding shall be performed on the galvanized parts of the equipment except that nuts may be threaded after galvanization.
c) To avoid the formation of white rust, galvanized material shall be stacked during transport and stored in such a manner as to permit adequate ventilation. Sodium dichromate treatment shall be provided to avoid formation of white rust after hot dip galvanization. The galvanized steel shall be subjected to test as per IS-2633 and BS:729 amended to date.

5.16 REMOTE MOITORING AND CONTROL PHILOSOPHY

a) The multi-function meter shall necessarily have RS485, MODBUS protocol for communication with purchaser's SCADA such that remote monitoring of its parameter is possible.

b) Contacts of O/G breaker for ON/OFF/TRIP indication status shall be wired up to the terminals.

6.0 NAME PLATE AND MARKING

The identifying markings which shall be indelibly marked on fuse-base are given below:
On Fuse Base:

1. Manufacturer's name

2. Rated voltage
3. Rated current
4. Serial No
5. Property of "TPSODL/TPCODL/TPNODL/TPWODL"
6. Month & year of Manufacturing
7. Guarantee period
8. Po No & date.

7.0 TESTS

All routine, acceptance & type tests shall be carried out in accordance with the relevant IS/IEC. All routine/acceptance tests shall be witnessed by TPSODL/TPCODL/TPNODL/TPWODL authorized representative. All the components shall also be type tested as per the relevant standards. Following tests shall be necessarily conducted on the equipment and its components as specified in IEC 62271 standards.

7.1 TYPE TESTS

Test to prove the capability of the main & earthing circuits to be subjected to be the rated peak and the rated short-time withstand currents.

a) Dielectric tests
b) Temperature rise test
c) Degree of protection test
d) Short circuit making & breaking capacities

7.2 ROUTINE TESTS

a) Dimensional and visual check for damages.
b) All main/auxiliary bus bars joints, wire terminations, nuts & bolts shall be checked and tightened
c) Mechanical operational tests
d) Test of auxiliary electrical devices
e) Dielectric tests
f) Measurement of resistance of main circuit
g) Verification of clearance & creepage distances
h) Verification of correct wiring continuity of protective circuit
i) Suitable injection tests for all measuring instruments to establish accuracy of calibration.
j) Tests after erection on site.

8.0 TYPE TEST CERTIFICATE

The Bidder shall furnish the type test certificates for the tests as mentioned above as per the corresponding standards. All the tests shall be conducted at CPRI / ERDA as per relevant IS.Type tests should have been conducted in certified Test laboratories 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, same shall be carried out without any cost implication to TPSODL/TPCODL/TPNODL/TPWODL

9.0 PRE-DISPATCH INSPECTION

The Material 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 discretion of the purchaser and the equipment, if found unsatisfactory as to workmanship or material, the same is liable to rejection. 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. Inspection by the TPCODL/TPNODL /TPSODL/TPWODL or its authorized representatives shall not relieve the bidder of his obligation of

furnishing equipment in accordance with the specifications. 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) PO copy
c) MDCC issued by TPCODL/TPNODL /TPSODL/TPWODL
d) TPCODL/TPNODL /TPSODL/TPWODL Invoice in duplicate
e) Packing list
f) Inspection report
g) Delivery Challan
h) Other Documents (as applicable).

10.0 INSPECTION AFTER RECEIPT AT STORES

The material received at TPCODL/TPNODL /TPSODL/TPWODL store will 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 Engineering and Contracts department.

11.0 GUARANTEE

Bidder shall stand guarantee towards design, materials, workmanship & quality of process/ manufacturing of items under this 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 at least 12 months from the date of commissioning or 48 months from the date of last supplies made under the contract whichever is earlier. Bidder shall be liable to undertake to replace/rectify such defects at its own costs, within mutually agreed time frame, and to the entire satisfaction of the Purchaser, failing which the Purchaser will be at liberty to get it replaced/rectified at Bidder's risks and costs and recover all such expenses plus the Purchaser's own charges (@ 20% of expenses incurred), from the Bidder or from the "Security cum Performance Deposit" as the case may be.

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.

12.0 PACKING

Supplier shall ensure that all material covered by this specification shall be prepared for rail/road transport (local equipment) and be packed in such a manner as to protect it from damage in transit. The bidder shall provide instructions regarding handling and storage precautions to be taken at site.

13.0 TENDER SAMPLE

NA

14.0 TRAINING

Not Applicable

15.0 QUALITY CONTROL

The bidder shall submit 'Quality Assurance Plan' followed in respect of bought out Items manufactured by him

a) Raw materials in process
b) Final inspection
c) Packaging
d) Marking.

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 reserves the sole rights for the type test of random sample from the lot and in case of any discrepancy or deviation from the Type test certificates

submitted along with the bid, the complete Lot shall be rejected. TPCODL/TPNODL /TPSODL/TPWODL's nominated representative shall have free access to the bidder's works to carry out inspections.

The bidder shall submit with the offer Quality assurance plan indicating the various stages of inspection, 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. The Purchaser's engineer or its nominated representative shall have free access to the manufacturer's/sub-supplier's works to carry out inspections. The bidder shall ensure that the material supplied is as per the Guaranteed Technical Particulars as specified in the specifications.

16.0 MINIMUM TESTING FACILITIES

Bidder shall have adequate in-house testing facilities for carrying out all routine tests & acceptance tests as per relevant Indian standards. In case of supply by the channel partner, the manufacturer shall have the in-house testing facilities to carry out the routine and acceptance tests.

17.0 MANUFACTURING ACTIVITIES

The successful bidder will have to submit the bar chart for various manufacturing activities clearly elaborating each stage, with quantity. This bar chart should be in line with the Quality assurance plan submitted with the offer.

The successful bidder will have to submit (after placement of RC/ PO) technical compliance document and drawing of Kit Kat Fuse as per RC line items for getting approval before mass manufacturing. Manufacturing mass quantity to start only after getting CAT-B/CAT-A approved drawings or as per intimation from TPCODL/TPNODL /TPSODL/TPWODL.

18.0 SPARES, ACCESSORIES AND TOOLS

Not applicable

19.0 DRAWINGS AND DOCUMENTS

Following documents shall be prepared based on TPCODL/TPNODL /TPSODL/TPWODL specifications and statutory requirements with complete BOM and shall be submitted with the bid:

a) General description of the equipment and all components including brochures.
b) Type test Certificates
c) Experience List.
d) Completely filled–in clause wise compliance of the specification.
e) Cross sectional drawing of the Kit kat Fuse.

FOLLOWING DOCUMENTS SHALL BE SUBMITTED AFTER THE PLACEMENT OF RC/PO

a. Completely filled in clause wise compliance of the Specification.
b. Type Test Certificates for each specified test if not submit during Technical Evaluation.
c. Drawing of Fuse.
d. Compliances of undertaking submitted during Technical Evaluation.

S.No	Description	For Approval	For Review Information	Final Submission
1	Technical Parameters	√		√
2	Manual/Catalogues/drawings for all components.		√	
3	Technical details of fuse wire.		√	√
4	Cross sectional area of the Kit kat		√	√

	fuse			
5	Installation Instructions		√	√
6	Instructions for use		√	√
7	Transport/shipping dimensions		√	√
8	QA & QC Plan	√	√	√
9	Routine, Acceptance and Type test Certificates	√	√	√

All the Documents and Drawings shall be in English Language.

20.0 GUARANTEED TECHNICAL PARTICULARS

Bidder to submit clause wise compliance of the Technical Specification.

SCHEDULE- "A" GUARANTEED TECHNICAL PARTICULARS: To be Furnished by Bidder

S.No.	PARTICULARS	UNITS	AS FURNISHED BY BIDDER
1	SWITCHBOARD		
a)	Design Architecture		
b)	Dimensions - WXDXH	mm	
c)	Rated Voltage	V	
d)	Rated Frequency	Hz	
e)	Rated impuse withstand voltage	kVP	
f)	Rated Insulation Voltage	V	
g)	System Earthing		
h)	Material of sheet		
i)	Thickness of enclosure sheet	mm	
j)	Thickness of doors/covers sheet	mm	
k)	Thickness of gland plate	mm	
l)	Paint shade		
m)	Degree of protection		
n)	Total weight	kg	
o)	Cable entry		
p)	Max. operating height from ground level	mm	
q)	Min. operating height from ground level	mm	

2	**CIRCUIT BREAKER**		
a)	Standard		
b)	Rated Voltage	V	
c)	Rated Current	A	
d)	Rated Ultimate Short circuit breaking capacity (Icu)	kA	
e)	Rated Service Short circuit breaking capacity (Ics)	% of Icu	
f)	Rated Insulation voltage	V	
g)	Rated Impulse withstand voltage	kV	
h)	Temperature rise	deg C	
3	**CURRENT TRANSFORMER**		
a)	Type		
b)	Short circuit withstand capacity	kA	
c)	Make of CT's		
4	**BUSBAR**		
a)	Material of bus bar		
b)	Bus bar insulation		
c)	Max current Density of bus bar	A/sqmm	
d)	Current rating of phase bus bars	A	
e)	Current rating of neutral bus bar	A	
f)	Temperature Rise	Deg C	
g)	Short Circuit withstand current	kA	
5	**CONTROL & METERING**		
a)	Multifunction Meter		
b)	Current rating	A	
c)	Voltage rating	V	
d)	Energy measurement provision		
e)	RS 485 modbus serial port provision		
f)	Remote control provision of I/Cs & B/Cs		
6	**OTHERS**		
a)	Auxiliary voltage for coils and motors	V	
b)	Local / Remote switch		

c)	Indication Lamps for CBs status		
d)	MCB for AC		
e)	MCB for Space heating		
f)	Panel anti-condensation heater with therostat		
g)	Panel illumination CFL with limit switch		
7	**MAKES**		
a)	MCCB		
b)	MCB		
c)	Multifunction Meters		
d)	CTs		
e)	Indication Lamps		

21. SCHEDULE OF 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:

S. 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

CONTENTS	
CLAUSE NO.	**DESCRIPTION**
1.0	**ORGANIZATIONAL VALUES**
2.0	**ETHICS**
3.0	**CONTRACT PARAMETERS**
3.1	Issue/ Award of Contract
3.2	Contract Commencement Date
3.3	Contract Completion Date
3.4	Contract Period/Time
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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 members of Team TPCODL, Associates and Stakeholders are requested to submit any grievance on ethics violation to Mr. Rajeev Kharyal, Chief Ethics Counselor.

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 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

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 (detailed in section 12 of this document) 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 execution of all items in the schedule of quantities (Supply, Service and or both as applicable) shall be deemed as the Contract Execution Completion Date.

3.6 Contract Execution Period/Time

The Period from Contract Commencement Date to Contract Execution Completion Date shall be the Contract Execution Period/Time. Timely Completion of Works/Timely Delivery of Materials is the essence of the contract. The period from effective date of contract to the date stipulated for completion of delivery of all items/completion of all the works/services, as per schedule of quantities of the contract is defined as contract execution completion time. The Delivery of Materials /The Completion of Works, as applicable, should be achieved in all respects as per schedules of quantities and all the terms and conditions of the contract, in the contract execution time.

Any revision/amendment in the originally stipulated contract execution time has to be approved by authorized representative of TPCODL.

3.7 Contract Price /Value

The total all inclusive price/value mentioned in the LOI/PO/RC of the contract document 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/actual measurement of work done and accepted and certified by the authorized representative of the company unless otherwise specified in schedule of quantities or in contract documents.

3.8 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.

- Letter of Intent (LOI/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)

3.9 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.

3.10 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 J. The bidders along with the tender document shall mandatorily submit a duly signed copy of the Acceptance Form as mentioned in the Annexure J as a token of acceptance for the same.

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.

4.1 Technical Evaluation

TPCODL reserves the right to assign scores to different parameters including but not limited to the following while evaluating the bids. TPCODL reserves the right to change the parameters and score without prior information to the associates:

S. No.	Evaluation Parameter	Max. Score
A	**Bidders already Registered with TPCODL**	**100**
A.1.	**Quality of the Products & Services** a. <u>For Supply Part:</u> No Material Rejections in last 2 years Deduction of 3 marks for each PO/ RO (for same product category) with major rejections in last 2 years. (Major rejection shall be considered when material is taken back by the vendor for rectification and the quantity of rejected material is more than 10%). b. <u>For Service Part:</u> No violation of statutory compliances in last 1 year. Deduction of 2 marks for each instance of violation in last 1 year. c. <u>Safety</u> Deduction of 2 marks for each instance of safety violation in last 1 year. Deduction of 4 marks for each reported Non-Fatal Accident in last 1 year. In case of any reported fatal accident: *ZERO MARKS*	12 12 16
A.2.	**Timely Execution of Contracts** Total Achieved Score = {30 – 3 x (Avg. %age LD deductions in last 2 years)}	30
A.3.	**Legal Issues with TPCODL** Zero instances of Arbitration procedures / Court Cases / PBG forfeitures in last 2 years: 30 marks else 'Zero' marks	30
B	**Bidders new to TPCODL**	**100**
B.1.	**Visits** <u>For Supply Part</u>: Factory Visit and Evaluation. <u>For Service Part:</u> Client Site Visit where the bidder is providing similar services. The visits as above shall be arranged by the bidder. However all costs towards conveyance, lodging, boarding etc. shall be borne by TPCODL. The score assigned by TPCODL based on the above visits shall be final and binding on the bidder. **<u>Safety:</u>**	30 20

S. No.	Evaluation Parameter	Max. Score
	Score achieved against the BA safety Management System questionnaire.	
B.2.	**Client Referrals** At least 3 nos. Customer References for similar products/ services in last 3 years. All customer references shall be either of the following: ▪ Govt. Organizations/ PSUs/ Power Distribution Utilities. ▪ Private Organizations with an annual turnover of >= 500 cr. PO copies or Completion Certificates are admissible. Each reference: 10 marks	30
B.3.	**Blacklisting Information** Not blacklisted by any reputed organization / utility in last 2 years: 20 marks else 'Zero' marks.	20

- Bidder shall be considered as technically qualified if they are able to achieve a technical score of >70 marks on the above parameters. 'A' or 'B'.
- The bidder must have the PF and ESI registration. In case it is not there (provided the bidder is not exempted from the PF and ESI), bidder shall not be evaluated on the above parameters and will be considered as disqualified.

4.2 Indemnity

Associates shall undertake to fully indemnify TPCODL (also referred to as the Company in the GCC) against all kinds of liabilities or damages, of whatsoever nature, including compensation arising from any accident to the person or property of those in Associate's employment or to any other person or properties including those of TPCODL, arising due to reasons attributable to any, act, omission or negligence of the Associate the Associates, for the entire period of contract including period of guarantee.

Within 7 days of award of work, the Associates shall submit Indemnity Bond in the format as per Annexure-E to Order Issuing Authority.

Contract having value more than Rs 2 Cr per Annum, Associates shall submit Indemnity Bond on Rs 100/- Non Judicial Stamp Paper in the format as per Annexure- E to Order Issuing Authority.

4.3 Display of Notice Boards at Work Sites

The Associate shall put up display notice board at each project site where the works are in progress indicating the information given below:

- Name of the Project.
- Estimated Cost of Project.
- Date of Commencement.
- Expected date of completion.
- Name of Associate and his telephone number.
- Name of Engineer-in-Charge and his telephone number.

4.4 Disposal of Waste at Site

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.

The associates shall follow the below criteria for disposal of waste at site during the execution of project.

- Associate shall ensure that the detailed project plan include the waste management, segregation of all designated waste material (Recyclable/ Non-Recyclable), collecting, storing, disposing and transferring the same to pre-arranged facility/destination in timely and safe manner as per environmental legislations during the execution of project. The project plan shall also include the innovative construction practice to eliminate or minimize waste, protect surface/ground water, control dust and other emissions to air and control noise during the execution of project. The copy of same shall be given to EIC before the commencement of project.
- The purchase policy of BA shall encourage the procurement of material with recycled and minimum packaging of goods during delivery. Associate shall provide the appropriate means for site to site transportation of materials to avoid damage and litter generation.
- Associate shall educate and inform to its project team about the requirement and responsibilities for waste minimization and disposal in general and provide training of practices that support this. Waste management should be treated like a safety program.
- In the event that area of contaminated or biological hazard is identified, Associate shall ensure that plant, equipment, personnel and any activity associated with the work is carried out in consultation with EIC of TPCODL.
- Associate shall ensure that the residents living near the site are kept informed about proposed working schedule and shall informed timings and duration of any abnormal noise full activity that is likely to happen.
- Associate shall ensure the regular maintenance and monitoring of vehicles and equipment for efficient fuel use so that emissions and noise are within acceptable limits to avoid air pollution.

