



**ODISHA POWER TRANSMISSION CORPORATION LTD.**

**OFFICE OF THE SENIOR GENERAL MANAGER,  
CENTRAL PROCUREMENT CELL,  
JANPATH, BHUBANESWAR - 751022  
TENDER SPECIFICATION NO.  
SR.G.M-CPC -TENDER-PANELS.- Pkg-54/2021-22**

**E-TENDER NOTICE NO. 54/2021-22**

For and on behalf of ODISHA POWER TRANSMISSION CORPORATION LTD, Sr.G.M. [C.P.C.] invites Tenders from **reputed relay manufacturers** in two part bidding system for supply of different type control & relay panels. The interested bidders would be required to enroll themselves on the tender portal [www.tenderwizard.com/OPTCL](http://www.tenderwizard.com/OPTCL). Complete set of bidding documents are available at [www.tenderwizard.com/OPTCL](http://www.tenderwizard.com/OPTCL) from **13.05.2022** at 11.00 A.M to **03.06.2022** at 12.30 P.M. Interested manufacturers may visit OPTCL's official web site <http://www.optcl.co.in> and [www.tenderwizard.com/OPTCL](http://www.tenderwizard.com/OPTCL) for detail specification.

**N.B.** All subsequent corrigendum / addendums to the tender notice shall be floated in the OPTCL's official web site <http://www.optcl.co.in> and [www.tenderwizard.com/OPTCL](http://www.tenderwizard.com/OPTCL) only. interested bidders are requested to visit e-tender portal for update information of tender (corrigendum / addendums etc.).

The bidders can view the tender documents from website free of cost.

SENIOR GENERAL MANAGER [C.P.C.]



**ODISHA POWER TRANSMISSION CORPORATION LTD.**

**OFFICE OF THE SENIOR GENERAL MANAGER,  
CENTRAL PROCUREMENT CELL,  
JANPATH, BHUBANESWAR – 751022**

**e-TENDER NOTICE NO- 54/2021-22**

For and on behalf of the ODISHA POWER TRANSMISSION CORPORATION LTD., the undersigned invites bids under two-part bidding system in e- tendering mode only as per the following details.

Tender specification No	Description of equipments / materials.	Quantity	Earnest money deposit (IN INR)	Cost of Tender specification documents	Tender Processing fee (in INR)	Last date of on line submission of bids.	Date of online opening of tender
SR.G.M- CPC - TENDER PANELS - Pkg- 54/2021-22	33 KV Control & Relay panels	02	NIL	14,160/-	5,900/-	Dt 04.06.2022 (Up to 1.00 PM)	Dt. 06.06.2022 03.00 PM)
	220 KY Relay panels (Main) for 160 MVA, 2201132 KV Auto Transformer	01					
	220 KV Relay panels (Back up) for 160 MY A,220/132 KV Auto Transformer	01					

The bidders can view the tender documents from website free of cost.

**TENDER COST:**

The bidders who want to submit bid shall have to pay **Rs. 14,160/- (Rupees Fourteen thousand One Hundred Sixty only non-refundable including GST @ 18%)** towards the tender cost, online through e-payment gateway link provided in e-tender portal (by using Net Banking, Debit Card or Credit Card).

The online payment can be made prior to last date & time of submission of online tender. They have to

also submit notarized hard copy of GST registration certificate on or before the scheduled date & time of opening of techno-commercial bid.

**TENDER PROCESSING FEE:**

The bidders shall have to submit non-refundable amount of Rs.5,900/- (Rupees Five thousand & nine hundred) only including GST @ 18%) towards the tender processing fee to K.S.E.D.C.Ltd, in e-payment mode. The e-payment of above amount is to be made to enable the bidder to download the bid proposal sheets & bid document in electronic mode.

**SUBMISSION OF TENDER COST, TENDER PROCESSING FEE & EMD :**

The bidder shall deposit the hard copy of required documents like tender cost, tender processing fee & ~~EMD-BG Bid security declaration~~, Affidavit, copy of GST Registration etc prior to last date & time for submission of bid as notified in tender notice. Local micro & small enterprisers (MSEs) (**In the state of Odisha**) based in Odisha and registered with respective DICs, Khadi, Village, Cottage & Handicrafts Industries, OSIC and NSIC can participate without payment of the cost of tender specification. They have to submit notarized hard copy of valid registration as local MSE (**In the state of Odisha**) as above on or before the date & time of submission of techno-commercial bid.

~~The demand draft/pay order for tender cost, processing fees are to be submitted along with the EMD at the office of the undersigned on or before the last date & time of submission of tender.~~

~~The bidders shall scan the Demand Draft/Pay order/ Bank guarantee, towards EMD/ notarised hard copy of valid registration as local MSE (**In the state of Odisha**) (if any) and upload the same in the prescribed form in .gif or .jpg format in addition to sending the original as stated above.~~

The prospective bidders are advised to register their user ID, Password, company ID from website **www.tenderwizard.com/OPTCL** by clicking on hyper link "Register Me".

Any clarifications regarding the scope of work and technical features of the tender can be had from the undersigned during office hours.

***Minimum qualification criteria of bidders: AS STIPULATED IN SECTION-II, (G.T.C.C) OF THE TENDER SPECIFICATION.***

**SR. GENERAL MANAGER,  
CENTRAL PROCUREMENT CELL**



**ODISHA POWER TRANSMISSION CORPORATION LTD.**

**OFFICE OF THE SENIOR GENERAL MANAGER,  
CENTRAL PROCUREMENT CELL,  
JANPATH, BHUBANESWAR – 751022  
FAX NO.:0674 – 2542964, TELEPHONE NO.:0674 – 2541801**

**e-TENDER NOTICE NO- 54/ 2021-22.**

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SENIOR GENERAL MANAGER, CPC

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## COMMERCIAL SPECIFICATION.

### PART - I

#### SECTION - I

### INSTRUCTIONS TO TENDERER

#### 1. Submission of Bids:-

The bidder shall submit the bid in Electronic Mode only i.e [www.tenderwizard.com/OPTCL](http://www.tenderwizard.com/OPTCL). The bidder must ensure that the bids are received in the specified website of the OPTCL by the date and time indicated in the Tender notice. Bids submitted by telex/telegram will not be accepted. No request from any bidder to the OPTCL to collect the Bids in physical form will be entertained by the OPTCL.

The OPTCL reserves the right to reject any bid, which is not deposited according to the instruction, stipulated above. The participants to the tender should be registered under GST Laws.

1. For all the users it is mandatory to procure the Digital Signatures of Class-III.
2. Contractors / Vendors / Bidders / Suppliers are requested to follow the below steps for Registration:
  - (a) Click “Register”, fill the online registration form.
  - (b) Pay the amount of Rs. 5,900/- through e-payment in favour of K S E D C Ltd Payable at Bangalore.
  - (c) Send the acknowledgment copy for verification.
  - (d) As soon as the verification is being done the e-tender user id will be enabled.
3. After viewing Tender Notification, if bidder intends to participate in tender, he has to use his e-tendering User Id and Password which has been received after registration and acquisition of DSCs.
4. If any Bidder wants to participate in the tender he will have to follow the instructions given below:
  - (a) Insert the PKI (which consist of your Digital Signature Certificate) in your System.  
(Note: Make sure that necessary software of PKI be installed in your system).
  - (b) Click / Double Click to open the Microsoft Internet Explorer (This icon will be located on the Desktop of the computer).
  - (c) Go to Start > Programs > Internet Explorer.
  - (d) Type [www.tenderwizard.com/OPTCL](http://www.tenderwizard.com/OPTCL) in the address bar, to access the Login Screen.
  - (e) Enter e-tender User Id and Password, click on “Go”.
  - (f) Click on “Click here to login” for selecting the Digital Signature Certificate.