4.5 Deployment of Work Force

Associate shall deploy adequate labour, as considered necessary by TPCODL for execution of the contract including Sundays and Holidays whenever required to do so with no extra cost to TPCODL. However, prior permission shall be taken from the site Engineer to carry out the work beyond normal working hours or on Sundays and Holidays. Female employees shall not be deployed beyond normal working hours/days and no child labour shall ever be deployed. Associate shall depute full time qualified and experienced engineers to supervise the work at site. All such staff shall be maintained from commencement to completion of all works to the entire satisfaction of the Engineer-in-Charge. Associate's employees deployed for the works under this contract will not be considered in Company's employment at any time. Associate shall continue to be responsible for all such employees, their safety, all types of statutory compliances related thereto and in any other manner whatsoever. The company will stand indemnified by the Associate in respect of all the above. At the same time Company upon noticing any breach or default on any statutory compliances, may at their sole discretion, decide to act in a manner as deemed fit at the risks and costs of the Associate.

TPCODL shall have the right to instruct the Associate to change the Sub- Associates or skilled /unskilled workers in case the conduct, the workmanship or speed of the work is not satisfactory.

Associates shall submit duly signed undertaking regarding engagement of competent staff / employee commensurate to the nature of job to Engineer–in–charge in the format attached as Annexure – H.

4.6 Damages to Properties

The Associates shall take necessary steps to ensure that the equipment and installations of the Company, Third parties, including other utility services like water supply pipelines; open drains telephone cables etc. are not damaged during execution of the works. The Associates shall be responsible for all such damages and shall have to repair/ replace and/or compensate for the entire claims in respect of such damages at its own cost.

4.7 Issuance of Material

The material issued to the Associate shall be in the custody of the Associates who shall be fully responsible for the same. After completion of the works, the Associates will reconcile the material. Any cost of material which is short or damaged/lost will be deducted from Associate bill/ deposits.

4.8 Company's Right To Use Works

If Taking Over Certificate is delayed for any reason, for which TPCODL's decision shall be final and binding upon the Associate, the Company shall be entitled to use the works or portion thereof without affecting Associate's responsibility and liability to complete the balance works as per company's directives from time to time, though Associate shall be afforded reasonable opportunity by the company to enable Associates to complete all balance works required for issuance of 'Taking Over Certificate' by the company.

4.9 Rights of TPCODL to vary the scope work

TPCODL shall 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 communicating the intent to do so in writing to the Associate. On receipt of such communication the Associate shall, within the time frame specified in the contract shall provide TPCODL with a reasonably detailed estimate of the cost of the change in scope outlined in the TPCODL communication. The change in the Contract price and time shall be revised 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 in the scope of work till such time revision of Contract price and time schedule are approved and communicated to the associate by TPCODL.

Any change in the Scope of Work and/or Terms & Conditions of the order shall be intimated by TPCODL through an amendment to the contract. The amendment shall be treated valid only if signed by the authorized signatory of the original contract.

5.0 PRICES/ RATES/ TAXES

5.1 For Supply part of Contract

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, cesses 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.

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.

5.2 For Service part of Contract

The Prices and Rates are inclusive of cost of materials supplied as per contract terms and for which MDCC is issued by TPCODL and to the extent required for completion of works, cost of service executed as per schedule of quantities, cost of testing as per contract terms, cost of documentations including all relevant test certificates and other supportive documents to be furnished as per contract terms. The rates shall remain firm till actual completion of contract.

The Prices/Rates are inclusive of all taxes, levies, cesses 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.

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

5.3 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

A. 5% of the Release Order/ Purchase Order price shall be paid as initial interest free advance on fulfillment of the following by the Associate:

   a) Acceptance of PO/ LOI.
   b) Submission of advance payment BG of 15% of the Release Order/ Purchase Order price which shall remain valid till the advance is fully adjusted.

c) Submission of Contract Performance Bank Guarantee of 5/10% of the RC/ PO price valid till 30 days after taking over of the works.

B. 10% of the Release Order/ Purchase Order price shall be paid as interest free advance against approval of drawings under Category-1 of major drawings, Quality Plans, Pert Chart, Field Quality Plan, posting of Project Manager and commencement of the first mile stone of the work mutually agreed including C-3 Form, and submission of a true copy of 'Erection All Risk Insurance Policy' taken for the awarded jobs. The drawing list shall be mutually agreed at the time of award of work.

C. 50% on account payment of the total of item wise cost of material Release Order/ Purchase Order shall be paid against receipt of material at site in good condition and certification by TPCODL along with bills complete in all respects viz. MDCCs etc.

D. 20% on account payment of the actual executed value shall be paid against mechanical completion of erection on prorate basis against monthly bills and 70% on account of the actual executed value shall be paid against the service line item including composite line item. In case this milestone is not completed beyond 120 days for reasons attributable to TPCODL, the payment corresponding to supply part shall be released subject to submission of BG of equivalent amount by the BA valid for a period of further 12 months. If required, it shall be extended by the BA on request of TPCODL.

E. 15% payment of the actual executed Release Order/ Purchase Order shall be paid after completion of acceptance test and Taking Over of the complete systems specified in the enquiry, including clearance of Electrical Inspection, compliance of final punch point and after reconciliation & adjustment of payments, if any, towards Quantities of materials issued from purchaser's stock and consumed by the contractor for expeditious completion of the job. In case this milestone is not completed beyond 120 days beyond schedule for reasons attributable to TPCODL, the payment corresponding to supply part shall be released subject to submission of BG of equivalent amount by the BA valid for a period of further 12 months. If required, it shall be extended by the BA on request of TPCODL.

The Contractor shall submit all Operation & Maintenance manuals and "As Built Drawings" etc. and shall also submit Equipment Warranty Bank Guarantee (EWBG) equivalent to 5/10% of actual executed contract price before the release of this last payment and return of CPBG. The validity of EWBG shall be for a period of 15 months from the date of taking over of the works or specified guarantee period in drawing/tender/technical specification documents etc. whichever is later. The associate shall also submit 'No Demand Certificate' at the time of receipt of full and final payment.

6.1 Pre-Requisites for Payment

- Associate should have completed execution of that part of contract, for which payment is sought, to the satisfaction of TPCODL's Engineer-in-Charge responsible for the contract and obtained certification for execution of the work.
- Associate has undertaken joint measurement of the work executed along with TPCODL's Engineer-in-charge

- Associate's bills/invoices submitted have been certified by Engineer-In-Charge.

6.2 Bills & Invoices

Unless specified otherwise in the special conditions of contract, Associate shall raise not more than one invoice/contract per month for the services rendered in the prescribed Tax Format and the invoice shall be submitted within 15 days of the following month at Bill Inward Receipt Desk (BIRD) located at IDCO Towers, Janpath, Bubaneswar**.**

All Bills shall be supported by joint measurement of work done, quality test report and a copy of wage sheet, if applicable (showing proof of having disbursed wages as per applicable law) and a copy of statement substantiating that statutory payments having been affected.

Bills/ invoices shall mention Associate's 'Sales, Service, WCT Tax Registration Number, PAN number as applicable.

Final bill submission after completion of project or execution of job must be within 30 days from the actual date of completion/execution of work awarded.

6.3 Payment & Statutory Deductions

Payment shall be released within 30 days from the submission of the bills. The associate shall submit "No Demand Certificate" in the format as per Annexure-D at the time of receipt of full and final payment. In case any non-compliance to contract conditions comes to TPCODL's notice, TPCODL will be entitled to deduct 30% of estimated wages plus 20% of wages as TPCODL's overheads. Associates would be obliged to provide the copy of monthly wage sheet in any case, failing which no payment shall be made. TPCODL at their sole discretion may deposit the PF etc. with statutory authorities. TPCODL will deduct the amounts of TDS as per statutory requirement under the income tax act and the DVAT Act and certificates (wherever applicable) will be issued to associate accordingly.

In case of non-submission of PAN No TDS @ 20% shall be deducted from all payable amounts for which no TDS certificate shall be issued. TDS once deducted as above shall not be revised in any condition.

6.3.1 Statutory Deductions

TPCODL will deduct the amounts of TDS, TCS as per statutory requirement under the income tax act, the Goods and Services tax act, BOCW Act, or any other applicable tax act and certificates (wherever applicable) will be issued to associate accordingly. For consumption of TPCODL's Water and Electricity by Associate for execution of Contract, Associate shall pay 0.5% & 1.0% respectively of contract value and it shall be deducted from the running bills. The Engineer-in-Charge as stated in the Order shall be responsible for certification of the work executed and the bills. Bills (including original) shall be submitted in triplicate at Bill Inward Receipt Desk (BIRD) located at IDCO Towers, Janpath, Bhubaneswar.

6.4 Guidelines for Raising Running/Final Bills

Contract Value Up to 5 Lakhs	One Final Bill
Contract Value More than 5 lakhs	Monthly Running Bill & One Final Bill

All Bills shall be processed only when all bank Guarantees are in place and before payments of Final Bill Associate have to furnish NDC.

6.5 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.

6.6 Full and Final Payment

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

7.0 MODE OF PAYMENT

Payment shall be made through RTGS mode for which Business Associated shall submit the details of Bank Account and other details as per annexure K. 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.

The quantities of items indicated are estimated and preliminary. However, payments shall be made on the basis of actual quantity of work carried out and measured jointly by the Company and the Associate. Associates shall be responsible to organize joint measurements of works with TPCODL Engineer-in-Charge before raising any bill of work done. In the event Associate fails to do so, TPCODL at their sole discretion, may take measurements of work done and proceed as deemed fit and in such an event Associate's right to lodge any subsequent claim shall stand forfeited.

8.0 SECURITY CUM PERFORMANCE DEPOSIT

Associates shall submit within 15 days from the effective date of issue of PO/RC, Security cum Performance 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 TPCODL indemnified always till completion of contracts.

9.2 Social Accountability

TPCODL expects its Associates to follow guidelines of best practices 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	25% relaxation in PBG for order value above 50 lacs else 50% 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).

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

9.4 Compliance to Labour Laws

Bidder needs to ensure compliance to applicable labour laws including timely disbursement of wages. In case wages are not disbursed as per the stipulated timelines, then TPCODL shall pay the wages to BA employees on behalf of BA. Apart from deducting the amount of wages paid, TPCODL shall deduct an additional service charge equivalent to 25% of the wages paid from the payment due to BA.

9.5 Compliance to Construction and Demolition Waste Management Rules & Environment (Protection) Amendment Rules

BA is liable to follow the Construction and Demolition Waste Management Rules- 2016, Environment (Protection) Amendment Rules- 2018 and Guidelines on dust mitigation measures in handling construction material and C&D wastes issued by CPCB.

Following are some main points of above Rules/Guidelines for Construction work, cable laying jobs etc.

1. Barricading to be provided at site to cover complete area.
2. Construction material and waste should be inside the closed area made by using barricading.
3. Water sprinkling/fine spray from nozzles to be done to suppress the dust.
4. The board of Dust mitigation measures shall be displayed at site for public viewing with required details.
5. Loose sand or soil and construction material that causes dust shall be covered.
6. Transport material that are easily wind borne need to be covered by a sheet made of either jute, tarpaulin, plastic or any other effective material.
7. All areas for storing C&D waste/construction material to be demarcated and preferably barricaded particularly those materials that have potential to be dust borne.
8. Grinding and cutting of building materials in open area shall be prohibited.
9. Construction material and waste should be stored only within earmarked area and road side storage of construction material and waste shall be prohibited.
10. No uncovered vehicles carrying construction material and waste shall be permitted.
11. Construction and demolition waste processing and disposal site shall be identified and required dust mitigation measures to be notified at the site.

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.

11.0 SAFETY

All Associates shall strictly abide by the guidelines provided in TPCODL's Contractor Safety Management System (CSMS) as applicable at all stages during the contract period. Associate shall execute the contracts ensuring the following in and as order of priority:

- Safety of Human Beings.
- Safety of equipment/Assets.
- Timely Completion of Contract.

Safety related requirements as mentioned in our Contractor Safety Management System is attached as annexure L and is an integral part of this GCC.

12.0 INSPECTION/PARTICIPATION

12.1 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 within maximum of two weeks of 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.

12.2 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.

12.3 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.

12.4 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.

12.5 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.

13.0 MDCC & DELIVERY OF MATERIALS

13.1 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 utilised 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 sub-contractors:

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.

13.2 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.

13.3 Consignee

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

13.4 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

13.5 Dispatch and Delivery Instructions

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

14.0 GUARANTEE

14.1 Guarantee of Performance

Associates shall stand guarantee that the equipment and material supplied/service or work rendered 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.

14.2 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 15 Months from the Date of Commissioning or 24 months from the date of delivery of final lot of supplies made, whichever is earlier.

14.3 Failure in Guarantee Period (GP)

If the equipment and material supplied/service or work rendered 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/service or work rendered under the contract 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/service or work 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 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.

14.4 Cost of repairs on failure in GP

The cost of repairs/rectification /replacement, apart from the actual cost of repairs/rectification/replacement is also inclusive of all associate costs of required transportation, site inspection /mobilization/dismantling and re-installation costs as applicable, to be borne by the 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.

14.5 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.

14.6 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.

14.7 Support beyond the Guarantee Period

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

15.0 LIQUIDATED DAMAGES

Liquidated damages @1% of the total executed contract value per week or part thereof, for the period of delay in integrated completion, subject to maximum 10% of the value of the contract shall become leviable without prejudice to other rights of the TPCODL. This amount shall be recoverable from any amount due or becoming due to the Business Associates under this or any other contract. In specific cases, TPCODL reserves the right to apply LD only on the unexecuted portion of the supply and works for standalone use, provided full quantity is executed within a maximum 30% additional time. 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.

15.1 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.

15.2 Material Recovery

In case of any recoveries for materials or services (for material free issued by TPCODL and not reconciled by BA or for services claimed and paid in excess at the time of running bills), the total cost which shall be recovered from the BA, shall be the gross amount of material or services (i.e. including taxes) plus applicable taxes as prevailing at the time of such recoveries.

16.0 ASSIGNMENT OR SUBCONTRACTING

Associates shall not assign/subcontract/outsource the schedule of activities of contract TPCODL enters with the associate, in part or full, without TPCODL's prior written approval.

However outsourcing of materials/equipment/services by Associate to make the integrated product for which TPCODL's has placed the contract with the associate from suppliers, makes and agencies which have been mutually agreed upon during contract pre-award stage is permitted subject to following conditions.

In such cases where outsourcing is done by the Associate

- Shall ensure that outsourced suppliers comply with the technical and financial qualification requirements specified by TPCODL in the contract document
- Shall furnish all particulars about the proposed outsourcing agencies and the details of the goods/services/work outsourced to the Associate while seeking approval of TPCODL for inclusion for outsourcing. The Associate shall give approval or shall refuse approval in writing within thirty (30) days of receipt of such request. However the Associate shall not be entitled for any additional contract execution time whatsoever in lieu of the process for approval for outsourcing agencies, and shall be held responsible for any delay in the project execution time.
- Shall remain jointly and severally liable for any action, deficiency, and/or negligence on the part of his outsourcing agencies. The approval extended by the Associate to outsourcing agencies recommended by the Associate shall not discharge the later from his Contract obligations.

Shall submit to the Associate unpriced copies of purchase orders with technical specifications included in the orders, placed on outsourcing agencies as soon as the respective orders have been placed by the Associate.

17.0 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.

18.0 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.

18.1 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.

18.2 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.

18.3 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.

18.4 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.

18.5 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.

19.0 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.

20.0 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 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.

21.0 LIABILITY & LIMITATIONS

21.1 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.***

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.

21.2 Limitation of Liability

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

22.0 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 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.

23.0 SUSPENSION Of CONTRACT

23.1 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 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.
- 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,

23.2 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 27 for breach/default of contract conditions.

23.3 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 24.3) 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.

24 TERMINATION OF CONTRACTS

24.1 Termination for Default/Breach of Contract

The contract / PO 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.

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 24 (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 24 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:

i) Associate shall discontinue the supply, on the expiry of the said period of two weeks.

ii) 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.

iii) 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.

iv) 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.

v) 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.

24.2 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. This convenience will be available to associate only after one year from the contract effective date. For this purpose, associate will provide a notice period of 90 days to TPCODL, Associate will have to pay TPCODL a 'termination convenience fee' equivalent to 5% of unexecuted contract value.

24.3 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**.**

25.0 DISPUTE RESOLUTION & ARBITRATION

In case of any dispute or difference the parties shall endeavor 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 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.

25.1 Governing law 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.

26.0 ATTRIBUTES OF GCC

26.1 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.

26.2 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.

26.3 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.

27.0 INSURANCE

The Associate shall arrange accident insurance policy for his foreign experts/specialists/personnel deputed to Site and Associate's/his sub-Associates' manufacturing works as well as for his Indian engineers and supervisory staff. The Associate shall also take out for his Indian workmen, where applicable, a separate policy as required under Workmen's Compensation Act.

Associates shall be responsible to suitably insure their entire work-force (to the extent of at least meeting requirements under Workmen Compensation Act) Tools, Plant, Third party liability at the project site, All Risk comprehensive insurance for the entire works (insurance for free issue items will be in TPCODL scope) for total contract (PO/RO) value or any other such risks during execution of works, till the works are handed over to the company, in consultation with TPCODL and shall submit copies of such insurances to the Engineer-in-Charge for review / acceptance before commencing the work. Engineer-in-charge must ensure compliance to insurance requirement by Associate before commencement of works. TPCODL shall stand fully indemnified in this respect.

28.0 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.

29.0 TRANSFER OF TITLES

The title of ownership and property to all equipment, installations, erections, constructions materials, drawings & documents shall pass to the TPCODL after Commissioning and complete handing over-taking over.

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.

The Associate shall take all corrective measures arising out of discrepancies, errors and omissions in drawings and other information within the time schedule and without extra cost to the TPCODL.

The Associate shall also be responsible for any delay and/or extra cost if any, in carrying out engineering, and site works by other agencies arising out of discrepancies, errors and omissions stated in as well as of any late revision/s of drawings and information submitted by the Associate.

30.0 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-I. You can also log on to our website www.tpcentralodisha.com to provide your feedback according to the guidelines mentioned below:

31.0 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

32.0 LIST OF ANNEXURES

S. No.	Subject	Annexure
1.	Performa for Bid Security Bank Guarantee	A
2.	Performa for Advance Payment Bank Guarantee	B
3.	Performa for Performance Bank Guarantee (CP cum EP)	C
4.	Performa for No Demand Certificate by Associate	D
5.	Performa for Indemnification on Statutory Compliance	E
6.	Performa For Application For Issuance of Consolidated TDS Certificate	F
7.	HR Service Level Agreement	G
8.	Under taking for competence of workmen	H
9.	Business Associate Feedback Form	I
10.	Acceptance Form For Participation In Reverse Auction Event	J
11.	NEFT or RTGS payment request form	K
12	Contractor Safety Management System	L
13	Vendor Appraisal Form	M
14	Manufacturers Authorization Form	N

ANNEXURE-A

PROFORMA FOR BID SECURITY BANK GUARANTEE

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").

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 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)

ANNEXURE-B

PROFORMA FOR ADVANCE PAYMENT BANK GUARANTEE

(On Rs.100/- Stamp Paper)

Note:

(a) Format shall be followed in toto

(b) Claim period of six months must be kept up

(c) The guarantee to be accompanied by the covering letter from the bank confirming the signature to the guarantee

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TP Central Odisha Distribution Limited

Bhubaneswar

Advance Payment B.G.No……

Contract No……dated……

1. You have entered into a Contract No_____ with M/s._____ (hereinafter referred to as "the Vendor") for the supply and delivery 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, you have agreed to make an advance payment of Rs._____ (Rupees_____ only) being _____% (_____percent) of the total value of the contract on "the Vendor" furnishing you with an irrevocable, unconditional and acceptable bank guarantee to be valid till the date of receipt of "the said equipment" covered by your above mentioned contract. For this purpose you have agreed to accept our 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 three months 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 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)**

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 month 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 _____ 200_____

Witness

Bank's rubber stamp

1. _____ Banks full address

Designation of Signatory

2. _____ Bank official number

ANNEXURE- C

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

---

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 three 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 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 _____ 200__

Witness

Bank's rubber stamp

1. _____ Banks full address

Designation of Signatory

2. _____ Bank official number

ANNEXURE-D

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.

Dated **Signature**

Place **Name**

Designation

(Company Seal)

ANNEXURE – E

PROFORMA FOR "INDEMNIFICATION ON STATUTORY COMPLIANCES"

(To be submitted by the successful Bidder within seven days of award of work)

(Certificate No. CCP/001)

Name of the Project

Letter of Award / Contract No.

Dated

Name of the Associate

Scheme No. / Job No.

By this confirmation we, _____ (Associate) are formally bound to M/s. TPCODL towards any sum which may be imposed, levied or hereinafter recovered by the Provident Fund Organization under the provisions of the Employees of the Provident Fund and Miscellaneous Provisions Act 1952 in respect of employees employed by us.

We well and truly bind ourselves and our heirs executors administrators and representatives jointly severely and respectively for the above payment only to be paid to M/s. TPCODL.

AND WHEREAS we, _____ (Associate) is making compliance of the Employees Provident Fund and Miscellaneous Provisions Act 1952, have entered into the above written bond for the indemnity to M/s. TPCODL against all losses from the acts or default of the said Associate in respect of compliance of the Provident Fund Act.

Similarly we hereby confirm that we have complied with all statutory and local laws and nothing is outstanding with regard to Local Sales Tax, Labour Laws, Local Municipal dues, Electricity dues etc. We have entered into the above written bond for the indemnity to M/s. TPCODL against all losses from the acts or default of the said Associate in respect of compliance of the Local Sales Tax Laws, Local Laws, Labour Laws, Local Municipal Dues, Electricity dues etc.

NOW THE CONDITION, of the above written bond is as such that if the Associate during the period of this contract commits any default or fails to make payment of Contributions in respect of his employees to the Employees Provident Fund Organization, he shall indemnify the Principal Employer M/s. TPCODL from all and every loss and damage caused to them from any act, omissions or negligence of the said Associate in respect of compliances under the Employees Provident Fund and Miscellaneous Provisions Act, 1952.

IN WITNESS to the above written bond we have here to set our hands, with our free consent.

Dated **Signature**

Place **Name**

Designation (Company Seal)

ANNEXURE-F

PROFORMA FOR APPLICATION FOR ISSUANCE OF CONSOLIDATED TDS CERTIFICATE

To be printed on the letterhead

To,

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

ANNEXURE - G

SERVICE LEVEL AGREEMENT

(To be adhered to by Business Associates (BAs) in TPCODL on Human Resource Issues)

1.0 The following shall be adhered to by the Business Associates during his / its association with TPCODL:

Shall Abide by Tata Core Values:

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

b) **Understanding –** We must be caring, show respect, compassion and humanity to our colleagues and customers and always work for the benefit of the communities we serve.

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

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

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

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

2.0 The Business Associate / his manager / supervisor who is responsible for managing the project site / performance contract etc. in TPCODL would also ensure adherence of these values by his employees / persons deployed by him in connection with his works undertaken in TPCODL.

3.0 The Business Associates are required to:

a) Support and respect the protection of human rights and make sure that they are not complicit in human right abuses.
b) Respect freedom of association and effective recognition of the right to collective bargaining.
c) Not to resort to any form of forced and compulsory labour.
d) Shall ensure abolition of child labour in his area of work.
e) There is no discrimination in respect of employment and occupation in respect of his employees.
f) Support precautionary approach to environmental challenges.
g) Promote greater environmental responsibility by himself and his employees in his areas of work.
h) Deploy and defuse environmental friendly technologies while carrying out the works.
i) Work against corruptions in all its form including extortion and bribery by himself and his employees.

4.0 The Business Associates are required to adhere to all applicable Labour Laws with special reference to the following:

a) No person below the age of 18 years and no child labour will be engaged directly or indirectly for executing the work connected with the business of TPCODL.

b) Minimum wages along with other statutory dues like PF, ESI, etc. as applicable to the workers shall be made within the prescribed period of 7th / 10th day of the following month.

c) Deduction / deposit / record keeping and all other requirements under Employees PF Act 1952, Employees State Insurance Act 1948 and other applicable acts (if any) shall be adhered to.

d) Only statutorily authorized deductions (if any) shall be made in accordance with the relevant statutes.

e) All the provisions of Contract Labour (R&A) Act 1970 shall be complied with in respect of the workers engaged for TPCODL work. The work will be commenced only after completing necessary formalities for obtaining Labour License (if applicable).

f) Necessary registers / records, filing of returns etc. shall be maintained for verification by Statutory / TPCODL authorities.

g) Payment of wages shall be made only in presence of and with certification of authorized representative of TPCODL or shall be made in the form of cheque / bank transfer to the employee.

h) During the period of contract, the Business Associate will arrange for deployment of his supervisor / manager for total supervision and control of the work and their manpower. All the activities related to their manpower e.g. attendance, leave, wage disbursement etc. will be done under the supervision & control of Business Associates, While adhering to the prescribed standard / norms of production / productivity & quality. During execution of the work, Business Associate shall engage only such qualified / skilled manpower as may be envisaged / required for ensuring level of production / service into the contract / work order.

i) Clearances as follows shall be obtained from IR & Welfare Group:

   i. Clearance for commencement (before start of the work).
   ii. No Objection Certificate (after completion / before final settlement).
   iii. Copies of PF / ESI Challans shall be deposited with IR & Welfare Group every month

j) The Business Associate shall indemnify TPCODL from any liabilities under applicable Labour Statutes.

k) The Business Associate shall ensure safety and health of his employees and shall also maintain hygienic working environment / condition in his area of work.

l) The Business Associate and his employee shall abide by Laws of Land and shall not violate any applicable provisions.

m) The Business Associate appreciates with and acquiesces to the right of TPCODL as principal employer to fulfil any of his legal obligations, if he fails to do so under applicable labour laws and deduct the same from his running bills / final payments / enchasing security deposit / Bank Guarantee as the case may be. If there is any further shortfall TPCODL has the right to recover the same from the Business Associate.

n) The Business Associate ensures that person employed by him adhere to the moral and legal conduct and shall not violate any standard conduct envisaged in the premise of

TPCODL by all such as, Transparency, Safety, Discipline, Integrity etc. The Business Associate or his employees should refrain from corrupt practices, giving or taking bribe in connection with any TPCODL business.

5.0 The '<u>Statutory Compliance Enforcement System</u>' in TPCODL is detailed below for adherence by all concerned. Business Associate Cell (BA Cell) will be the process owner for implementation of the system with the help of concerned Engineer I/c or Officer I/c.

a) Statutory Compliance being a professed value in TPCODL Code of Conduct, the concerned Engineer / Officer in charges are requested to adhere to the provisions and advise respective Business Associates in their domain to comply in letter and spirit.

b) Immediately after issuance of letter of intent, the authorized representative of the Business Associate will report to BA Cell for completion of statutory requirements.

c) Normally, the work will be started only after 'Clearance for Commencement of Work (CCW) is issued by BA Cell to the Business associate. However in exceptional exigencies in engineer I/c / Officer I/c may direct the Business Associate to start the work and inform BA Cell about the same. Statutory requirements in this case may be completed in parallel.

d) First monthly bill will be released only after producing CCW to the finance department. Similarly closure of work and final settlement will be affected after issuance of no objection certificate from BA Cell group.

6.0 <u>Requirements for 'Clearance for Commencement of Work' (CCW):</u>

a) Submission of filled up Form 'A' for database (Annexure-1).
b) Copy of PF Code allocation letter.
c) Copy of ESI Code allocation letter.
d) Submission of duly filled up Form IV CL(R&A) act (In case more than or equals to 20 workers during the period of contract).
e) Submission of duly filled up Form VI A (Notice of Commencement).
f) Copy of insurance cover note under WC Act 1923 (if applicable).
g) Copy of Contract Agreement.
h) Copy of indemnity bond (if applicable).
i) Affidavit with regard to payment of wages through cheque / bank transfer only.

7.0 <u>Requirements during execution of work:</u>

a) Copy of receipt of application for license / license (if applicable).
b) Copy of PF Challan (latest by 26th day of every Month).
c) Copy of ESI Challan (latest by 26th day of every Month).
d) Copy of Wage disbursement sheet / Bank statement.
e) Filing / Maintenance of all statutory registers / reports / returns for inspection by Statutory/ TPCODL authorities.
f) Certification of wage disbursement by authorized representative of TPCODL.
g) Copy of 'Labour Welfare Fund' deposit certificate / Challan.
h) Insuring safe working practices at the work place.

8.0 <u>Requirements for 'No Objection Certificate' (NOC) for closure of work:</u>

a) Submission of duly filled up Form VI A (Notice of Completion).
b) Copy of Half yearly / Annual return for ESI / PF / CL(R&A).

c) Consolidated copy of wage sheet of last month indicating full & final settlement of all dues like retrenchment benefit, bonus, leave encashment etc. Copy of individual declaration by employees in Form X regarding termination of employment.

d) Confirmation certificate regarding filling up of form for transfer / withdrawal of PF by the concerned workers.

In case any of the above are deviated / not complied with the Letter of Award/Order shall be liable to be withdrawn / cancelled.

Enclosure:

1) Form A
2) Form X
3) Form XI
4) Form VI A
5) Form XXIV

FORM (A)

[To be submitted by the Business Associate to the Principal Employer within a week from LoA issuance]

A. Details of the Agency

1. Name of Agency :
2. Nature of work :
3. Local Address with Ph.No. :

   (With Father's name) :
4. Permanent Address (Full) :
5. PF code no. & Place :
6. ESI Code no. & Place :
7. Name and address of :

   Sub-contractor (if any)

B. Details of Work

8. Name of work (as specified in LOI/LOA) :
9. LOI/LOA Nos. & Dates :
10. Period of contract (Specify Dates) :

    [Including Extension period, if any] :
11. Work Area [Department / Location] :
12. Name / Cell no. of Officer I/c :
13. Maximum No. of workers and staff to be engaged on any day during the year.
    - Supervisory Staff :
    - Workers :
14. Do you have any other contract in TPCODL : Yes/No

    If yes, furnish details:

15. Details of Workmen's compensation Policy, if applicable

Name of Insurance Company ……..
……Policy No …… Number of persons covered …… Period of coverage: From …….. To ……..

If no, I hereby undertake the liability arising out of Workmen's Compensation Act and Rules made there under.

C. Details of workers to be engaged

No. of Workers

S. No.	Unskilled*	Semi-skilled*	Skilled*	Clerical / Supervisory

*** Number to be indicated**

I/We shall fulfill all obligations arising from and under all relevant law in force from time to time. I/We undertake to keep the TPCODL indemnified against any loss or liability arising out of failure of my / our abiding the relevant laws.

The name of my / our representatives is …… to enter the TPCODL Premises on my behalf.

Date:

(Signature of the Business Associate

or his Authorized Representative)

This Business Associate is / will be engaged in TPCODL.

(Signature and seal of

Officer I/c of the Work)

Form X

Undertaking

I _____ hereby undertake that all the dues in respect of my employment with M/s _____ for the period of _____ to _____have been settled and final payments including retrenchment benefit have been made to me in full.

( )

_____

Date:

Form XI

Undertaking

With reference to the contract job awarded by M/s TP Central Odisha Distribution Limited to M/s_____ vide work order No._____ dated_____

I _____on behalf of

M/s _____hereby undertake:

1. that the dues in respect of the workmen/ employee(s) engaged by us for the said contract, payable as per the provisions of relevant statute pertaining to
   i. wages/ salary
   ii. PF & ESI, Bhubaneswar Labour Fund
   iii. All other statutory obligation

   has been paid /settled in full and no amount/ compliance is due/ pending.

2. That in case any dispute / claim is raised by the concerned workers i.r.o. any dues / payments, M/s _____ will settle the same on it's own and such liability will be borne by M/s _____

3. That M/s _____ hereby indemnify M/s TPCODL from any future liability i.r.o. any statutory obligation in respect of said contract.

Date:

_____

( )

Authorized Signatory

For M/s _____

FORM- VI A

Notice for Commencement /Completion of contract work

I/We, Sh. / M/s _____ (Name and Address of the Contractor) hereby intimate that the contract work _____ (name of work) in establishment of the _____ (name and address of the Principal Employer) for which License No._____dated_____has been issued to me/us by the Licensing Officer _____(name of the Headquarters), has been commenced / completed with effect from _____date / on date.