- (g) Select the Certificate and enter DSC Password.
- (h) Re-enter the e-Procurement User Id Password
5. To make a request for Tender Document Bidders will have to follow below mentioned steps.
- Click “Un Applied” to view / apply for new tenders.
  - Click on Request icon for online request.
6. After making the request Bidders will receive the Tender Documents which can be checked and downloaded by following the below steps:
- Click to view the tender documents which are received by the user.
  - Tender document screen appears.
  - Click “Click here to download” to download the documents.
7. After completing all the formalities Bidders will have to submit the tender and they must take care of following instructions.
- Prior to submission, verify whether all the required documents have been attached and uploaded to the particular tender or not.
  - Note down / take a print of bid control number once it displayed on the screen
8. Tender Opening event can be viewed online.
9. Competitors bid sheets are available in the website for all.
10. **For any e-tendering assistant contact help desk number mentioned below.**
- Bangalore – 080- 40482000.

The participants to the tender should be registered under GST Laws.

## **2. Division of Specification.**

The specification is mainly divided into two parts viz. Part-I & Part-II.

### **Part-I Consists of**

- |                   |   |
|-------------------|---|
| [i] Section-I     | Instruction to Tenderers.               |
| [ii] Section-II   | General Terms & conditions of contract. |
| [iii] Section-III | Schedules and forms etc.                |
| [iv] Section-IV   | Technical Specification.                |

### **Part-II Consists of**

Schedule of prices as per Annexure-V

## **3. Tenders shall be in Two Parts.**

The Tenderers are required to submit the tenders in two parts viz. Part-I (Techno commercial) & Part-II (Price bid).

The Tenderers are required to submit the tenders in two parts Part-I, technical and commercial and Part-II “Price Bid”.

## **4. Opening of Bids.**

- [a] The part-I shall be opened on the date and time fixed by the OPTCL for opening of bids in Electronic mode in presence of such of the Tenderers or their authorized representatives [limited to one person only] on the due date of opening of tender who opt remain present. After scrutiny of the technical particulars and other commercial terms, clarifications, if required, shall be sought for from the bidders. The Tenderers shall be allowed 15 days time for such activity.
- [b] On receipt of technical clarification, the bids shall be reviewed, evaluated and those not in conformity with the technical Specification / qualifying experience, shall be rejected. If any of the technical proposal requires modification to make them comparable, discussion will be held with the participating bidders.
- All the responsive bidders shall be given opportunity to submit the revised technical and revised price proposals as a follow up to the clarification (modification if any) on the technical proposals. The qualified bidders shall be given opportunity to submit revised price proposals within 15 days from the date of such discussion or within time frame mutually agreed, whichever is earlier.
- [c] When the revised price proposals are received, the original price proposals will be returned to the bidders unopened along with their original technical proposals. Only the revised technical and price proposals will be considered for bid evaluation. The price bids [Part-II] of such of the Tenderers, whose tenders have been found to be technically and commercially acceptable, including those supplementary revised price bids, submitted subsequently, shall be opened in the presence of the bidder's representative on a date and time which will be intimated to all technically and commercially acceptable Tenderers.
- [d] The bidders are required to furnish sufficient information to the Purchaser to establish their qualification, capacity to manufacture and/or supply the materials/perform the work. Such information shall include details of bidder's experience, its financial, managerial and technical capabilities.
- [e] The bidders are also required to furnish details of availability of appropriate technical staff and capability to perform after sales services. The above information shall be considered during scrutiny and evaluation of bids and any bid which does not satisfactorily meet these requirements, shall not be considered for price bid evaluation.
- [f] The price bids of the technically and otherwise acceptable bids shall only be evaluated as per the norms applicable in terms of this Specification.



5. **Purchaser's Right Regarding Alteration of Quantities Tendered.**

The Purchaser may alter the quantities of materials/equipment at the time of placing orders. Initially the purchaser may place orders for lesser quantity with full freedom to place extension orders for further quantity under similar terms and conditions of the original orders. Orders may also be split among more than one tenderer for any particular item, if considered necessary in the interest of the Purchaser to get the goods/equipment earlier.

6. **Procedure and opening time of tenders.**

Tenders will be opened in the office of the Senior General Manager [C.P.C.] on the specified date and time in presence of the Tenderers or their authorized representatives [limited to one person only] in case of each bidder who may desire to be present, at the time of opening the bids.

7. **Bidder's Liberty to deviate from Specification.**

The Tenderer may deviate from the specification while quoting, if in his opinion, such deviation is in line with the manufacturer's standard practice and conducive to a better and more economical offer. All such deviations should however be clearly indicated giving full justifications for such deviation. [Read with Clause-9, Section-II of the Specification].

8. **Eligibility for submission of bids.**

Only those manufacturers who have deposited the cost of tender specification are eligible to participate in the tender. They should submit the money receipt as a proof of such payment. The local Micro and small Enterprises(MSEs)(**In the state of Odisha**) based in Odisha and registered with respective DICs, Khadi, Village, Cottage & Handicrafts Industries, OSIC and NSIC can participate without payment of the cost of tender specification.

9. **Purchaser's right to accept/reject bids:**

The purchaser reserves the right to reject any or all the tenders without assigning any reasons what so ever if it is in the interest of OPTCL, under the existing circumstances. [Read with clause-10, Section-II of the specification].

10. **Mode of submission of Tenders.**

[A] Tenders shall be submitted in electronic mode only.  
([www.tenderwizard.com/OPTCL](http://www.tenderwizard.com/OPTCL))

[B] **Telegraphic or FAX tenders** shall not be accepted under any circumstances.

## 11. Earnest money deposit:

The tender shall be accompanied by *bid security declaration* **Earnest Money deposit of value** specified in the notice inviting tenders against each lot / bid. Tenders without the required EMD as indicated at **Annexure-VIII** will be rejected out rightly.

~~The local Micro and small Enterprises(MSEs)(In the state of Odisha) based in Odisha and registered with respective DICs, Khadi, Village, Cottage & Handicrafts Industries, OSIC and NSIC can participate by submitting Earnest Money Deposit @ fifty percent of the amount indicated in the Notice Inviting Tender.~~

~~The earnest money deposit shall be furnished in one of the following forms subject to the conditions mentioned below:~~

- ~~(a) **Cash:** Payable to drawing & disbursing Officer, OPTCL (Hd.qrs. Office), Bhubaneswar -751022~~
- ~~(b) **Bank Draft:** To be drawn in favour of Drawing & Disbursing Officer, OPTCL [H.Qrs.Office], Bhubaneswar 751 022.~~
- ~~(c) Bank Guarantee from any Nationalized/Scheduled Bank strictly as per enclosed proforma vide **Annexure-VI** to be executed on non judicial stamp paper worth Rs.100.00 or as applicable, as per prevailing laws in force and also to be accompanied by the confirmation letter of the issuing Bank Branch.~~

### **NOTE:**

- ~~(i). The validity of the EMD in the form of Bank Guarantee shall be at least for 240 days from the date of opening of tender failing which the tender will be liable for rejection.~~
- ~~(ii) No interest shall be paid on the Earnest Money Deposit.~~
- ~~(iii) **E.M.D. in shape of cash may be submitted up to Rs. 25,000/- (Rupees Twenty-five Thousand) only. Above Rs. 25,000/- (Rupees Twenty five thousand) the Earnest Money Deposit shall be furnished in any one of the forms indicated above (i.e. Through Bank Draft, Bank Guarantee/ National Savings Certificate).**~~
- ~~(iv) No adjustment towards EMD shall be permitted against any outstanding amount with the **ODISHA POWER TRANSMISSION CORPORATION LTD.**~~
- ~~(v) The chart showing particulars of EMD to be furnished by Tenderers of different categories is placed at **Annexure-VIII.**~~

- ~~(vi) In the case of an unsuccessful tenderer, the EMD will be refunded after the tender is decided. In the case of successful Tenderer, this will be refunded only after furnishing of security money referred to at clause 19 of Section II.~~
- ~~(vii) Suits, if any, arising out of this clause shall be filed in a Court of law to which the jurisdiction of High Court of ODISHA extends.~~
- ~~(vii) EMD will be forfeited if the tenderer fails to accept the letter of intent and/or purchase order issued in his favour or to execute the order, placed on them.~~
- ~~(viii) Tenders not accompanied by Earnest Money shall be disqualified.~~

**12. Validity of the Bids:** -The tenders should be kept valid for a period of **180** days from the date of opening of the tender, failing which the tenders will be rejected.