Signature of Contractor

With Office Seal

The Inspector

_____

_____

FORM XXIV

[See Rule 82(1)]

Return to be sent by the Contractor to the licensing Officer (in duplicate)

Half -Yearly Ending_____

1. Name and address of the Contractor
2. Name and address of the Establishment
3. Name and address of the Principal Employer
4. Duration of Contract: From _____to _____
5. No. of days during the half year on which
   (a) the establishment of the principal employer had worked
   (b) the contractor's establishment had worked
6. Maximum No. of contract labour employed on any day during the half –year:

Men	Women	Children	Total

7. (i) Daily hours of work and spread over
   (ii) (a) whether weekly holiday observed and on what day
   (b) if so, whether it was paid for
   (iii) No. of man – hours of overtime worked
8. No. of man days worked by

Men	Women	Children	Total

9. Amount of wages paid

Men	Women	Children	Total

10. Amount of deductions from wages, if any

Men	Women	Children	Total

Whether the following have been provided –

(i) Canteen : _____

(ii) Rest rooms : _____

(iii) Drinking water **:** _____

(iv) Crèches **:** _____

(v) First Aid **:** _____

Signature of contractor

Place _____

Date _____

ANNEXURE – H

UNDERTAKING FOR COMPETENCE OF WORKMEN

Name of Associate :

Tender No. :

Item :

With reference to the tender mentioned above, I/We _____, hereby undertake that the workmen/ employee(s) engaged by M/s _____ for the job against said tender shall be competent in all respect, commensurate to the nature of job.

Date:

_____

( )

Authorized Signatory

For M/s

Seal

ANNEXURE-I

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

Your Name	
Your Designation	
Your Organization	
Contact Nos.	
Email	

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)

SECTION - A

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

S. No.	Parameters	1 Do Not Agree	2 Slightly in Agreement	3 In Fair Agreement	4 Mostly in Agreement	5 Fully Agree	Remarks/ Suggestion
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						

S. No.	Parameters	1	2	3	4	5	Remarks/ Suggestion
		Do Not Agree	Slightly in Agreement	In Fair Agreement	Mostly in Agreement	Fully Agree	
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						
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

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

SN	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	Division / Sub-Division						
1.3	Projects/HOG						
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 **fairness of treatment and transparency** with its Business Associates?						
3	How would you rate TPCODL in comparison to your other clients in terms of **processes and systems to manage partnership** with its Business Associates						
4	How would you rate TPCODL in comparison to your other clients in terms of **building long term & mutually relations**hip with its Business Associates						

SECTION–C

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

SNo	Parameters	Certainly NO	Probably NO	Probably YES	Certainly 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 have observed / experienced elsewhere in Indian/ International organization.

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

We thank you for your time and courtesy!!

ANNEXURE-J

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 outrightly 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-K

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)

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 _____

(Authorized 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 authorized 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-L

CONTRACTOR SAFETY MANAGEMENT SYSTEM

1. OBJECTIVE

The objective of the Contractor Safety Management System is to lay down clear guidelines for all Business Associates (including their associates, staff and agents) which would facilitate them to observe all statutory rules and regulations, comply with applicable standards of Central Electricity Authority (Measures relating to safety and electric supply) Regulations, 2010 & (safety requirements for construction, operation and maintenance of electrical plants and electric lines) Regulations,2011, TPCODL Safety Manual and Guidelines and thus, ensure creation of safe working environment for all stakeholders of our network.

2. SCOPE

All contracts (minor and major) will be subject to the provisions of this document.

Minor Contracts: Contracts which satisfy all the criteria listed under the head "Minor Contracts".

Major Contracts: Contracts which satisfy any two or more criteria listed under the head "Major Contracts"

Criteria	Minor Contracts	Major Contracts
Value of Contract	< Rs. 1500000/- (less than Rs. Fifteen Lac)	>= Rs. 1500000/- (Equal or more than Rs. Fifteen Lac)
Period	Period less than 1 year	Any period
Working on energized electrical equipment	No	Yes
Working on height (above 1.8 Mtrs from ground)	No	Yes
Work involving construction activity	No	Yes
Working with hazardous goods or chemicals	No	Yes
Work involving danger to general public	No	Yes

Note: *Exceptions for major and minor contract are – in house software development, supply of material or equipment but no direct or indirect installation of the same material, administration contracts (courier, water supply, printing, security, transport, etc.), minor civil work like plastering at ground level or flooring, etc. The facility management (housekeeping) contract will always be treated as a minor contract.*

3. INFORMATION REQUIRED AT TIME OF VENDOR REGISTRATION OR BEFORE COMMENCEMENT OF CONTRACT

3.1 Business Associate is required to fill the Safety Management System Questionnaire as per *annexure 1* and submit along with the vendor registration process / bid / tender document. The filled questionnaire will be scrutinized by Engineer In-charge / indenting group and recommend suitability of the BA with respect to safety requirements. The fulfilment of statutory requirements for vendor registration pertaining to labour laws etc. shall be done by BA Cell on being referred to it.

3.2 Business Associate is required to take suitable risk control measures mentioned against the identified Hazards and Risk document provided for all contracts as per *annexure 2*. The primary objective of this is to evaluate the understanding of the BA towards risk mitigation and employment of safe work procedures. BA is required to conduct the Hazard identification and Risk Assessment study as per the procedure and deploy more or other measures if deemed necessary.

3.3 Business Associate shall comply with **Statutory Requirements related to Safety and Occupational Health** and submit the "Safety Undertaking" as per *annexure 4*.

4. GENERAL SAFETY CONDITIONS REQUIRED TO BE FULFILLED BY BUSINESS ASSOCIATES

The requirements of the contractor safety management system applicable to the minor or major contracts related to various groups are as following –

4.1 Maintenance of Distribution Network – *Annexure 3.1*
4.2 Distribution Projects – *Annexure 3.2*
4.3 EHV Projects – *Annexure 3.3*
4.4 Maintenance of Sub transmission network – *Annexure 3.4*
4.5 Civil / Generation Projects – *Annexure 3.5*
4.6 Meter Management Group (MMG), Revenue Recovery Group (RRG), Energy Auditing Group, AMI, MRG, etc. – *Annex3.6*
4.7 Maintenance and Operation of Street Light. **–** *Annexure 3.7*

1. *Please note that hydra cranes used by any dept should be ACE Model No. FX 150 ACE SX 150, Escorts Model No. TRX 1550 or contemporary. Use of old generation hydra cranes like ACE 14XW or ACE 12 XW, etc are prohibited.*

(*Details as per Annexure attached)*

Note: *For minor contracts, the BA shall assign the duties of Safety Representative to the Work Supervisor. Work Supervisor will deliver all duties and responsibilities of Safety Supervisor as detailed in this document.*

The Business Associate (BA) having major contract will appointing Safety supervisor, engineer / manager for the TPCODL work. The BA shall make all necessary arrangements for getting their workforce safety trained and competency checked from the concerned official of TPCODL before deployment in the field. BA Cell shall recommend the suitability after competency checked by Engineer In-charge and SAFETY group (or his representative) of TPCODL. After getting the clearance from concerned official, BA cell and receiving temporary I-card issued by TPCODL, Business Associate shall commence the working.

Safety Representative of Business Associates will formally become the nodal point for safety concerns for TPCODL. ***BA shall not frequently transfer or terminate the services of any of the safety representatives appointed for TPCODL work site. BA needs to ensure***

***that Safety representative is available at all points of time; failing which the work being carried out in the interim (period when Safety representative is not available) shall be treated as working under improper supervision and due penal provisions shall be initiated against the BA*.** BA will be required to provide all applicable infrastructure and power to ensure smooth working of the safety representative to maintain a sound safety management system. **In all contracts safety representative will not be assigned any other activity at site apart from the works related to safety management. The duties are detailed in clause 5.5 of this document.** TPCODL will be auditing the facilities provided to the BA`s safety team time to time.

The Safety Representative of the BA shall be required to meet and follow the instructions of the Engineer In-charge and SAFETY Group of TPCODL. He shall be responsible for providing the MIS and/or any other relevant information, as and when desired, within the stipulated time frame as per the requirements of TPCODL. Any non-conformance to safety will lead to the negative marking or issue of safety violation challan/ tokens which shall affect the monthly evaluation and performance of BA.

All contracts where BA has to depute vehicle for their staff and equipment to move from one location to other, the BA shall ensure that vehicle complies all required statutory clearances and requirement as per The Motor Vehicle Act, 1988 as well as TPCODL Road Safety Policy and are in good & safe state of working.

5. QUALIFICATION AND EXPERIENCE OF THE SAFETY AND SITE PERSONNEL

Qualification and experience required for the safety and site personnel are as following:

5.1 Safety Supervisor: It is mandatory that educational qualification of safety supervisor be ITI (of relevant trade) / Diploma (Any branch of engineering) and he has a working experience on electrical system / relevant field of work at least 5 yrs for ITI and 3 years for Diploma holder. Having formal experience of the safety systems will be an added advantage

5.2 Safety Engineer: It is mandatory that educational qualification of safety engineer be at least Diploma (relevant branch) and he has working experience on electrical system of at least 3 yrs. Having the formal experience of the safety systems will be an added advantage.

5.3 Safety Manager: The educational qualification of safety manager should be graduate engineer with working experience on electrical system / network of at least 3 yrs. OR Diploma in Industrial Safety with working experience of 05 years including at least 02 years on electrical network.

However, clause 5.1, 5.2 and 5.3 are not applicable for minor contracts. In such cases, BA shall assign the duties of Safety Representative to the Work Supervisor. Work Supervisor will deliver required duties of Safety Representative (as per clause 5.5) in addition to other duties without diluting the importance of safety.

5.4 Site Skilled Personnel: For all responsibility related to site activities and operations, the BA shall employ only qualified and skilled persons and shall comply the provisions of section 19 & 29 of Central Electricity Authority (Measures relating to safety and electric supply) Regulations, 2010. Persons holding valid approvals only by any Government approved agency or a competency assessment panel or a team set up by TPCODL

shall be allowed to perform the High Risk / High Hazard activities (refer page 1). The skill / qualification required for the electrician and electrical supervisor are given in *annexure 5*. The contracts related to maintenance of Distribution Network, Distribution Projects, EHV Projects, maintenance of Sub-Transmission Network, MMG & EAG, maintenance and operation of street lights, shall preferably have at least 20 per cent of ITI qualified electricians in the first year of the contract. This figure shall preferably be incremented by 15 per cent every subsequent year.

Note: For the competency assessment may please refer the work instructions. An employee shall have to necessarily undergo the competency assessment check once in every eighteen months.

5.5 **Requirements from the Safety Representative(s) of the Business Associate:**

5.5.1 Safety training of 2 hrs/employee/month and one day of safety induction training to all new employees joining the BA will be conducted by the BA as per Safety training modules of TPCODL.

5.5.2 Safety Talk / tool box talk before start of shift to BA employees.

5.5.3 Ensuring the availability & proper usage of the standard safety equipment (PPE)

5.5.4 Periodic inspection of PPE to ensure their serviceability and maintaining the 10% buffer stock of standard PPEs.

5.5.5 Ensuring the adherence to standard operating procedures of TPCODL as mentioned in TPCODL Safety standard and O & M and concerned function's manual.

5.5.6 Safety inspections / audits as per the process of TPCODL

5.5.7 Working in close coordination SAFETY Group of TPCODL.

5.5.8 Reporting of unsafe acts, unsafe conditions, near miss, incident or accident to Engineer In-Charge and SAFETY Group of TPCODL immediately after its occurrence.

5.5.9 Regular HIRA at site and comply the control measures as stated in the detailed HIRA as per the *annexure 2*. Also deployment of JSA based checklist shall be ensured.

5.5.10 Ensuring compliance with safety and other laws as may be applicable and providing for safety assurance.

5.6 **Training and Syllabus:** The BA shall not deploy any person at work place / site or send newly recruited personnel directly to concerned official for competency assessment without Safety Induction Training.

5.6.1 All new BA employees have to necessarily undergo one and half days Safety training and Competency assessment at training centre of BA cell. This training will be conducted once in a week. After the completion of Safety training & Competency assessment I-card will be issued to all competent BA employees

5.6.2 BA is expected to initially train and judge the capability of the workman at his own end before further recommending the workmen for Competency assessment. If any BA workman sent for competency assessment. In case any BA workman fails in the Competency test at concerned official, it will be deemed that BA has not imparted sufficient training at his end and actual cost of training ₹ 7500/ BA employee/ failed attempt will be recovered.

5.6.3 The workers who have imparted Safety Training and issued I-Cards of TPCODL, are not deployed at TPCODL worksites/ voluntarily left the job by workers/ used somewhere else other than TPCODL by the BA, in that case Management reserves the rights to intervene and recover the actual cost of training i.e. ₹ 7500/BA employee. (*Exempted for attrition rate of BA workers less than or equal to 10% of total workforce deployed at TPCODL)*

5.7 It is desired that Safety representative of the BA to impart the general safety training to each employee of duration 2 hrs per month. The training will be organized at BA level and the record to be sent to engineer in-charge and SAFETY group of TPCODL every month. Please refer schedule and syllabus in *annexure 6*.

List of Personal Protective Equipment (PPE) and Maintenance schedule: BA shall commence the project or any work only when the required PPE are made available to the team of employees involved in the work. Each PPE of BA shall be checked / inspected by the safety representative / supervisor at zone before the work start or as prescribed in the list. Safety representative shall regularly check the healthiness of each PPE allocated to lineman. Suitable record shall be maintained at zone. Defective PPE shall be immediately replaced or within 24 hours by the BA. In no case linemen or any other official of BA may be allowed to work with defective PPE. It is preferred that BA ensures minimum stock of each PPE at zone for immediate replacement with defective one. The PPE shall be IS / BS / CE marked and exactly as per the standard or specification mentioned in the *annexure 7*. Working without PPE / non-standard PPE shall be treated as safety violation and penalty as stated in section 6.0 of this document. If TPCODL finds that BA has not provided the adequate / appropriate PPE to their staff, TPCODL reserves the rights to stop the work and call the BA to provide appropriate PPEs at the risk. If the BA fails to provide the required PPEs at the risk then the same shall be provided by TPCODL at the actual cost of the PPE. The amount shall be charged to BA and same shall be first recovered from the current bill of BA or any future payment to be made to BA. In the event of any balance amount still left for recovery, the same shall be adjusted against retention amount or by invoking bank guarantee submitted by BA.

5.8 Safety Audit / Inspection & HIRA: The BA shall get the required safety inspection / audit conducted by his technical team comprising of safety representative as per the *annexure 8*. The safety representative will be required to conduct the HIRA (Hazard Identification and Risk Assessment) *as per annexure 2* of the process and work undertaken at least two times in a year or every time if a new process / activity / machine is introduced or whenever an accident take place. The risk identified to be addressed suitably with –

- Engineering Control
- Management Control, and
- Personal Protective Equipment.

The safety representative of BA shall inform and educate for the identified risk and hazard control methods to employees, supervisor and engineer as well as the engineer in-charge and SAFETY group of TPCODL.

5.9 Safety Performance and Safety MIS: The BA shall maintain good practice of safety all through the contract duration. Safety shall always be of paramount importance during the contract period. Safety performance will be monitored on yearly basis throughout the period and no relaxation will be given for bad performance. BA with good track record and excellent performance will be rewarded suitably as per clause 6.0 of this document. The BA has to provide monthly "Performance Report – Safety" to engineer in-charge and SAFETY group TPCODL this shall be part of monthly bill along with training details. Performa of the report is enclosed as *annexure 9*.

5.10 Pre – Employment Medical Check-up and Fitness of employees engaged for the critical works: The BA shall submit the health fitness certificate for all those workers involved in climbing the pole or working at height for following diseases:

5.10.2 Epilepsy

5.10.3 Colour blindness
5.10.4 Deafness
5.10.5 Vertigo & height phobia

Every year BA will give an undertaking stating that all the employees are fit to work and have not developed aforesaid diseases. The Record of such medical check-ups shall be submitted to BA Cell before issue of temporary identity card. The records shall be maintained at BA Cell. All such medical check-ups shall be repeated once in a year for all workers involved in climbing the pole or working on electrical network.

6. REWARD AND PUNITIVE MEASURES

6.1 To support the enforcement of good SHE & DM practices by the Business Associate and to eliminate repeated or continuing safety violations, use of appropriate reward and punitive measures shall be made. Each unsafe act or violation of the safety guidelines as described in the Safety Manual of the TPCODL will be audit criteria of this system. Broadly the measures identified are following:

6.1.1 Working without PPE/ Safety Gadgets
6.1.2 Working without proper tools and tackles, barricading, Poor condition of Crane / Hydra / Vehicle, using without certification / Licence, Incompetent driver/ Helper
6.1.3 Working without creation of effective safety zone
6.1.4 Improper Supervision at worksite, Lineman/ Supervisor working without competency
6.1.5 Working without adherence to PTW process or authorization/ not adherence to SOPs / W.I. of TPCODL.
6.1.6 Improper Working at height equal to or above 1.8 mtrs without taking proper fall protection measures/ Poor condition of Ladder

6.2 Measures of Reward and Punitive Measures

The Engineer In-Charge, NSO, SC, ASOs, CSI / SIs and SHE &DM group will conduct the surprise audits of the work / project and if any non-conformance is found the same will be booked and entered in the format “Safety Violation Record” *annexure 10*. The flow of the information is given below:

Safety Violation Escalation & Monitoring process	
Action	**Responsibility**
Safety Violation form has been filled and counter foil sent to SAFETY team for information. The main form is to be given to BA supervisor / Engineer in-charge. *(Automatically generated if Site audit done through Mobile App.)*	Engineer In-charge/ NSO / SC / SAFETY Group /CSI/ ASO/ Any authorised TPCODL official.
↓	
Entry of the violation in the master record and sending the information to concerned Manager, HoG, HoD, Head and Chief (O &S). *(Automatically generated if Site audit done through Mobile App.)*.	SAFETY Group
↓	
Forwarding the information Centralized Account Payable (CAPS) for amount deduction from the current bill of the BA,	Engineer In-charge

if any.	
↓	
HoG (Safety – II) & HoG (Safety & Quality – Commercial) and CAPS to generate the MIS of the violations and the amount deducted.	SAFETY Group
↓	
The pool of the amount generated after the deduction to be utilized in safety welfare of BA employees.	SAFETY Group with approval of CFO/Chief (O & S) /CEO&MD

The safety violations have been rated from 1 to 5 (figure 6.3) as per the gravity of the violation. If the same violation is repeated it may escalate into a higher penalty. If a particular Business Associate employee violates safety norms three times, he shall not be allowed to work in TPCODL for a period of one year from the date of the 3rd violation.

6.3 Safety Violation Escalation Matrix

6.3.1

Consequence of Safety Violation Observed (Not related to Incident/ Accident)		Violation				
S.No.	Safety Violation	1st	2nd	3rd	4th	Subsequent Violations
1	Working without PPE (Helmet/Gloves/Safety Harness/ Safety Shoes etc.)	A	B	C	D	Will attract the same penality as applicable in the 4th violation.
2	Improper Working at Height	A	B	C	D	
3	Working without proper tools and tackles	A	B	C	D	
4	Poor condition of Crane/Hydra/ Vehicle/Incompetent driver/ Helper	A	B	C	D	
5	Violation of SOP/ WI	B	C	D	E	
6	Working without adherence to PTW process or authorization/ Safety Zone	C	D	E		

Legend	Action to be taken	Responsibility	Penality Amount (in Rs.)	
A	Warning letter	Engineer Incharge	Nil	The number of violations are to be calculated cumulatively over the contract period and not on monthly basis.
B	Levy of Penalty	Engineer Incharge	2,000	
C	Memo to BA & Levy of Penalty	Head of Group	4,000	
D	Memo to BA & Levy of Penalty	Head of Department	10,000	
E	Memo to BA, Levy of Penalty and termination of Contract	Head of Department	1,00,000	

Figure 6.3 (1a)-Penality Matrix for Safety violation (Applicable for Minor Contracts)

Consequence of Safety Violation Observed (Not related to Incident/ Accident)		Violation				
S.No.	Safety Violation	1st	2nd	3rd	4th	Subsequent Violations
1	Working without PPE (Helmet/Gloves/Safety Harness/ Safety Shoes etc.)	B	C	D	D	Will attract the same penality as applicable in the 4th violation.
2	Improper Working at Height	B	C	D	D	
3	Working without proper tools and tackles	A	B	C	D	
4	Poor condition of Crane/Hydra/ Vehicle/Incompetent driver/ Helper	B	C	D	E	
5	Violation of SOP/ WI	C	D	E		
6	Working without adherence to PTW process or authorization/ Safety Zone	C	D	E		

Legend	Action to be taken	Responsibility	Penality Amount (in Rs.)	
A	Levy of Penalty	Engineer Incharge	5,000	The number of violations are to be calculated cumulatively over the contract period and not on monthly basis.
B	Memo to BA & Levy of Penalty	Engineer Incharge	10,000	
C	Memo to BA & Levy of Penalty	Head of Group	25,000	
D	Memo to BA & Levy of Penalty	Head of Department	50,000	
E	Memo to BA, Levy of Penalty and termination of Contract	Head of Department	1,00,000	

Figure 6.3 (1b)-Penality Matrix for Safety violation (Applicable for Major Contracts)

Once the BA reaches the "BLACK" (color – "5") category, i.e. highest level of safety violation, "Termination" notice to BA will be issued from the office of the Head of Department (equivalent to GM/ Sr. GM level) and further, *if required,* continuation / extension of contract will only be initiated by Functional Chief / Head of the department (equivalent to Sr. GM / Chief level) and approved by CEO & MD. Till the extension, the contract will remain suspended.

TPCODL encourages the reportage of the safety violation during the contract work by BA. Any TPCODL employee can register a safety violation against the BA in the "Safety Violation Form" *annexure 10*. Initially the observer has to fill the form and handover the counterfoil (lower portion) of the document to the supervisor of the BA, inform the site engineer of TPCODL and send the top portion of the Safety Violation Form to SAFETY group for the further necessary action against the BA. ***The cumulative nos. of Safety Violations pertaining to any particular BA shall be calculated on yearly basis.***

Safety violations resulting in incident / accident will be treated as per gravity of the injury / fatality and its impact as well as type i.e. minor or Major. Consequences of incident / accident are shown in the matrix (figure 6.3(2) for major and 6.3(3) for minor) below. In case of any accident, findings and recommendations of Accident Enquiry Committee will be final and binding and will supersede the arbitration clause of GCC.

Consequence Of an Incident / Accident (In case of MAJOR contract)		Incident / Accident				Action Required
Sl. No	Type of the injury	1st	2nd	3rd	4th	
1	Slight injury (First Aid Case)	F (Strengthening of process through continuous improvement in the work procedure)				Take risk reduction measures
2	Minor injury (No or Hospitalization less then 48 Hrs)	F	G	G	H	
3	Major injury (Bone injury or burn or Hospitalization more then 48 Hrs)	G	G	H	I	
4	Single fatality	J	K			Intolerable
5	Multiple fatalities (Two or more fatalities during one event)	K				

Legend	Action to be taken	Responsibility	Penalty (in Rs.)	
F	Memo to BA and levy of penalty	Engineer Incharge	5,000/-	*The number of violations are to be calculated cumulatively over the contract period and not on monthly basis.*
G	Memo to BA and levy of penalty	Head of Group	20,000/-	
H	Memo to BA and levy of penalty	Head of Group	50,000/-	
I	Memo to BA and levy of penalty	Head of Department	2,00,000/-	
J	Memo to BA and levy of penalty	Head of Department	5,00,000/-.	
K	Memo to BA, levy of penalty, termination of contract and black listing of BA	Functional Head	10,00,000/-	

Figure 6.3 (2) - Penalty Matrix for Incident / Accident in Major Contracts

(*For example: In major contracts, if there is first incidence of major injury say bone injury (Cat. 3) where worker was hospitalized for more than 48 hrs then a penalty of amount Rs.20000/- will be deducted from the current bill produced for the payment. This penalty will be similar for first two incidents. However, it will increment to next higher category i.e. Rs. 50,000/- on subsequent incidents as per the above matrix)*

Consequence Of an Incident / Accident (In case of MINOR contract)		Incident / Accident				Action Required
Sl. No	Type of the injury	1st	2nd	3rd	4th	
1	Slight injury (First Aid Case)	L (Strengthening of process through continuous improvement in the work procedure)				Take risk reduction measures
2	Minor injury (No or Hospitalization less then 48 Hrs)	L	M	M	N	
3	Major injury (Bone injury or burn or Hospitalization more then 48 Hrs)	M	M	N	O	
4	Single fatality	P	Q			Intolerable
5	Multiple fatalities (Two or more fatalities during one event)	Q				

Legend	Action to be taken	Responsibility	Penalty (in Rs.)	
L	Memo to BA and levy of penalty	Engineer Incharge	5,000/-	*The number of violations are to be calculated cumulatively over the contract period and not on monthly basis.*
M	Memo to BA and levy of penalty	Engineer Incharge	10,000/-	
N	Memo to BA and levy of penalty	Head of Group	25,000/-	
O	Memo to BA and levy of penalty	Head of Department	1,00,000/-	
P	Memo to BA and levy of penalty	Head of Department	3,00,000/-.	
Q	Memo to BA, levy of penalty, termination of contract and black listing of the BA	Functional Head	5,00,000/-	

Figure 6.3 (3) - Penalty Matrix for Incident / Accident in Minor Contracts

(*For example: In minor contracts, if a worker meets with a non-fatal accident say bone injury (Cat. 3) where he was hospitalized for more than 48 hrs then a penalty of amount Rs. 10,000/-, will be charged from the current bill produced for the payment. This penalty will be similar for first two incidents. However, it will increment to next higher category i.e. Rs. 25,000/- on subsequent incidents as per the above matrix.)*

In case of single or multiple fatalities described under legends J&K of 6.3(2) and P&Q of 6.3(3), the concerned BA may be debarred from extension of contract or participate in new contract. In such event the approval of Chief (O & S) will be necessary for extension or award of new contract to concerned BA.

6.3.2 COMPENSATION FOR BA PERSONNEL

In the event of any untoward incident/ accident, the Business Associate shall ensure prompt medical assistance such as treatment, sickness benefit, etc. is provided to the victim(s) as per the Employees' Compensation Act, 1923 or Employees' State Insurance Act, 1948, as applicable. Also, the BA will be required to take adequate measures for compensating the victim(s) or his/her/their kin as follows:

I. <u>For Death or Permanent / Total Disablement</u>

The BA shall take an insurance coverage of at least Rs. 15 lakhs for each engaged employee, to cover any incidence of Death or Permanent / Total Disablement (Permanent/Total Disability shall be considered as defined under Employees' Compensation Act, 1923). In the event of any such unfortunate incident, the BA would ensure that adequate compensation is paid immediately to the family of the victim(s) from his own resources. This compensation shall be covered under the insurance policy subscribed by the BA mentioned earlier and the arrangement should be such that it would get reimbursed to the BA by the insurance agency subsequently.

II. For Permanent Partial Disablement and Temporary Total Disablement

The compensation in this case will be as per provisions of the Employees' Compensation Act, 1923 or Employees' State Insurance Act, 1948, as applicable.

Accordingly, the BA shall obtain a suitable Insurance Policy on award of Contract and submit documentary evidence of the policy to the BA Cell before commencement of work. The BA shall ensure that the Insurance policy is active at all times and all employees are covered in all respects till the conclusion of contract period or till working with TPCODL. The BA shall submit a copy of the policy after periodic renewals to the BA Cell.

However, on occurrence of such unfortunate incident, if it is found that the victim(s) is/are not covered under any insurance policy, the BA shall be liable to pay the entire sum of Rs. 10 lakhs from his own resources.

Further, in case of an accident resulting in Death or Permanent / Total Disablement while on duty, the appointed BA Nodal Officer will ensure that the BA complies with all statutory provisions and benefits i.e. PF, Compensation, Gratuity etc., and that all these are made available to the employees' nominee(s) as per the stipulated timelines.

6.3.3 TPCODL rewards the BA with good track record of safety management. It is proposed that BA complying with Contractors Safety Management, Safety Manual and Safety process will be rewarded suitably as per the procedure, rule and regulations of the TPCODL. In any case major accident is reported during an assessment period BA will not be eligible for this reward scheme. Assessment of contracts will be once in year. Generally the assessment cycle is calendar year and guidelines will be declared time to time.

Abbreviations Used in the Document

TPCODL	TP Central Odisha Distribution Limited
BA	Business Associate
HIRA	Hazard Identification & Risk Assessment
JSA	Job Safety Analysis
EHV	Extra High Voltage
SAFETY	Safety, Occupation Health, Environment & Disaster Management
MMG	Meter Management Group
EAG	Energy Audit Group
PPE	Personal Protective Equipment
SOP	Standard Operating Procedures
CSI/SI	Circle Safety In-charge / Safety In-charge
ASO	Area Safety Officer
NSO	Nodal Safety Officer
SC	Safety Coordinator
HoG / HoD	Head of Group / Head of Department
AGM / GM / VP	Assistant General Manager / General Manager / Vice President

CFO / Chief (O & S)/ CEO & MD	Chief Finance Officer / Chief (Operating & Safety) / Chief Executive Officer & Managing Director
COS	Corporate Operation Services
CAP	Centralized Account Payable System
PTW	Permit To Work
GCC	General Conditions of Contract.

- END -

Annexure 1 (Refer Para 3.1)

Business Associate Safety Management System Questionnaire

	Certification			
	The information provided in this questionnaire is a summary of the company's occupational health and safety management system.			
	Company Name:			
Turnover and experience:			Name of top officer:	
Date:			Position	
	Contract Details			
Contract Name			Contract Number:	

Business Associates Safety Management System Questionnaire	Marks	Yes	No	Score achieved
Safety Policy and Management				
- **Is there a written company Safety policy?** - If yes provide a copy of the policy, if No please refer Note 1.	1			
- **Does the company have an Safety Management system** - If yes provide details, if No please refer Note 1.	1			
- **Is there a company Safety Management System manual or plan?** - If yes provide a copy of the content page(s), if No please refer Note 1.	2			
- **Are Safety and occupational health responsibilities clearly identified for all levels of Management and staff?** - If yes provide details, if No please refer Note 1.	2			
Safe Work Practices and Procedures				
- **Has the company prepared safe operating procedures or specific safety instructions relevant to its operations and relevant work as per contract?** - If yes provide a summary listing of procedures or instructions, if No please refer Note 2.	1			

Certification				
- Comments				
- **Is there a register of injury or accident?** - If yes provide a copy (format)	1			
- **Is there a documented incident or accident investigation procedure?** - If yes provide a copy of a standard incident report form, if No please refer Note 2. - Comments	1			
Safety Training				
- **Describe how occupational health and safety training is conducted in your company** If No please refer Note 1.	2			
- **Is a record maintained of all training and induction programs undertaken for employees in your company?** - If yes provide examples of safety training records, if No please refer Note 2.	1			
- **Are regular safety inspections / audits are undertaken at worksites?** -If yes provide details (formats), if No please refer Note 3.	1			
- **Is there a procedure by which employees can report hazards at workplaces?** - If yes provide details if No please refer Note 1.	1			
Safety Monitoring				
- **Is there an officer / supervisor responsible for monitoring workplace / worksite safety?**	1			

Certification				
- If yes provide details				
Safety Performance Monitoring				
- **Are employees regularly provided with information on company health and safety performance?** - If yes provide details	1			
- **Has the company ever been convicted of an occupational health and safety offence?** - If yes provide details	NO Marks *(Negative mark ONE for each case)*			
- Has there been any major accident of employee at TPCODL site in past	NO Marks *(Negative mark ONE for each case*			
- Has there been any fatal accident of employee at TPCODL site in past. - (Note: Bid evaluation committee has to take cognizance of the incident and shall evaluate the bid only after formal approval of competent authority i.e. CTO. - In case of yes please refer Note 4.	NO Mark (Negative mark FIVE for each case)			
Minimum of 75% marks is required for qualification.		Total Marks achieved		
Company Reference				
1. Name of company *2. Name of company*				

Note

1: If company does not have formal procedure on Safety Management System than vendor may submit proposed Safety road map along with safety action plan and brief safety policy on his letter head signed by head of the organization.

2: The vendor may submit the same in the Safety Action Plan.