**13. PRICE:** -

i) Tenderers are requested to quote-'FIRM' Price. No deviation from **FIRM PRICE** will be entertained irrespective of deviation clause No.7 of this part of the specification.

**14. Revision of tender price by Bidders:** -

[a] After opening of tenders and within the validity of period, no reduction or enhancement in price will be entertained. ~~If there is any change in price, the tender shall stand rejected and the EMD deposited shall be forfeited.~~

[b] After opening of price bid if the validity period is not sufficient to place purchase order, the tenderer may be asked by the purchaser to extend the validity period of the bid under the same terms and condition as per the original tender.

However, the tender are free to change any or all conditions including price except delivery period of their bids at their own risk, if they are asked by the purchaser to extend the validity period of the bid prior to opening of price bid.

**15. Tenderers to be fully conversant with the clauses of the Specification:** -

Tenderers are expected to be fully conversant with the meaning of all the clauses of the specification before submitting their tenders. In case of doubt regarding the meaning of any clause, the tenderer may seek clarification in writing from the Senior General Manager (Central Procurement Cell) OPTCL.

This, however, does not entitle the Tenderer to ask for time beyond due date, fixed for receipt of tender.

**16. Documents to Accompany Bids.**

Tenderers are required to submit tenders in the following manner:

**Part-I of the Tender shall Contain the following documents.**

- [i] Declaration Form. [As per Annexure-I]
- [ii] **Proof on Earnest Money declaration & Tender Cost.**
- [iii] Technical specification and Guaranteed Technical Particulars conforming to the Purchaser's Specification along with drawings, literatures and all other required Annexures, duly filled in.
- [iv] Photostat copies of type test certificates of materials/equipment offered as stipulated in the Technical Specification.
- [v] Abstract of Terms & conditions in prescribed proforma as per **Annexure-II.**
- [vi] General Terms & Conditions of supply offer as per Section-II of the Specification.
- [vii] List of orders executed for similar materials/equipment during preceding 2 (two) years indicating the customer's name, Purchase Order No. & Date, date of supply and date of commissioning etc.
- [viii] Data on past experience **as per Clause-7 of Section-II** of the Specification.
- [ix] GST Compliance Rating. The GST Identification Number(GSTIN) under GST Laws and permanent account number [PAN] of the firm under Income tax Act are required.
- [x] Audited Balance sheet & profit loss accounts of the bidder, for past (3) three years.
- [xi] Schedule of quantity and delivery in the prescribed Proforma vide Annexure, as appended.
- [xii] List of Orders in hand to be executed.
- [xiii] Deviation schedule.
- (xiv) Local micro & small enterprisers (MSEs) (**In the state of Odisha**) based in Odisha and registered with respective DICs, Khadi, Village, Cottage & Handicrafts Industries, OSIC and NSIC have to submit notarized hard copy of valid registration as local MSE(**In the state of Odisha**) as above on or before the date & time of submission of techno-commercial bid and upload the scan/soft copy of the same in e-tender portal.

[xv]The bidder should not have any pending litigation or arbitration with OPTCL with regard to any project or related activity. The bidder should certify/declare the same in unequivocal terms by way of an affidavit duly sworn before a magistrate/notary.

**17. Documents/Papers to accompanyPart-II Bid.**

- (a) Part – II of the tender shall consist of the following
  - (i) Schedule of prices in the prescribed proforma

**18. Conditional Offer:**

Conditional offer shall not be accepted.

**19. General: -**

- (i) In the event of discrepancy or arithmetical error in the schedule of price, the decision of the purchaser shall be final and binding on the Tenderer.
- (ii) For evaluation, the price mentioned in words shall be taken if there is any difference in figures and words in the price bid.
- (iii) Notice inviting tender shall form part of this specification.
- (iv) The price bids of the technically and otherwise acceptable bids shall only be evaluated. The EMD of others, if any, shall be returned to the bidders.
- (v) Tenderer can offer any lot or all the lots of the tender, if there are more than one lots. But the tender (bid) must be furnished separately for each lot. For each lot, the tenderer has to submit PART-I & PART-II of the bids separately.
- (vi) It should be distinctly understood that the part-II of the bid shall contain only details/documents relating to price, as outlined in clause-17 mentioned herein above. Inclusion of any of the documents/information etc. shall render the bid liable for rejection.
- (vii) The tenderer must submit the EMD amount, cost of tender document (Form Fee) and Tender processing fee in a sealed cover envelope super-scribing the tender specification number, Tender Notice No & Date of tender clearly on the cover envelope. The said envelope is to be submitted in the office of the purchaser on or before the last date and time of submission of Bids.

**20.0 Expenses in respect of OPTCL's representative for witnessing the inspection &testing of the offered equipment/materials at the inspection and testing site.**

The testing and inspection of the equipment/ materials at manufacturer works are in the scope of work of the Contractor/Supplier.

OPTCL inspecting officer, on receipt of offer for inspection from the contractor/supplier, proceeds to the manufacturer works to witness the Type/Acceptance/Routine test.

Important:

It is hereby informed to all the bidders that the relevant clauses of the contract specification, pertaining to inspection and testing of equipment/materials, are hereby supplemented with following additional terms and conditions.

The expenses under the following heads, in respect of OPTCL's representative for witnessing the inspection & testing of the offered equipment/materials at the inspection and testing site, shall be borne by the contractor / supplier.

**a) Hotel Accommodation:**

- I. Single room accommodation in 4 star hotel for the OPTCL inspecting officer of the rank of Assistant General Manager (Grade E-6) and above.
- II. Single room accommodation in 3 star hotel for the OPTCL inspecting officer of the rank below Assistant General Manager (Grade E-6).

N.B.: It is the responsibility of the contractor to arrange the hotel accommodation matching with their inspection and testing schedule, so that the inspecting officer can check-in the hotel one day prior to the date of inspection and check out after the completion of the inspection, subject to availability of the return travel ticket. In case of extended duration of inspection or non-availability of the return travel ticket, Contractor/supplier/manufacturer shall arrange for the extended stay of the inspecting officer in the Hotel accordingly. In case there is no hotel with prescribed standard in and around the place of inspection, the contractor/supplier/manufacturer shall suggest alternative suitable arrangement at the time of offer for inspection, which is subjected to acceptability of OPTCL inspecting officer.

**b) Journey of the inspecting officer:**

- (i) To and fro travel expenditure from the Head Quarters of the inspecting officer to the place of inspection/testing shall be borne by the contractor/supplier/manufacturer. Journey from the Head Quarters of the inspecting officer to the nearest Air Port by train (Ist/IIInd A.C) & A/C Taxi then

by Air to the place of inspection/testing or to the nearest place of inspection/testing and then by train (Ist/IIInd A.C) & A/C taxi to the place of inspection/testing shall be arranged by the contractor/supplier/manufacturer.

- (ii) For train journey, inspecting officer of the rank Assistant General Manager and above shall be provided with 1st class AC ticket and inspecting officer below the rank of Assistant General Manager shall be provided with 2nd class AC ticket.
- (iii) The Air-ticket / train-ticket booking/cancellation is the responsibility of the contractor / supplier.
- (iv) Moreover, if during the journey there is an unavoidable necessity for intermediate travel by road/ waterway/sea-route, the contractor/supplier shall provide suitable conveyance to the inspecting officer for travel this stretch of journey or bear the cost towards this. Any such possibilities shall be duly intimated to OPTCL at the time of their offer for inspection.