3: The vendor may utilize the same format of TPCODL or on request SAFETY group will assist the vendor in developing the audit system. For other points also vendor may take the assistance of SAFETY group for development of Safety management system.

4: The vendor may submit the Safety Improvement Plan and Safety Action Plan for his employees based on following points.

i. *Action plan for enhancing safety awareness*
ii. *Action plan for safety training of employee*
iii. *Action plan for increasing safety audit in field*
iv. *Action plan for provision and utilization of safety PPE.*
v. *Action plan for fatality reduction.*
vi. *Action plan for enhanced supervision at site*
vii. *Action plan for making employee more responsible and accountable for safety.*
viii. *Action plan for availability and utilization of all required tool and equipment.*
ix. *Safety Improvement done in last two years, specially highlighting those which have been taken after the fatal accident along with results.*
x. *Safety initiatives planed or started recently.*
xi. *Any other point.*

Based on above points and documentary evidences vendor will be required to submit a detailed report in support of his bid. The bid evaluation committee and competent authority will scrutinize the facts and the evidence submitted. If found satisfactory competent authority i.e. CTO may accord his approval for bid opening otherwise his tender shall be disqualified.

Annexure 2 (Refer Para 3.2 and 5.8)

Risk Assessment Form

Business Associate:
Scope of the work:
BA's Representative:
Telephone:
Signature: Date:

Specific Task/Activity	Potential Hazards/Consequences	Class of Risk	Control Measures
Working at Height	Fall from height	2	1. Mandatory usage of JSA checklist prior to start of work 2. Use appropriate ladder 3. Use full body safety harness having double lanyard. 4. Use Electrical Safety Shoes if working on electrical network otherwise use safety shoes. 5. Use Safety helmet. 6. Use PPE as per the annexure 7 of this CSM document 7. Refer Work instruction related to Working at Height for other details 8. Use of metal scaffold to be ensured in height work (cup lock type) 9. Deploy competent workforce who are medically fit

Specific Task/Activity	Potential Hazards/Consequences	Class of Risk	Control Measures
Working on electrical equipment / network	Electric flash / electrocution	3	1. Mandatory usage of JSA checklist prior to start of work 2. Use Electrical Safety Shoes while working on electrical network. 3. Use Electrical Safety gloves of appropriate voltage rating. 4. Use face shield / visor attached with helmet. 5. Use Safety helmet. 6. Use PPE as per the annexure 7 of this CSM document 7. Mandatory usage of Insulated tools & tackles on electrical system 8. Mandatory compliance for Lock Out & Tag out system. Refer Work instruction related to Working on electrical equipment / network for other details
Excavation / Civil work	Collapse of soil, Fall in excavated pit leading to Injury	2	1. Use safety shoes. 2. Use Safety helmet. 3. Use PPE as per the annexure 7 of this CSM document 4. Hard Barricading of the worksite. 5. Refer Work instruction related to excavation / civil work for other details
Material lifting & Mechanical Erection work	Fall of material/object, Topple of crane,	2	1. Mandatory compliance of crane checklist 2. Visual condition check of lifting tools and tackles such as wire rope sling,belt sling, chain, pulley block, D-shackles, etc. shall be ensured. 3. The operator's physical fitness and alertness should be judged by sup. / EIC. 4. Use PPE as per the annexure 7 of this CSM document 5. Refer Work instruction related to Material lifting & Mechanical Erection work
Road Safety	Road Accidents	3	1. Mandatory compliance of TPCODL Road Safety policy W07(COR-P-12)

Specific Task/Activity	Potential Hazards/Consequences	Class of Risk	Control Measures
Note: This information for the general indication purpose. The detailed risk assessment shall be conducted before start of the work by the authorized representative of the BA. The report of same shall be submitted to engineer in-charge along with annexure 4 of the CSM document.			

Guidelines for filling the Risk Assessment Form

- *Specific Task/Activity* - The documentation of each major task associated with the contract.
- *Potential Hazards* - The identification of hazards associated with each activity or task to be carried out.
- *Class of Risk* - Each hazard should be evaluated as a level of risk, described as Risk Class 1, 2 or 3 defined above.
- *Control Measure* - The identification and documentation of actions required to eliminate or reduce the hazards that could lead to accident or injury.

Hazard / Risks shall be classified according to the following schedule:

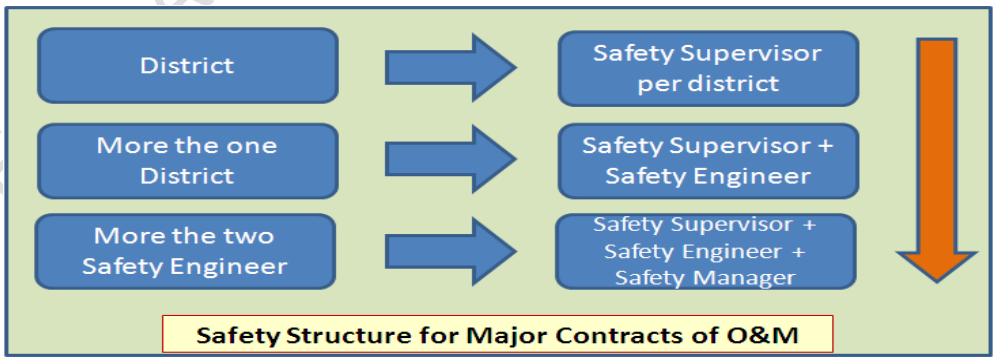
- Class 1: Potential to cause injury treatable with first aid
- Class 2: Potential to cause death or permanent injury
- Class 3: Potential to cause more than one or more lost time injuries.

Annexure 3.1 *(Refer Para 4.0)*

General Safety Conditions for the Maintenance of Distribution Network Contracts:

A BA awarded a contract (O&M) work of maintenance of distribution network will be required to fulfil the following conditions:

- BA shall provide Safety Policy and safety objectives of their company.
- BA shall comply with all statutory requirements like: applicable acts, regulations, codes of practice, OHSAS Standards, etc.
- BA shall provide the filled safety management questionnaire as per Annexure 1
- BA shall conduct a job risk assessment and provide information as per Annexure 2
- BA shall abide by Safety manuals, guidelines of TPCODL.
- BA shall provide its organisation structure & responsibilities in terms of Safety Management to TPCODL.
- BA shall document the work practices and procedures in terms of Safety Management.
- BA shall ensure safety training and induction program for the employees
- BA shall conduct safety audits & inspections as per TPCODL procedures provided by SAFETY group.
- BA shall provide and ensure the proper usage of the safety equipment (PPE) as per the TPCODL approved list in *annexure 7.*
- BA shall ensure periodic inspection of PPE to ensure its serviceability as per the specification given by TPCODL.
- BA shall ensure the adherence to standard operating procedures or guidelines laid down by TPCODL.
- BA shall ensure reporting of any unsafe act, unsafe conditions, near miss, incident or accident to engineer in-charge and SAFETY team of TPCODL.
- BA shall provide safety performance and Safety MIS (*annexure 9)* to engineer in-charge and SAFETY group periodically. Based on any non-confirmation to the safety procedures and guidelines, BA is liable to be negatively marked for his performance and suitable penalty will be imposed.
- BA shall ensure to depute a Safety Supervisor for managing a complete safety management system in a district. In case the BA has been awarded work in more than one district, then the following safety structure will be adopted.

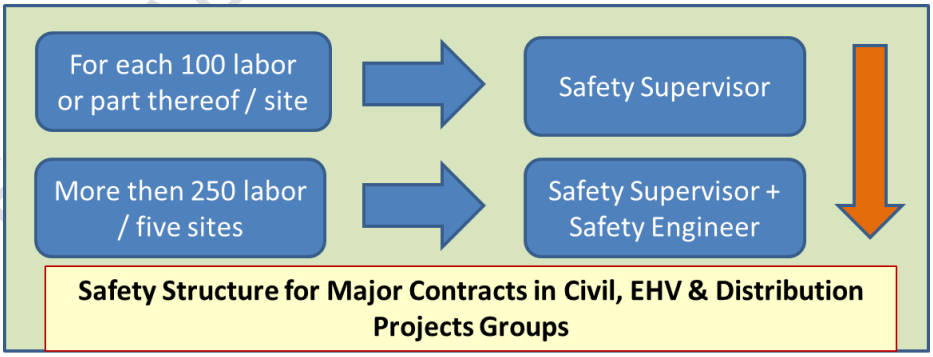


Annexure 3.2 *(Refer Para 4.0)*

General Safety Conditions for the Distribution Projects Major Contracts:

A BA awarded a major contract work of TS&P in area of a circle will be required to fulfil the following conditions:

- BA shall provide Safety Policy and safety objectives of their company.
- BA shall comply with all statutory requirements like: applicable acts, regulations, codes of practice, OHSAS Standards, etc.
- BA shall provide the filled safety management questionnaire as per Annexure 1.
- BA shall conduct a job risk assessment and provide information as per Annexure 2
- BA shall abide by Safety manuals, guidelines of TPCODL.
- BA shall provide its organisation structure & responsibilities in terms of Safety Management to TPCODL.
- BA shall document the work practices and procedures in terms of Safety Management.
- BA shall ensure safety training and induction program for the employees
- BA shall conduct safety audits & inspections as per TPCODL procedures provided by SAFETY group.
- BA shall provide and ensure the proper usage of the safety equipment (PPE) as per the TPCODL approved list in annexure 7.
- BA shall ensure periodic inspection of PPE to ensure its serviceability as per the specification given by TPCODL.
- BA shall ensure the adherence to standard operating procedures or guidelines laid down by TPCODL.
- BA shall ensure reporting of any unsafe act, unsafe conditions, near miss, incident or accident to engineer in-charge and SAFETY team of TPCODL.
- BA shall provide safety performance and Safety MIS (*annexure 9)* to engineer in-charge and SAFETY group periodically. Based on any non-confirmation to the safety procedures and guidelines, BA is liable to be negatively marked for his performance and suitable penalty will be imposed.
- BA shall ensure to depute a Safety Supervisor for managing a complete safety management system in the area. In case the BA has been awarded work in more than one circle, then the following safety structure will be adopted.



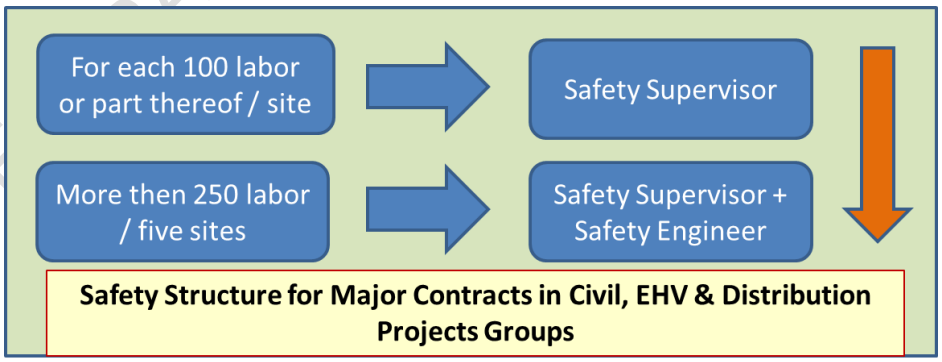
Safety Structure for Major Contracts in Civil, EHV & Distribution Projects Groups

Annexure 3.3 *(Refer Para 4.0)*

General Safety Conditions for the major EHV Projects Contracts:

A BA awarded a major contract work of EHV projects will be required to fulfil the following conditions:

- BA shall provide Safety Policy and safety objectives of their company.
- BA shall comply with all statutory requirements like: applicable acts, regulations, codes of practice, OHSAS Standards, etc.
- BA shall provide the filled safety management questionnaire as per Annexure 1
- BA shall conduct a job risk assessment and provide information as per Annexure 2
- BA shall abide by Safety manuals, guidelines of TPCODL.
- BA shall provide its organisation structure & responsibilities in terms of Safety Management to TPCODL.
- BA shall document the work practices and procedures in terms of Safety Management.
- BA shall ensure safety training and induction program for the employees
- BA shall conduct safety audits & inspections as per TPCODL procedures provided by SAFETY group.
- BA shall provide and ensure the proper usage of the safety equipment (PPE) as per the TPCODL approved list in annexure 7.
- BA shall ensure periodic inspection of PPE to ensure its serviceability as per the specification given by TPCODL.
- BA shall ensure the adherence to standard operating procedures or guidelines laid down by TPCODL.
- BA shall ensure reporting of any unsafe act, unsafe conditions, near miss, incident or accident to engineer in-charge and SAFETY team of TPCODL.
- BA shall provide safety performance and Safety MIS (*annexure 9)* to engineer in-charge and SAFETY group periodically. Based on any non-confirmation to the safety procedures and guidelines, BA is liable to be negatively marked for his performance and suitable penalty will be imposed.
- BA shall ensure to depute a Safety Supervisor for managing a complete safety management system in the area. In case the BA has been awarded work in more than one circle, then the following safety structure will be adopted.
- BA shall refer Construction Safety Manual in TPCODL Safety Manual for details.

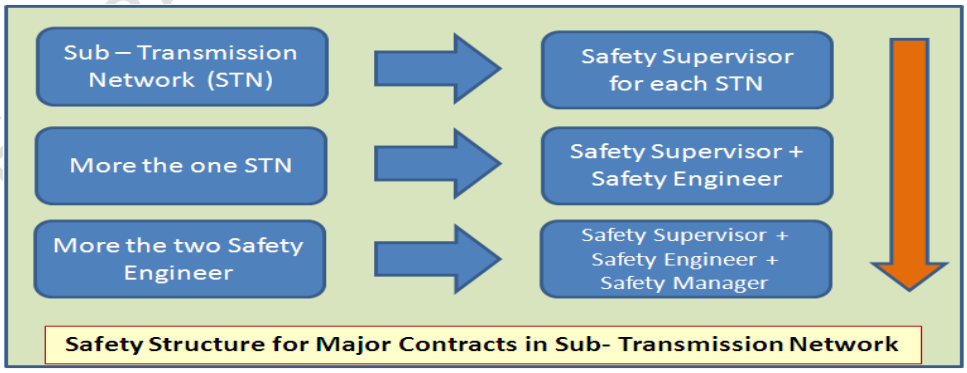


Annexure 3.4 *(Refer Para 4.0)*

General Safety Conditions for the Maintenance of Sub – Transmission Network Contracts:

A BA awarded a major contract work of maintenance of sub – transmission network in area of a power system will be required to fulfil the following conditions:

- BA shall provide Safety Policy and safety objectives of their company.
- BA shall comply with all statutory requirements like: applicable acts, regulations, codes of practice, OHSAS Standards, etc.
- BA shall provide the filled safety management questionnaire as per Annexure 1
- BA shall conduct a job risk assessment and provide information as per Annexure 2
- BA shall abide by Safety manuals, guidelines of TPCODL.
- BA shall provide its organisation structure & responsibilities in terms of Safety Management to TPCODL.
- BA shall document the work practices and procedures in terms of Safety Management.
- BA shall ensure safety training and induction program for the employees
- BA shall conduct safety audits & inspections as per TPCODL procedures provided by SAFETY group.
- BA shall provide and ensure the proper usage of the safety equipment (PPE) as per the TPCODL approved list in annexure 7.
- BA shall ensure periodic inspection of PPE to ensure its serviceability as per the specification given by TPCODL.
- BA shall ensure the adherence to standard operating procedures or guidelines laid down by TPCODL.
- BA shall ensure reporting of any unsafe act, unsafe conditions, near miss, incident or accident to engineer in-charge and SAFETY team of TPCODL.
- BA shall provide safety performance and Safety MIS (*annexure 9)* to engineer in-charge and SAFETY group periodically. Based on any non-confirmation to the safety procedures and guidelines, BA is liable to be negatively marked for his performance and suitable penalty will be imposed.
- BA shall ensure to depute a Safety Coordinator for managing a complete safety management system in the area. In case the BA has been awarded work in more than one area power system, then the following safety structure will be adopted.



Annexure 3.5 *(Refer Para 4.0)*

General Safety Conditions for the major contract work in Civil / Generation Projects:

A BA awarded a major contract work of / in civil or Generation project will be required to fulfil the following safety conditions:

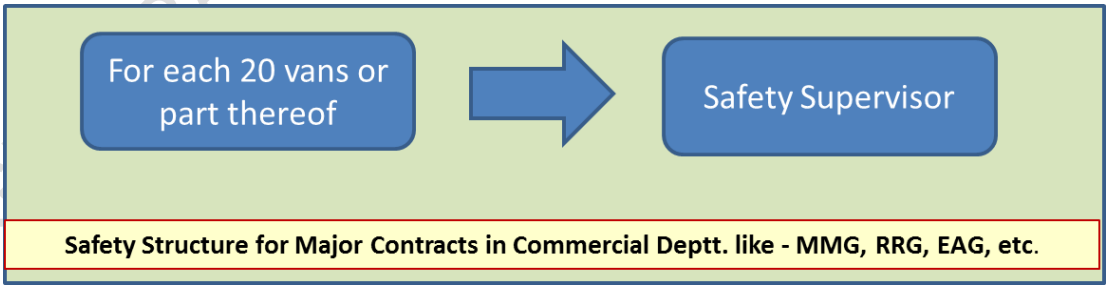
- BA shall provide Safety Policy and safety objectives of their company.
- BA shall comply with all statutory requirements like: applicable acts, regulations, codes of practice, OHSAS Standards, etc.
- BA shall provide the filled safety management questionnaire as per Annexure 1
- BA shall conduct a job risk assessment and provide information as per Annexure 2
- BA shall abide by Safety manuals, guidelines of TPCODL.
- BA shall provide its organisation structure & responsibilities in terms of Safety Management to TPCODL.
- BA shall document the work practices and procedures in terms of Safety Management.
- BA shall ensure safety training and induction program for the employees
- BA shall conduct safety audits & inspections as per TPCODL procedures provided by SAFETY group.
- BA shall provide and ensure the proper usage of the safety equipment (PPE) as per the TPCODL approved list in annexure 7.
- BA shall ensure periodic inspection of PPE to ensure its serviceability as per the specification given by TPCODL.
- BA shall ensure the adherence to standard operating procedures or guidelines laid down by TPCODL.
- BA shall ensure reporting of any unsafe act, unsafe conditions, near miss, incident or accident to engineer in-charge and SAFETY team of TPCODL.
- BA shall provide safety performance and Safety MIS (*annexure 9)* to engineer in-charge and SAFETY group periodically. Based on any non-confirmation to the safety procedures and guidelines, BA is liable to be negatively marked for his performance and suitable penalty will be imposed.
- BA shall ensure to depute a Safety Supervisor (for workforce upto 100 at site) / a safety engineer (for workforce upto 250 at site) / safety manager (for more than two safety engineers) for managing a complete safety management system at the project site. In case the BA has been awarded more than one major contracts, then the following safety structure will be adopted.
- BA shall refer Construction Safety Manual in TPCODL Safety Manual for details.

Annexure 3.6 *(Refer Para 4.0)*

General Safety Conditions for the major contract work in Commercial Department like - MMG, RRG, EAG, etc.:

A BA awarded a major contract work in meter management group & energy auditing group will be required to fulfil the following safety conditions:

- BA shall provide Safety Policy and safety objectives of their company.
- BA shall comply with all statutory requirements like: applicable acts, regulations, codes of practice, OHSAS Standards, etc.
- BA shall provide the filled safety management questionnaire as per Annexure 1
- BA shall conduct a job risk assessment and provide information as per Annexure 2
- BA shall abide by Safety manuals, guidelines of TPCODL.
- BA shall provide its organisation structure & responsibilities in terms of Safety Management to TPCODL.
- BA shall document the work practices and procedures in terms of Safety Management.
- BA shall ensure safety training and induction program for the employees
- BA shall conduct safety audits & inspections as per TPCODL procedures provided by SAFETY group.
- BA shall provide and ensure the proper usage of the safety equipment (PPE) as per the TPCODL approved list in annexure 7.
- BA shall ensure periodic inspection of PPE to ensure its serviceability as per the specification given by TPCODL.
- BA shall ensure the adherence to standard operating procedures or guidelines laid down by TPCODL.
- BA shall ensure reporting of any unsafe act, unsafe conditions, near miss, incident or accident to engineer in-charge and SAFETY team of TPCODL.
- BA shall provide safety performance and Safety MIS (*annexure 9)* to engineer in-charge and SAFETY group periodically. Based on any non-confirmation to the safety procedures and guidelines, BA is liable to be negatively marked for his performance and suitable penalty will be imposed.
- BA shall ensure to depute a Safety Supervisor for managing a complete safety management system for the work as per the following safety structure.
- The BA for the RRG work shall depute one Safety supervisor.



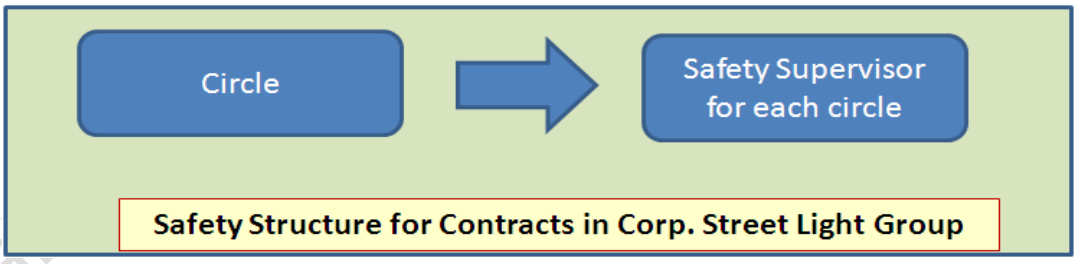
Safety Structure for Major Contracts in Commercial Deptt. like - MMG, RRG, EAG, etc.

Annexure 3.7 *(Refer Para 4.0)*

General Safety Conditions for the major contract work in O&M of street light group:

A BA awarded a major contract work in operation and maintenance of street light group will be required to fulfil the following safety conditions:

- BA shall provide Safety Policy and safety objectives of their company.
- BA shall comply with all statutory requirements like: applicable acts, regulations, codes of practice, OHSAS Standards, etc.
- BA shall provide the filled safety management questionnaire as per Annexure 1
- BA shall conduct a job risk assessment and provide information as per Annexure 2
- BA shall abide by Safety manuals, guidelines of TPCODL.
- BA shall provide its organisation structure & responsibilities in terms of Safety Management to TPCODL.
- BA shall document the work practices and procedures in terms of Safety Management.
- BA shall ensure safety training and induction program for the employees
- BA shall conduct safety audits & inspections as per TPCODL procedures provided by SAFETY group.
- BA shall provide and ensure the proper usage of the safety equipment PPE as per the TPCODL approved list in annexure 7.
- BA shall ensure periodic inspection of PPE to ensure its serviceability as per the specification given by TPCODL.
- BA shall ensure the adherence to standard operating procedures or guidelines laid down by TPCODL.
- BA shall ensure reporting of any unsafe act, unsafe conditions, near miss, incident or accident to engineer in-charge and SAFETY team of TPCODL.
- BA shall provide safety performance and Safety MIS (*annexure 9)* to engineer in-charge and SAFETY group periodically. Based on any non-confirmation to the safety procedures and guidelines, BA is liable to be negatively marked for his performance and suitable penalty will be imposed.
- Each BA shall ensure to depute a Safety Supervisor for managing a complete safety management system for the work awarded as per the below structure.



Annexure 4 *(Refer Para 3.3)*

Safety Undertaking by way of Affidavit

I_____ s/o_____R/o_____ (AUTHORIZED REPRESENTATIVE/PARTNER/DIRECTOR/PROPRIETOR) of M/S _____(name of company/firm)__ having its office at (Complete address of Company), authorized vide power of attorney dated ------/Board resolution dated----/letter of authority dated----, hereinafter referred to as **Contractor [or Business Associate (BA)]** which expression shall, unless it be repugnant to or inconsistent with the meaning or context thereof, be deemed to include its heirs, executors, administrators, and assigns do hereby affirm and undertake as under :

1. The present undertaking shall remain in force from the date of execution of contract awarded by TPCODL and shall be valid till the date of termination of the said contract by either parties. The undertaking is binding on me (contractor) as well as my sub-contractor and its employees, representatives etc.
2. That I(the contractor) will be responsible and liable to comply and abide by all the safety rules, instructions and regulations as may be specified and laid down by The TP Central Odisha Distribution Limited (TPCODL) so as enable TPCODL to achieve its goal of Zero On site incidences.
3. That the Contractor shall be fully responsible for ensuring occupational health and safety of its employees, representatives, agents as well as of its subcontractor's employees, at all times during the discharge of their respective obligations under the contract including any methods adopted for performance of their tasks / work.
4. That Contractor shall ensure ,at its own expense to arrange for and procure, implement all requisite accident prevention tools, first aid boxes, personal protective equipment, fire extinguisher, safety training, Material Safety Data Sheet, pre-employment medical test, etc. for operations & activities including as & when so specified by TPCODL specifically. , failing which TPCODL shall be entitled, but not obliged, to provide the same and recover the actual cost thereof from the Contractor's payments.
5. That the Contractor shall engage adequate and competent Safety – Supervisor / Engineer / Manager / Skilled persons at site as per the Para 5 (Qualification and experience of safety personnel) and Annexure 3 of Contract Safety Management.
6. That the Contractor shall engage the competent Site – Supervisor with each group of workers for safe and correct workmanship, proper co-ordination of material and site work as per contract.

7. That the Contractor shall immediately replace supervisor in case it is found to be not up to the level of skill and experience required as in skill and experience required in *annexure 5* of this document, but any such replacement shall be only with the prior concurrence of TPCODL .
8. That the Contractor and its subcontractors shall abide by all the safety guidelines as per Safety Manual, Contract Safety Management and other guidelines issued from time to time by TPCODL during the contract period.
9. That in case the Contractor and/or any of its Subcontractor fail to ensure the compliance as required in terms of this undertaking the Contractor shall keep and hold TPCODL / its directors / officers / employees indemnified against any / all losses / damage / expense / liability / fines / compensation / claims / action / prosecutions or the like which might be suffered by TPCODL or to which TPCODL might get exposed to as a result of any breach /wilful negligence /deliberate default on the part of the Contractor /Subcontractor in complying with the same. Contractor shall also furnish any press release, clarification etc. if sought by TPCODL for any near miss or safety violations, accidents, which are attributable to fault of Contractor.

DEPONENT

VERIFICATION

Verified at Bhubaneswar on this _Day of _____20__ that the contents of the above affidavit are true and correct and nothing material has been concealed therefrom

DEPONENT

Annexure 5 *(Refer Para 5.4)*

SKILL / QUALIFICATION REQUIRED FOR ELECTRICIAN AND ELECTRICAL SUPERVISOR

Skill / Qualifications Required for Electrician *(Certificate of Competency Class-II)*:

1. Formal education in ITI – Wireman/ Electrician trade.

   OR

2. Working experience of minimum three years of practical wiring.

   OR

3. Have completed three years apprenticeship course through Apprenticeship Advisor, Govt. of Odisha / other state Govt. in the trade of Lineman / Wireman / Electrician.
4. A candidate must have attained the age of Eighteen years.

Skill / Qualifications Required for Electrical Supervisor (*Certificate of Competency Class-I)*:

1. Have at least five years' experience of practical wiring after passing the certificate of competency class-II i.e. electrician.

   OR

2. Recognized Degree or Diploma or equivalent qualification in Electrical Engineering from any Technical institute / College or University recognized by the Board.

   AND

   Must have completed the training/job in rectifying the common defects in electrical line and power installation for a period of one and three years after passing Degree or Diploma respectively

   OR

3. Possessing the valid certificate of certificate of competency class – 1 (Electrical Supervisor)

Annexure 6 (*Refer Para 5.6)*

Training Module for BAs Worker & Supervisor

Training for BA Supervisor **Duration – 02 Hrs / Month**

Methodology: **Lecture and Practical Demonstration of Safety Zone Creation**

Session: 1

Topic: **Electrical Safety Aspects**

Sub Topics:

1. Learning specifics of HT & LT Network of zone
2. Major type of HT / LT / service lines / street light maintenance works
3. Understanding the need of Safety
4. Understanding the safe process of maintenance :
    - Planning of the maintenance job
    - Availability of men, material & machine, PPEs, Safety gear and approved PTW
    - Briefing of the job by the supervisor of the TPCODL
    - Identification of Risks associated with the maintenance work and planning for controlling measures by TPCODL supervisor
    - Creation of safety zone by TPCODL supervisor and satisfying that the network is dead – Use of Neon Tester, Shorting Chain and Safety Tagging
    - Start of the work – Right person for the right job
    - Alert supervision
    - Completion of the job – Check points
    - Energization of network
    - Actions to be taken in case of some accident

Session: 2

Topic: **Use of Electrical Testing Equipment**

Methodology: **Lecture and Practical Demonstration**

Sub Topics:

1. Meggar, Hi Pot, Clamp On Meter, Neon Tester, Discharge Rod, Line tester etc.

Session: 3

Topic: **Awareness of Electrical Safety Aspects**

A. Understanding the need of this Training and Safety
B. Learning specifics of HT & LT Network
C. Major type of work to be carried out in zones
D. Switching Operations (Do's & Don'ts) including Street Light Switching
E. Working on Height *(practical demo also)*
F. Understanding the Safe Process of Maintenance / Working:
    - Planning of the job
    - Availability of men, material & machine, PPEs, Safety gear and approved PTW
    - Briefing of the job by the supervisor
    - Permit to Work
    - Safety Tagging and Lock Out Tag out

- Identification of Risks associated with the work to be carried out and planning for controlling measures by proper supervision
- Concept of "***Safety Zone***"
- Identification and use of Neon Tester, Shorting Chain, Clamp On Meter, Hi Pot, Meggar etc.
- Completion of the job – Check points
- Accident Theory & Incident Reporting
- Actions to be taken in case of some accident

Session: 4

Topic: Identification, Demonstration and Usages of Tools, PPEs and other Safety Gears and demonstration of working on HT pole

Session: 5

Topic: Practical demonstration of Safety Zone creation

FREQUENCY

Regular Safety Training Program

- It will be conducted for all field & supervisor staff of BA in such a manner that all BA Personnel attend at least two hours safety training during every month.

One Day Induction Safety Training Programs:

- This training will be for the new BA's personnel, who have been cleared by the Cross Functional Panel to undergo Safety training and who are likely to be deployed at various work sites of TPCODL by the BA, as a part of AMC / Work Contract.

Duration / Periodicity:

- Duration and periodicity has been defined above. However, this is subject to change at the discretion of TPCODL.

Annexure 7 *(Refer Para 5.7)*

LIST OF PERSONAL PROTECTIVE EQUIPMENT AND TESTING FREQUENCY

Sl. No.	Name of PPE	IS / EN Standard	Testing Frequency	Remarks	Ref Brand & Model
01	Leather Safety Shoes (Color – Black) with PU toe cap.	IS:15298 (Part-2)	Monthly and visual check every day for any crack or damage in the leather or sole.		BATA (Model No.- Endura L/C) Liberty (Model No. – 7198-01 HT Barton Black – Warrior)
02	HDPE Safety helmet with chin strap and ratchet type for adjustment.	IS:2925-1984	Monthly and visual check every day for any crack in shell.		Karam (PN Safetech) Joseph Leslie Accent Industries Honeywell
03	Full body harness (Safety belt)	EN 361	Monthly and visual check every day of the bends and the harness.		Karam (PN Safetech) Joseph Leslie Accent Industries
04	Electrical Safety Gloves	EN: 60903 CE marked	Weekly and visual check for any crack and blow test before every work.	Manufactured not beyond 12 months.	Make Sparian / Sumitech / CATU supplied with inner cotton glove with over glove of split leather.
05	Full face visor with safety helmet	EN: 166 CE marked (Visor)	Monthly and visual check every day for any crack in shell.	Clear acrylic visor attached with safety helmet.	Karam (PN Safetech) Joseph Leslie Accent Industries Honeywell
06	Fire Proof jacket for chest protection		Monthly and visual check every day.		
07	Safety Chain for shorting cum earthing.	As per TPCODL standard	Weekly and visual check before every work.	Made of brass, Total length – 5.5 meters and made of 12 SWG.	

Note:

1. *Any other Personal Protection Equipment required beyond above list will be according to BIS or EN Standards.*
2. *All Personal Protection Equipment will be checked by the engineer in-charge or SAFETY group of TPCODL.*
3. *Safety Representative of the BA has to maintain the record of the availability, condition and checking of the PPEs.*
4. *All tools required as per the contract must be according to respective IS / EN standards.*
5. *TPCODL may revise or add the above list of PPE and their specifications as and when feel necessary. The information about new specifications /models will be circulated by the Engineer In-charge (EIC), which shall adhere by the business associated in the shortest possible time. The EIC shall issue a memo / instruction to BA with timeline for implementation. Any delay will be treated as non- compliance / safety violations. Refer picture of each PPE given in next page.*

Pictures of PPE for reference purpose.