**c) Local Conveyance:**

At the place of the inspection/testing, for local journey of the inspecting officer between Hotel and inspection/testing site and or any other places, Air-conditioned four wheeler vehicle in good condition shall be provided by the contractor/supplier/manufacturer.

**d) Following points are also to be considered:**

- (i) All the above expenses shall be deemed to be included in the bidder's quoted price for that supply item. Bidder shall not be eligible to raise any extra claim in this regard.
- (ii) Contractor/supplier/manufacturer may assume that only in 40% of the inspection and testing offer cases, OPTCL inspecting officer, not below the rank of Assistant General Manager will witness the inspection and testing.
- (iii) In case of inspection and testing of some critical equipment/materials like Power transformers, OPTCL may depute more than one inspecting officer.
- (iv) Contractor/supplier/manufacturer shall judiciously plan the inspection/testing schedule and place of inspection/testing, so that optimum number of inspection/testing and minimum time shall be required to cover all the equipment/materials of the relevant contract package.

(v) It shall be the responsibility of the Contractor/Supplier to organize the above tour related matters of OPTCL inspecting officer including the matters related to overseas inspection/testing, if any.

**21.0 (a).** Detailed information on any litigation or arbitration arising out of contract completed or under execution by it over the last five years. A consistent history of litigation by or against the bidder may result in rejection of bid.

**21.0 (b).** The bidder should not have any pending litigation or arbitration with OPTCL with regard to any project or related activity. The bidder should certify / declare the same in the unequivocal terms by way of an affidavit duly sworn before a magistrate/notary. Bid furnished by the bidder shall not be eligible for consideration if it is not accompanied by the affidavit. Further the bid / LOA/ LOI shall be liable for outright rejection/ cancellation at any stage if any information contrary to the affidavit / declaration is detected.



**SECTION – II.**  
**GENERAL TERMS AND CONDITIONS OF CONTRACT [G.T.C.C.]**

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PART-I

SECTION-II

**GENERAL TERMS AND CONDITIONS OF CONTRACT [G.T.C.C.]**

1. **Scope of the contract:**

The scope of the contract shall be to design, manufacture, supply of equipment as per the specification at the consignee's site, and rendering services in accordance with the enclosed technical specification and bill of quantity.

**2.0 Definition of terms:**

For the purpose of this specification and General Terms and Conditions of contract [GTCC], the following words shall have the meanings hereby indicated, except where otherwise described or defined.

**2.1** "The Purchaser" shall mean the Senior General Manager[Central Procurement Cell] for and on behalf of ODISHA POWER TRANSMISSION CORPORATION LTD., Bhubaneswar.

**2.2** "The Engineer" shall mean the Engineer appointed by the Purchaser for the purpose of this contract.

**2.3** "Purchaser's Representative" shall mean any person or persons or consulting firm appointed and remunerated by the Purchaser to supervise, inspect, test and examine workmanship and materials of the equipment to be supplied.

**2.4** "The supplier" shall mean the bidder whose bid has been accepted by the purchaser and shall include the bidder's executives, administrators, successors and permitted assignees.

**2.5** "Equipment" shall mean and include all machinery, apparatus, materials, and articles to be provided under the contract by the suppliers.

**2.6** "Contract Price" shall mean the sum named in or calculated the bid.

**2.7** "General Condition" shall mean these General Terms and Conditions of Contract.

**2.8** "The Specification" shall mean both the technical as well as commercial parts of the specification annexed to or issued with GTCC and shall include the schedules and drawings, attached thereto as well as all samples and pattern, if any.

**2.9** "Month" shall mean "Calendar month".

2.10 Writing” shall include any manuscript, type written, printed or other statement reproduction in any visible form and whether under seal or under hand.

**2.11** “Basic Price (Taxable Value for goods) at the point of destination” shall mean the price quoted by the bidder for equipment and material at the consignee’s store/site. The cost is inclusive of packing, forwarding, freight, insurance and all expenses and taxes and duties at the end of the supplier excluding goods and service tax. The Goods & Service Tax shall be shown in a separate column item wise alongside the Basic Price quoted at the applicable rate in the Tax Invoice. The applicable rate of GST shall refer to the HSN code of the material supplied. The Basic Price and GST thereon shall be the “FOR Destination Price” as quoted by the bidder.

2.12 The term “Contract document” shall mean and include GTCC, specifications, schedules, drawings, form of tender, Notice Inviting Tender, covering letter, schedule of prices or the final General Conditions, any special conditions, applicable to the particular contract.

2.13 Terms and conditions not herein defined shall have the same meaning as are assigned to them in the Indian Contract Act, failing that in the Odisha General Clauses Act.

3. **Manner of execution:**

All equipment supplied under the contract shall be manufactured in the manner, set out in the specification or where not set out, to the reasonable satisfaction of the Purchaser’s representative.

4. **Inspection and Testing:**

[i] The purchaser’s representative shall be entitled at all reasonable times during manufacture to inspect, examine and test at the supplier’s premises, the materials and workmanship of all equipment/materials to be supplied under this contract and if part of the said equipment/material is being manufactured in other premises, the supplier shall obtain for the purchaser’s representative permission to inspect, examine and test as if the equipment/material were being manufactured in the contractor’s premises. Such inspection, examination and testing shall not relieve the supplier from his obligations under the contract.

[ii] The Supplier shall give to the purchaser adequate time/notice (at least clear 15 days for inside the state suppliers and 20 days for outside the state suppliers)

in writing for inspection of materials indicating the place at which the equipment/material is ready for testing and inspection and shall also furnish the shop Routine Test Certificate, Calibration certificates of Testing instruments, calibrated in Govt. approved laboratory with authenticity letter of that laboratory along with the offer for inspection. A packing list along with the offer, indicating the quantity which can be delivered in full truck load/Mini truck load to facilitate issue of dispatch instruction shall also be furnished.

- [iii] Where the contract provides for test at the Premises of the supplier or any of his sub-vendors, the supplier shall provide such assistance, labour, materials, electricity, fuel and instruments, as may be required or as may be reasonably demanded by the Purchaser's representative to carryout such tests efficiently. The supplier is required to produce shop routine test Certificate, calibration certificates of Testing Instruments before offering their materials/equipment for inspection & testing. The test house/laboratory where tests are to be carried out must be approved by the Govt. A letter pertaining to Govt. approved laboratory must be furnished to the purchaser along with the offer for inspection.
- [iv] After completion of the tests, the Purchaser's representative shall forward the test results to the Purchaser. If the test results conform to the specific standard and specification, the Purchaser shall approve the test results and communicate the same to the supplier in writing. The supplier shall provide at least five copies of the test certificates to the Purchaser.
- [v] The Purchaser has the right to have the tests carried out at his own cost by an independent agency whenever there is dispute regarding the quality of supply.
- [vi] If the firm fails to present the offered items for inspection/testing as per their inspection call due to any reason(s) during the visit of inspecting officer at the testing site ,the firm shall have to bear all expenses towards repetition of inspection and testing of the total offered quantity or part thereof.

5. **Training facilities.**

The supplier shall provide all possible facilities for training of Purchaser's Technical personnel, when deputed by the Purchaser for acquiring first hand knowledge in assembly of the equipment, its erection, commissioning and for its proper operation & maintenance in service, wherein it is thought necessary by the purchaser.

6. **Rejection of Materials.**

In the event any of the equipment /material supplied by the manufacturer is found defective due to faulty design, bad workmanship, bad materials used or otherwise not in conformity with the requirements of the Specification, the Purchaser shall either reject the equipment/material or ask the supplier in writing to rectify or replace the defective equipment/material free of cost to the purchaser. The Supplier on receipt of such notification shall either rectify or replace the defective equipment/material free of cost to the purchaser within 15 days from the date of issue of such notification by the purchaser. If the supplier fails to do so, the Purchaser may:-

- [a] At its option replace or rectify such defective equipment /materials and recover the extra costs so involved from the supplier plus fifteen percent and/or.
- [b] Terminate the contract for balance work/supplies, with enforcement of penalty Clause as per contract for the un-delivered goods and with forfeiture of Performance Guarantee/ Composite Bank guarantee.
- [c] Acquire the defective equipment/materials at reduced price, considered equitable under the circumstances.

7. **Experience of Bidders:**

The bidders should furnish information regarding experience particularly on the following points:

- [i] Name of the manufacturer:
- [ii] Standing of the firm and experience in manufacture of equipment/material quoted:
- [iii] Description of equipment/material similar to that quoted, supplied and installed during the last two years with the name(s) of the Organisations to whom supplies were made wherein, at least one (1) certificate shall be from a state/central P.S.U.
- [iv] Details as to where installed etc.
- [v] Testing facilities at manufacturer's works.
- [vi] If the manufacturer is having collaboration with another firm [s], details regarding the same.
- [vii] A list of purchase orders of identical material/equipment offered as per technical specification executed during the last two years along with users certificate. User's certificate shall be legible and must indicate, user's name,

address, designation, place of use, and satisfactory performance of the equipment/materials for at least two years from the date of commissioning. Wherein at least one (1) certificate shall be from a State/Central or P.S.U. Bids will not be considered if the past manufacturing experience is found to be unsatisfactory or is of less than 2 (two) years on the date of opening of the bid and bids not accompanying user's certificate will be rejected..

8. **Language and measures:**

All documents pertaining to the contract including specifications, schedule, notices, correspondence, operating and maintenance instructions., drawings or any other writing shall be written in English language. The metric system of measurement shall be used exclusively in this contract.

9. **Deviation from specification:**

It is in the interest of the tenderers to study the specification, specified in the tender schedule thoroughly before tendering so that, if any deviations are made by the Tenderers,(both commercial and Technical), the same are prominently brought out on a separate sheet under heading "Deviations Commercial" and "Deviations Technical".

A list of deviations shall be enclosed with the tender. Unless deviations in scope, technical and commercial stipulations are specifically mentioned in the list of deviations, it shall be presumed that the tenderer has accepted all the conditions, stipulated in the tender specification, not- withstanding any exemptions mentioned therein.

10. **Right to reject/accept any tender:**

The purchaser reserves the right either to reject or to accept any or all tenders if the situation so warrants in the interest of the purchaser. Orders may also be split up between different Tenderers on individual merits of the Tenderer. The purchaser has exclusive right to alter the quantities of materials/ equipment at the time of placing final purchase order. After placing of the order, the purchaser may defer the delivery of the materials. It may be clearly understood by the Tenderer that the purchaser need not assign any reason for any of the above action [s].

11. **Supplier to inform himself fully:**

The supplier shall examine the instructions to tenderers, general conditions of contract, specification and the schedules of quantity and delivery to satisfy himself as to all terms and conditions and circumstances affecting the contract price. He shall quote price [s] according to his own views on these matters and understand that no additional allowances except as otherwise provided there in will be admissible. The purchaser shall not be responsible for any misunderstanding or incorrect information, obtained by the supplier other than the information given to the supplier in writing by the purchaser.

12. **Patent rights Etc.**

The supplier shall indemnify the Purchaser against all claims, actions, suits and proceedings for the infringement of any patent design or copy right protected either in the country of origin or in India by the use of any equipment supplied by the manufacturer. Such indemnity shall also cover any use of the equipment, other than for the purpose indicated by or reasonably to be inferred from the specification.

13. **Delivery:-**

- [a] Time being the essence of the contract; the equipment shall be supplied within the delivery period, specified in the contract. The Purchaser, however, reserves the right to reschedule the delivery and change the destination if required. The delivery period shall be reckoned from the date of placing the Letter of Intent/Purchase order, as may be specified in LOI/Purchase order.
- [b] The desired delivery period shall be as indicated at Appendix-II (Quantity & Delivery Schedule) of Section-IV (Technical Specification).

14. **Despatch instructions.**

I] The equipment / materials should be securely packed and dispatched directly to the specified site at the supplier's risk by Road Transport only.

II] **Loading & unloading of Ordered Materials.**

It will be the sole responsibility of the supplier for loading and unloading of materials both at the factory site and at the destination site/store.

The Purchaser shall have no responsibility on this account.

15. **Supplier's Default Liability.**

- [i] The Purchaser may, upon written notice of default to the supplier, terminate the contract in circumstances detailed hereunder.

- [a] If in the judgement of the Purchaser, the supplier fails to make delivery of equipment/material within the time specified in the contract or within the period for which if extension has been granted by the Purchaser in writing in response to written request of the supplier.
- [b] If in the judgement of the Purchaser, the supplier fails to comply with any of the provisions of this contract.
- [ii] In the event, Purchaser terminates the contract in whole or in part as provided in Clause-15 (I) of this section, the Purchaser reserves the right to purchase upon such terms and in such a manner as he may deem appropriate in relation to the equipment/material similar to that terminated and the supplier will be liable to the Purchaser for any additional costs for such similar equipment/material and/or for penalty for delay as defined in clause-22 of this section until such reasonable time as may be required for the final supply of equipment.
- [iii] In the event the Purchaser does not terminate the contract as provided in clause 15(I) of this Section, supplier shall be liable to the Purchaser for penalty for delay as set out in Clause-22 of this section until the equipment is accepted. This shall be based only on written request of the supplier and written willingness of the Purchaser.

**16 Force Majeure:**

The supplier shall not be liable for any penalty for delay or for failure to perform the contract for reasons of force majeure such as acts of god, acts of the public enemy, acts of Govt., Fires, floods, epidemics, Quarantine restrictions, strikes, Freight Embargo and provided that the supplier shall within Ten (10) days from the beginning of delay on such account notify the purchaser in writing of the cause of delay. The purchaser shall verify the facts and grant such extension, if facts justify.

**17. Extension of time:-**

If the delivery of equipment/material is delayed due to reasons beyond the control of the supplier, the supplier shall without delay give notice to the purchaser in writing of his claim for an extension of time. The purchaser on receipt of such notice may or may not agree to extend the contract delivery date as may be reasonable but without prejudice to other terms and conditions of the contract.



**18. Guarantee period: - ( As per clause 35 of the technical specification.**

[i] The stores covered by this specification should be guaranteed for satisfactory operation and against defects in design, materials and workmanship for a period of at least 36 [Thirty six] months from the last date of delivery. The above guarantee certificate shall be furnished in triplicate to the purchaser for his approval. Any defect noticed during this period should be rectified by the supplier free of cost to the purchaser provided such defects are due to faulty design, bad workmanship or bad materials used, within one month upon written notice from the purchaser failing which provision of clause 22 (ii) shall apply.

[ii] Equipment/material failed or found defective during the guarantee period shall have to be guaranteed after repair/replacement for a further period of 36 months from the date of receipt of materials / equipment after rectification/repair. The Bank Guarantee is to be extended accordingly. Date of delivery as used in this clause shall mean the date on which the materials are received in OPTCL'S stores/site in full & good condition which are released for Despatch by the purchaser after due inspection.

**19. B.G. towards security deposit, 100% payment and performance guarantee:**

[i] For manufacturers situated Inside & out side the state of Odisha.