Sl. No.	Name of PPE	IS / EN Standard	Picture
01	Leather Safety Shoes (Color – Black) with PU toe cap.	IS:15298(Part-2) and with test report of electrical resistance.	
02	HDPE Safety helmet with chin strap and ratchet type for adjustment.	IS:2925-1984	
03	Full body harness (Safety belt) The straps at shoulder and thigh shall have full pad for comfort. The back shall be so designed that harness straps do not tangle with each other.	EN 361:2002 EN 358 : 2000 IS: 3521:1991/2002	

04	Electrical Safety Gloves – Composite type Soft electrical gloves as per size of individual.	EN: 60903 CE marked	
05	Full face visor with safety helmet	EN: 166 CE marked (Visor)	
06	Fire Proof jacket for chest protection		
07	Safety Chain for shorting cum earthing.	As per TPCODL standard	  
08	Reflective jacket to each workmen	As per TPCODL standard	

Note : Picture shown are for indicative purpose only. Actual product may differ.

Annexure 8 *(Refer Para 5.8)* LIST OF AUDITS TO BE CONDUCTED

Audits	Responsibility	Freq.	Ref. Doc.
Permit to Work & Field Audit	BA Safety Representative	Weekly	F04 (COR P - 12)
Tool Bag & PPE's Audit		Weekly	F06 (COR P - 12)
First Aid Box Maintenance Record		Fortnightly	F08 (COR P - 12)
Fire Extinguisher Record ***(Applicable for the BA involved in major construction works and have storage of flammable material at worksite)***		Monthly	F09 (COR P - 12)
Safety Talk Register		Weekly	F18 (COR P - 12)
Site Safety Audit		Daily	F29A (COR P - 12)

Note:

1. *(BA Safety Representative has to use the formats as per Safety process COR – P – 12 of TPCODL)*

Annexure 9 (*Refer Para 5.9)*

PERFORMANCE REPORT – SAFETY

FOR THE MONTH OF……

Name of BA : ……..

Name of the Project and Purchase order No: ……

Date of commencement of work: ……

Man Hour Worked in this month (No. of employees X 8 Hrs + Overtime): ……

Cumulative Man Hour worked: ……

Total Number of Minor Injury (this month): …… Minor Injury (Total)…….

Major Injury (this month): …….. Major Injury (Total): ……

Detail of the Incident / Sub Standard Acts and Condition

Activity	This Month	Cumulative (Total)	Day Lost (this month)	Days Lost (Cumulative)
No. of the Incident				
No. of lost time injuries				
No. of dangerous occurrences				
No. of near miss reported				
Substandard Act/Conditions observed			Attach details of observation of this month	
Safety Violation Notice received (from TPCODL) (both in numbers and in Rs.)	No.	No.	No. of violation letter received and compliance report for the TPCODL.	
	Rs.	Rs.		

Note: Cumulative means total from date of commencement of work according to the contract.

Detail of the Accident / Near Miss Incidents:

Date and Time	Type of the incident	Name of Employee	Brief Description	Corrective and Preventive actions recommended

Details of the Safety Violations:

Date and Location	Brief Description	Name of employee involved	Action Taken

Detail of the Safety Talk / Tool Box Talk / Safety Training

Date and Location	Topic (s)	Total Number of employees (Worker / Supervisor)	Number of participants (Worker / Supervisor)

Detail of the Safety Meeting

Date and Location	Number of participants	Topics discussed	Major Observations / Innovation

Detail of the Safety Inspection /Audit: (as per TPCODL site audit checklist F29A(COR-P-12)

Date	Area / Location	Major Observations	Recommendations	Action Taken

Any other Safety, Occupational Health, Environment & Disaster Management Promotional Activity (During this month):

Date	Location	Activity	Level of Participation	Number of participation

Signature of the BA Safety Representative Signature of ZM / HoG

Name, E. No. and Date Name, E. No. Date.

Note: The original form to be deposited with Engineer in-charge and a copy to SAFETY group on or before 5th of every month along with bill. List of training of the current month and status of PPE to be also mentioned individual wise.

BA may include additional lines if required. The TPCODL may revise the format as and when deemed required.

ANNEXURE-M

VENDOR APPRAISAL FORM

TO BE SUBMITTED BY VENDOR (To be filled as applicable)			
VENDOR:			
1.0	**DETAILS OF THE FIRM**		
	1.1	NAME (IN CAPITAL LETTERS)	:
	1.2	TYPE OF CONCERN (PROPRIETORY) Partnership, Pvt. Ltd., Public Ltd. etc.	:
	1.3	YEAR OF ESTABLISHMENT	:
	1.4	LOCATION OF OFFICE POSTAL ADRESS TELEGRAPHIC ADDRESSES, TELEX NO. FAX NO.	:
	1.5	LOCATION OF MANUFACTURING UNITS	:
		i) UNITS 1	:
		ii) OTHER UNITS	:
2.0	**PRODUCTS MANUFACTURED**		:
3.0	**TURNOVER DURING THE LAST 3 YEARS (TO BE VERIFIED WITH THE LATEST PROFIT & LOSS STATEMENT).**		:
4.0	**VALUE OF FIXED ASSETS**		:
5.0	**NAME & ADDRESS OF THE BANKERS**		:
6.0	**BANK GUARANTEE LIMIT**		:
7.0	**CREDIT LIMIT**		:
8.0	**TECHNICAL**		
	8.1	NO.OF DESIGN ENGINEERS (INDICATE NO.OF YEARS EXPERIENCE IN RELATED FIELDS)	:
	8.2	NO.OF DRAUGHTSMEN	:
	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 / COLLABORA-TOR'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	:
9.0	**MANUFACTURE**		
	9.1	SHOP SPACE, LAYOUT LIGHTING, VENTILATION, ETC.	:
	9.2	POWER (KVA)	:
		MAINS INSTALLED	:
		UTILISED	:
		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	:
10.0	**INSPECTION / QC / QA / TESTING**		
	10.1	NUMBER OF PERSONNEL (INDICATE NO.OF YEARS OF EXPERIENCE)	:
	10.2	INDEPENDENCE FROM PRODUCTION	:
	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 RECOGNISED 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	:
11.0	**EXPERIENCE (INCLUDING CONSTRUCTION / ERECTION / COMMISSIONING) TO BE FURNISHED IN THE FORMAT INDICATED IN APPENDIX)**		:
12.0	**SALES, SERVICE AND SITE ORANISATIONAL DETAILS**		:

13.0	**CERTIFICATE FROM CUSTOMERS (ATTACH COPIES OF DOCUMENTS)**	:
14.0	**POWER SITUATION**	:
15.0	**LABOUR SITUATION**	:
16.0 *	**APPLICABILITY OF SC/ST RELAXATION (Y/N)** **IF YES, SUPPORTING DOCUMENTS TO BE ATTACHED**	
17.0	**ORGANIZATIONAL DETAILS** 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	:
18.0	**DOCUMENTS TO BE ENCLOSED:** 1. FACTORY LICENSE 2. ANNUAL REPORT FOR LAST THREE YEARS 3. TYPE TEST REPORT FOR THE ITEM 4. PAST EXPERIENCE REPORTS 5. ISO CERTIFICATE –QMS, EMS, OHAS, SA 6. REGISTRATION OF SALES TAX 7. COPY OF TIN NO. 8. COPY OF SERVICE TAX NO. 9. REGISTRATION OF CENTRAL EXCISE 10. COPY OF INCOME TAX CLEARANCE. 11. COPY OF PF REGISTRATION 12. COPY OF ESI REGISTRATION 13. COPY OF INSURANCE FOR WORK MAN COMPENSATION ACT NO 14. COPY OF ELECTRICAL CONTRACT LIC NO 15. COPY OF PAN NO 16. COPY OF WC TAX REGISTRATION 17. DOCUMENTS IN SUPPORT OF SC/ST RELAXATION AT S.NO.16.0 18. GST Registration No	

*** 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.

ANNEXURE-N

MANUFACTURER AUTHORIZATION FORM

(To be submitted on OEM's Letter Head)

Date: …….

Tender Enquiry No.: ……..

To,

Chief (Procurement & Stores)

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

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

Date: 15th June, 2018

(Praveer Sinha)
CEO & Managing Director

TATA POWER
Lighting up Lives!

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

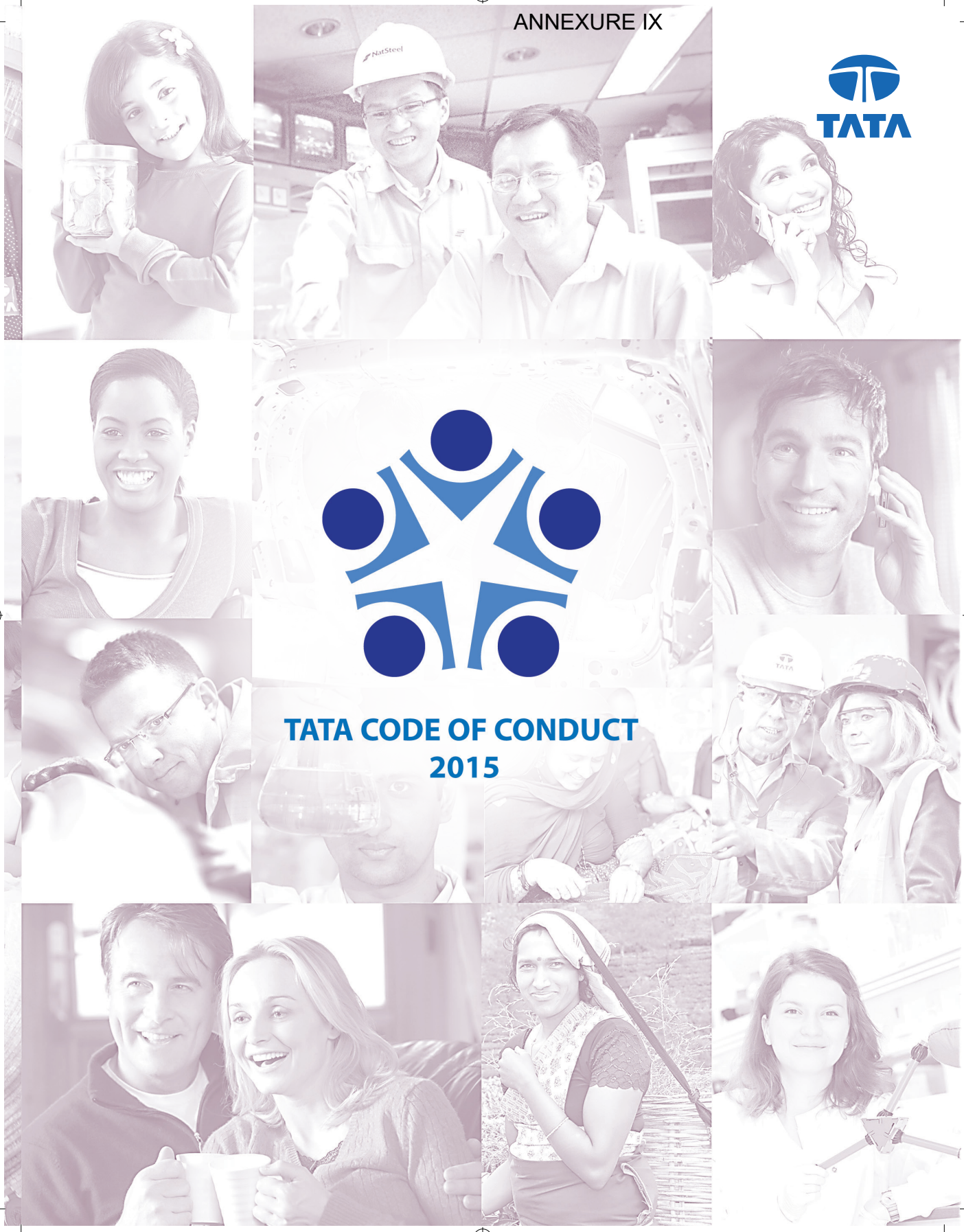
The management will commit all the necessary resources required to meet the goals of Corporate Sustainability.

(Praveer Sinha)
CEO & Managing Director

Date: 15th June, 2018

TATA POWER
Lighting up Lives!

ANNEXURE IX



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)

CONTENTS

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
21st 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-authorised, 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.

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 29th 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.

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

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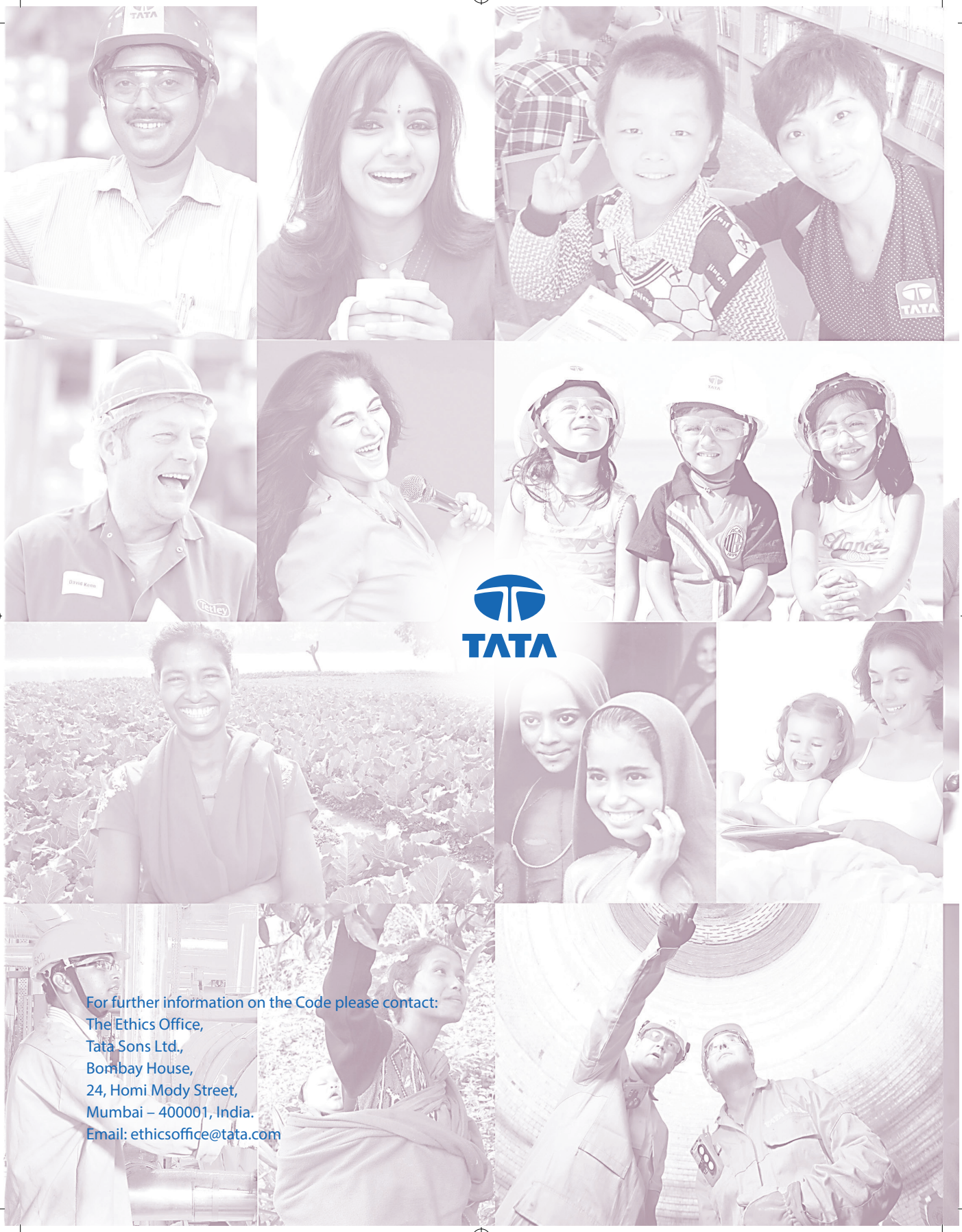

TATA

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