A Composite Bank Guarantee as per the Proforma enclosed at Annexure-VII of the specification for ~~10% (ten percent)~~ 3%(Three percent) of the taxable value plus GST there on of the purchase order(In case of successful bidder who is a local Micro and small Enterprise(MSEs) (In the state of Odisha),based in Odisha &registered with respective DICs, Khadi, Village, Cottage & Handicrafts Industries, OSIC and NSIC ~~5% (five percent)~~, 3%(Three percent) shall be furnished from any nationalized/scheduled bank having a place of business at Bhubaneswar, to the office of Sr.General Manager [Central Procurement Cell] OPTCL within **30 days from the date of issue of the purchase order**. The BG shall be executed on non-judicial stamp paper worth of Rs.29.00 [Rupees twenty nine] only or as per the prevalent rules, valid for a period of 2 months more than from guarantee period (as indicated this clause-18 of above) from the last date of delivery period, for scrutiny and acceptance, failing which the

supply order will be liable for cancellation without any further written notices. The BG should be accompanied by a confirmation letter from the concerned bank and should have provision for encashment at Bhubaneswar, before the Bank Guarantee is accepted and all concerned intimated. The B.G should be revalidated as and when intimated to you to cover the entire guarantee period.

- [ii] No interest is payable on any kind of Bank Guarantee.
- [iii] In case of non-fulfillment of contractual obligation, as required in the detailed purchase order/Specification, the composite Bank guarantee shall be forfeited.

## **20. Import License**

In case imported materials are offered, no assistance will be given for release of Foreign Exchange. The firm should arrange to import materials from their own quota. Equipment of indigenous origin will be preferred.

## **21. (A)Terms of Payment.**

- i)(a) 100% taxable value of each consignment with 100% Goods and Services Tax in full as applicable will be paid on receipt of materials in good condition at stores/desired site and verification thereof, subject to furnishing and approval of Contract cum Performance Bank Guarantee at the rate of ~~10% (Ten percent)~~ **3%(Three percent)** of Taxable Value plus GST thereon [In case successful bidder is a local Micro and small Enterprise (MSEs),based in Odisha& registered with respective DICs, Khadi, Village, Cottage & Handicrafts Industries, OSIC and NSIC, **3% (three percent) in place of 10% (ten percent)** will be applicable].
  - b. Guarantee certificate,
  - c. Test certificate by the Purchaser.
- ii) TDS under GST Laws shall be deducted, as applicable and requisite TDS certificate will be issued.
- iii) Any statutory variation due to imposition of new tax or revision in rate of existing tax shall be paid/reimbursed based on scheduled delivery or actual delivery whichever is earlier (i.e. If delivery is within schedule period, statutory variation as applicable shall be paid, and if delivery is made beyond schedule date, any additional financial implication due to statutory variation shall be to the bidder's account)

[B] The supplier shall furnish Contract cum Performance Bank Guarantee of appropriate amount to OPTCL as indicated in (i) above, within 30 days from the date of issue of the purchase order.

**22. Price Reduction Schedule for Delay in Completion of Supply under Purchase Order/Contract**

(i) If the Supplier fails to deliver the materials/equipment within the delivery schedule, specified in the Purchase Order/Contract including delivery time extension, if any, granted with waiver of Price Reduction Schedule, the Purchaser shall recover from the Supplier, Price Reduction Schedule for a sum of half per cent (0.5 per cent) of the Taxable Value of the un-delivered equipment /materials for each calendar week of delay or part thereof. For this purpose, the date of receipted challan shall be reckoned as the date of delivery. The total amount of Price Reduction Schedule shall not exceed five per cent (5%) of the Taxable Value of the un-delivered equipment/materials. Equipment will be deemed to have been delivered only when all its components, accessories and spares as per technical Specification are also delivered. If certain components, accessories and spares are not delivered in time, the equipment/materials will be considered delayed until such time as the missing components, accessories and spares are delivered.

(ii) During the guarantee period, if the Supplier fails to rectify/replace the equipment/material within 30 days from the date of intimation of defect by the purchaser, then the Price Reduction Schedule at the rate of half percent (0.5%) of the Total Taxable Value for each calendar week of delay or part thereof shall be recovered by the purchaser. For this purpose, Price Reduction Schedule shall be reckoned from the 30th day from the date of issue of letter on defectiveness of equipment/material. The total amount of Price Reduction Schedule in this case shall not exceed 10% (TEN PERCENT) of the Purchase Order/Contract amount except GST (i.e. Total Taxable Value). If the defects, so intimated are not rectified or equipment/materials not replaced by the supplier within the guarantee period, then whole of the C.P.B.G. will be forfeited by the purchaser, without any intimation to the supplier.

**23. Insurance**

The Supplier shall undertake insurance of stores covered by this Specification unless otherwise stated. The responsibility of delivery of the stores at

destination in good condition rests with the Supplier. Any claim with the Insurance Company or transport agency arising due to loss or damage in transit has to be settled by the supplier. The Supplier shall undertake free replacement of materials damaged or lost, which will be reported by the consignee within 30 days of receipt of the materials at destination without awaiting for the settlement of their claims with the carriers and underwriters.

**24. Payment Due from the Supplier.** All costs and damages, for which the supplier is liable to the purchaser, will be deducted by the purchaser from any money, due to the supplier, under any of the contract (s), executed with OPTCL.

**25. Rating under Goods and Services Tax and Balance sheet and profit &**

**Loss Account:**

The following documents are to be submitted at the time of Tender Submission:

- i. Compliance rating under Goods and Services Tax for immediate preceding financial year.
- ii. Audited Balance Sheet and Profit & Loss Account of the bidder for the previous three years to assess the financial soundness of the bidder(s).
- iii. GST registration certificate and PAN Card Copy.
- iv. Tax holiday/exemption certificate under GST or any other Act.
- v. TDS exemption certificate under the Income Tax Act or any other act.

**26. Certificate of Exemption from Goods and Services Tax.**

Offers with exemption from Goods and Services Tax shall be accompanied with authenticated attested Photostat copy of exemption certificate. Any claim towards Goods and Services Tax shall be paid on actual basis subject to payment of GST by the supplier. In case Outward supply details of the supplier of Goods in GSTR-1 do not match with GSTR -2 of OPTCL on GSTN portal, the same will be adjusted through debit/credit advice issued by OPTCL under intimation to the supplier after allowing cooling period of 3 months after the date of supply.

**27. Supplier's Responsibility.**

Notwithstanding anything mentioned in the Specification or subsequent approval or acceptance by the Purchaser, the ultimate responsibility for design,

manufacture, materials used and satisfactory performance shall rest with the Tenderers. The Supplier(s) shall be responsible for any discrepancy noticed in the documents, submitted by them along with the bid(s)

**28. Validity.**

Prices and conditions contained in the offer should be kept valid for a minimum period of **180** days from the date of opening of the tender, failing which the tender shall be rejected.

**29. EVALUATION.**

**(i)** Evaluation of price bids will be on the basis of the FOR DESTINATION PRICE including Goods and Services Tax & other levies as may be applicable. The FORD PRICE shall consist of the following components:

- a) Taxable value of equipment/materials including mandatory spares, if any for maintenance of equipment. (At the discretion of the purchaser)
- b) Goods and Services Tax
- c) Other levies, if any.
- d) Test charges, if any.
- e) Supervision of erection, testing and commissioning charges, if any.
- f) Any other items, as deemed proper for evaluation by the purchaser.
- g) Loading will be made for items not quoted by the bidder at the highest rate quoted by other bidders unless particular item is included in other items.
- h) Any imposition of new tax or revision of tax shall be considered between due date of submission of bids and the date of price bid opening.

**(ii) Weightage shall be given to the Following factors in the Evaluation & Comparison of Bids:-**

In comparing bids and in making awards, the Purchaser will consider other factors such as compliance with Specification, minimum qualification criteria as per clause-30, outright rejection of tenders clause-34 of this tender, relative quality, adaptability of Supplies or services, experience, financial soundness, record of integrity in dealings, performance of materials/equipments earlier supplied, ability to furnish repairs and maintenance services, the time of delivery, capability to perform including available facilities such as adequate shops, plants, equipment and technical Organization.

**(iii)** The local MSE (**In the state of Odisha**) bidders shall be required to furnish their willingness to match their bid price with that of the lowest evaluated bidder without any price preference and in case they agree, they shall be eligible to get up to 30% of the tendered quantity to be distributed suitably among the willing MSE bidders failing which the said 30% of the tendered quantity be awarded to the lowest evaluated bidder.

**(IV) e-Reverse Auction process shall be resorted to in the tender as follows.**

<b>STRATEGY FOR E-REVERSE AUCTION</b>	
1	Bidders are required to go through the guide lines given below and submit their acceptance to the same.
2	e-Reverse Auction (RA) will be conducted in e-tender portal of OPTCL on specified date and time, while bidders shall quote from their own offices/places of their choice. Internet connectivity shall be ensured by the respective agencies/bidders themselves.
3	KEONICS shall arrange for demonstration/ training (if not trained earlier) of bidder's nominated person(s), to explain all the rules related to e-Reverse Auction/ Business Rule document to be adopted.
4	The strategy to be used for reverse auction shall be "DYNAMIC TEMPLATE BIDDING"
<b>Procedure for electronic Reverse Auctioning (e-RA):</b>	
5	<p>a. The e-RA shall be conducted on <a href="http://www.tenderwizard.com/OPTCL">www.tenderwizard.com/OPTCL</a> only.</p> <p>b. Bidder has to submit letter towards agreement to the Process related Terms &amp; Conditions for e-Reverse Auction, as per (Reverse Auction Process Compliance Form at Annexure-XIX). In non-receipt of the same, vendors will not be allowed to participate in e-RA.</p> <p>c. e-RA shall be carried out after opening of Price bids and completion of Price bid evaluation, which will be intimated only to the techno-commercially qualified bidders by OPTCL as per procedure given below.</p> <p>d. OPTCL reserves the right to conduct e-RA and it is obligatory on part of bidder(s) invited to participate in e-RA process once they have responded to the techno-commercial bid.</p>
6	<p>Prior intimation/ Notice for RA invitation will be given to techno-commercially qualified bidders regarding the date &amp; time of opening of the e-RA.</p> <p>The start bid price (SBP) for e-Reverse Auction of each bidder under a particular package shall be the L1 evaluated price for the subject package including Taxes &amp; Duties for the total scope for subject Package. Taking the above discovered L1 price as the upper limit e-RA will be conducted to determine the lowest possible price.</p> <p>Reverse Auction will be conducted amongst first 50% of the technically qualified bidders arranged in order of prices from lowest to highest, as L1, L2,L3-----Ln, and L1 price will be discovered. Minimum of 3 bidders shall be eligible for e RA. (eg. If 4 bidders are financially evaluated then the L1, L2 and L3 bidders shall be eligible for e-RA). Number of bidders eligible for participating in RA would be rounded off to next higher integer value if number of technically qualified bidders is odd (e.g. if 7 bids are technically qualified, then RA will be conducted amongst L1 to L4).</p> <p>However, in case only two bidders are found to be responsive, e-RA would be carried out with both the parties without any elimination. However, OPTCL reserves the right to invite the evaluated L1 bidder for negotiation without conducting the e-RA.</p> <p>In case of price submitted by any bidder is found to be abnormal, OPTCL</p>

	<p>reserves the right to reject the bid of the bidder(s).</p> <p>Rank of bidders would be displayed as per the total cost to OPTCL, i.e including Taxes and Duties payable by OPTCL as per the provisions of the bidding document &amp; after e-RA process is over.</p>
7	<p>Names of bidders/ vendors shall not be disclosed during the e-RA process. Names of bidders/ vendors shall be anonymously masked in the e-RA process.</p> <p>(i) In case of RA, start/ reference price and step value of decrement shall be indicated to the bidders at the start of the auction. Any participating bidder can bid one or multiple step decrement lower than the prevailing lowest bid at that time. The Bidder shall be able to view Bid Start Price, Bid Decrement Value, Prevailing Lowest Bid value, last Bid Placed by him and time left for bidding.</p> <p>(ii) The step value of decrement in a package to be offered by bidder (the minimum amount of reduction in the total bid price including all taxes &amp; duties during auction) , shall be kept at 0.15% of L1 bidder's final evaluated price (or) at approved amount as decided by OPTCL.</p> <p>(iii) Bidders can only quote any value lower than their previous quoted price. However, at no stage, increase in Price will be permissible.</p> <p>(iv) At any point during Reverse Auction, bidding Price field (Total price) shall remain enabled for the bidders. <b>Time period for e-RA shall be unlimited.</b> The initial auction period (1<sup>st</sup> slot) will be of thirty (30) minutes with provision of auto extension by (10) ten minutes from the schedule/ extended closing time, if any fresh lower bid is received in last ten minutes of initial auction period or extended auction period. The reverse auction process shall get closed automatically if no fresh lower bid is received within schedule slot/ extended slot.</p> <p>(v) However, bidders are advised not to wait till the last minute or last few seconds to enter their bid during the period of e-reverse auction to avoid complication related with internet connectivity, network problem, system crash down, power failure etc.</p>
8	<p>After conclusion of e-Reverse Auction i.e. (Closing Price in Reverse Auction will be taken as offered price by the L1 bidder), decrease in price of individual head of the template shall be considered proportionately on all individual line items of the respective head of the price schedule of the successful L1 bidder .</p> <p>Any bid received at the tender wizard server end subsequent to closure of the e-RA shall be summarily rejected and shall not be considered as a valid bid under whatsoever circumstances. For this purpose, tender wizard server log shall prevail.</p> <p>The bidder shall not involve himself or any of his representatives in price</p>

	<p>manipulation of any kind directly or indirectly by communicating with other bidders.</p> <p>During Reverse Auction, If no bid is received within the specified time, OPTCL, at its discretion, may decide to close the reverse auction process/ proceed with conventional mode of tendering [ Evaluation of Part-II (price bid) submitted by bidders earlier].</p>
9	<p>Consequent upon completion of e-Reverse Auction, OPTCL's decision on award of contract shall be final and binding on the bidders.</p> <p>OPTCL shall be at liberty to call the L1 bidder for further process/ negotiation and also at liberty to cancel the e-reverse auction process/ re-tender at any time, without assigning any reason thereof. OPTCL can decide to reschedule or cancel any reverse auction: the bidders shall be informed accordingly.</p> <p>OPTCL/ Service Provider shall not have any liability to bidders for any interruption or delay in access to the e-Tender site/ Reverse Auction link irrespective of the cause.</p>

### **30. Minimum Qualification Criteria of Bidders.**

All the prospective bidders are requested to note that their bids for tendered equipment can only be considered for evaluation if:

- i) The bidder should be a manufacturer of different types of Relay and should have supply experience for a minimum period of **2 (two)** years as on the date of opening of the tender.
- ii) At least 50% of the tendered quantity should have been supplied within the above-stipulated period.
- iii) The above **MATERIALS** should have at least **2 (two)** years successful performance from the date of commissioning. At least one of the performance certificates shall be submitted from State Power Sector Utility/Central Power Sector Utility.
- iv) The bidder should have conducted type tests on the tendered **MATERIALS** in Government approved laboratory within five years from the date of opening of the tender.

### **31. Jurisdiction of the High Court of Odisha.**

Suits, if any, arising out of this contract shall be filed by either Party in a court of Law to which the jurisdiction of High court of Odisha extends.

### **32. Correspondences.**

- i) Any notice to the supplier under the terms of the contract shall be served by Registered Post or by hand at the Supplier's Principal Place of Business.
- ii) Any notice to the Purchaser shall be served at the Purchaser's Principal Office in the same manner.



33. **Official Address of the Parties to the Contract**

The address of the parties to the contract shall be specified:-

- [i] **Purchaser:** Senior General Manager (Procurement)(CPC) OPTCL  
Bhubaneswar-751022 (Odisha)  
Telephone No. 0674 - 2541801  
FAX No. 0674 - 2542964
- [ii] **Supplier:** Address  
Telephone No.  
Fax No.

34. **Outright Rejection of Tenders**

Tenders shall be outrightly rejected if the followings are not complied with.

- [i] The tenderer shall submit the bid in electronic mode only and shall submit the tender cost on or before the date and time of submission of technical bid. In case of local Micro and small Enterprises(MSEs) registered with respective DICs, Khadi, Village, Cottage & Handicrafts Industries, OSIC and NSIC participating in the tender they have to submit notarised hard copy of valid registration as local MSE as above on or before the date and time of submission of technical bid.
- [ii] The tenderer shall submit the bid in electronic mode only
- [iii] The Tender shall not be submitted telegraphically or by FAX.
- [iv] The prescribed EMD shall be submitted on or before the date and time of submission of technical bid.
- [v] The Tender shall be kept valid for a minimum period of 180 days from the date of opening of tender.
- [vi] The Tender shall be submitted in two parts as specified.
- [vii] The Tenders shall be accompanied by a list of major supplies effected prior to the date of opening of tender. Data of at least 3 (three) years shall be furnished.
- [viii] The tenderer shall upload the scanned copy of latest type test certificates (for the tests, carried out on the tendered equipment, being offered). Such type tests should have been conducted within last five years from the date of opening of this tender in a Government approved laboratory/CPRI in presence of any Government Organisation's representative(s).

- [ix] The schedule of prices should be filled up fully to indicate the break-up of the prices including taxes and duties. Incomplete submission of this schedule will make the tender liable for rejection. Vide Clause-4(ii) of Part-II.
- [x] The Tenderer should quote 'FIRM' price only and the price should be kept valid for a minimum period of 180 days from the date of opening of the tender.
- (xi) The tenderer shall upload the scanned copy legibly written user's certificate to prove the satisfactory operation of the offered equipment/materials for a minimum period of 3 (three) years from the date of commissioning/use as per the tender specification. User's certificate shall include the detailed address of the user with Equipment/Material, Name and type as per this specification, number of years of satisfactory use/operation & date of issue of this user's certificate with official seal written in English only & clearly visible must be furnished. At least one of the user's certificates shall be from state or Central Govt. or their Undertakings.
- (xii) Guaranteed Technical particulars & Abstract of terms and Conditions should be filled in completely.
- (xiii) (a) Detailed information on any litigation or arbitration arising out of contract completed or under execution by it over the last five years. A consistent history of litigation by or against the bidder may result in rejection of bid.
- (b) The bidder should not have any pending litigation or arbitration with OPTCL with regard to any project or related activity. The bidder should certify/declare the same in unequivocal terms by way of an affidavit duly sworn before a magistrate or Notary. Bid furnished by the bidder shall not be eligible for consideration if it is not accompanied by the affidavit. Further, the bid/LOA/LOI shall liable for outright rejection/cancellation at any stage if any information contrary to the affidavit/declaration is detected.

35. **Documents to be treated as confidential.**

The supplier shall treat the details of the specification and other tender documents as private and confidential and these shall not be reproduced without written authorization from the Purchaser.

36. **Scheme/Projects**

The materials/equipment covered in this specification shall come under "-----  
----- Scheme "

## 37.0 Registration from DPIIT

- I. Any bidder from a country which shares a land border with India will be eligible to bid in this tender only if the bidder is registered with the Competent Authority as per requirement of Govt. of India
- II. "Bidder" (including the term 'tenderer', 'consultant' or 'service provider' in certain contexts) means any company, including any member of a consortium or joint venture (that is a company ),
- III. "Bidder from a country which shares a land border with India" for the purpose of this Order means :-
  - a. An entity incorporated, established or registered as company in such a country ; or
  - b. A subsidiary company of an entity incorporated, established or registered in such a country ' or
  - c. An entity substantially controlled through entities incorporated , established or registered in such a country ; or
  - d. An entity whose beneficial owner is situated in such a country ; or
  - e. An Indian (or other) agent of such an entity ; or
  - f. A consortium or joint venture where any member of the consortium or joint venture falls under any of the above.
- IV. The beneficial owner for the purpose of (iii)(d) above will be as under :
  1. In case of a company the beneficial owner is the natural person(s), who, whether acting along or together, or through one or more juridical person, has a controlling ownership interest or who exercises control through other means.

**Explanation-**

    - a. "Controlling ownership interest" means ownership of or entitlement to more than twenty-five per cent of shares or capital or profits or the company.
    - b. "Control" shall include the right to appoint majority of the directors or to control the management or policy decisions including by virtue of their shareholding or management rights or shareholders agreements or voting agreement;
  2. Where no natural person is identified under (1) above, the beneficial owner is the relevant natural person who hold the position of senior managing official ;
- V. An Agent is a person employed to do any act for another, or to represent another in dealings with third person.
- VI. The successful bidder shall not be allowed to sub-contract works to any contractor from a country which shares a land border with India unless such contractor is registered with

the Competent Authority.

**Certificate ( to be furnished in bidder company's letter head)**

I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India and on sub-contracting to contractors from such countries; I certify that this bidder is not from such a country or, if from such a country, has been registered with the Competent Authority and will not sub-contract any work to a contractor from such countries unless such contractor is registered with the Competent Authority. I hereby certify that this bidder fulfils all requirements in this regard and is eligible to be considered. [Where applicable evidence of valid registration by the Competent Authority shall be attached.

### SECTION – III.

#### LIST OF ANNEXURES

#### [ I TO XX ]

The following schedules and proforma are annexed to this specification and contained in Section-III as referred to in the relevant clauses.

1	Declaration form	ANNEXURE-I
2	Abstract of terms and conditions to accompany Section-II of Part-I	ANNEXURE-II
3	Schedule of Quantity and Delivery	ANNEXURE-III
4	Abstract of price component [to accompany Part-II of this specification]	ANNEXURE-IV
5	Schedule of prices to accompany Part-II	ANNEXURE-V
6	<del>Bank Guarantee form for earnest money deposit</del>	<del>ANNEXURE-VI</del>
7	Composite Bank Guarantee form for security deposit, payment and performance	ANNEXURE-VII
8.	<del>Chart showing particulars of E.M.D.</del>	<del>ANNEXURE – VIII</del>
9.	Data on Experience.	ANNEXURE – IX
10.	Schedule of spare parts.	ANNEXURE-X
11.	Schedule of Installations.	ANNEXURE-XI
12.	Schedule of deviations(Technical)	ANNEXURE-XII(A)
13.	Schedule of deviations(Commercial)	ANNEXURE-XII(B)
14.	Litigation/Arbitration	ANNEXURE-XIII
15	E-Reverse Auction Form	ANNEXURE-XIV
16	Certificate of DPIIT	ANNEXURE-XV



**ANNEXURE-II**  
**ABSTRACT OF GENERAL TERMS AND CONDITIONS OF CONTRACT [COMMERCIAL] TO**  
**ACCOMPANY PART-I**  
**(To be filled up by the tenderer as indicated in the excel sheet)**

Place: -  
Date: -

**Signature of the Tenderer**  
with seal of the company

**ANNEXURE-III**  
**SCHEDULE OF QUANTITY AND DELIVERY**  
(To be filled up by the tenderer as indicated in the excel sheet)

Place:

Date:

Signature of Tenderer  
with seal of Company.

**ANNEXURE-IV**  
**ABSTRACT**  
**(To be filled up by the tenderer as indicated in the excel sheet)**

Place

Date:

Signature of Tenderer  
With seal of company

**ANNEXURE-V.**

**SCHEDULE OF PRICES**

**TENDER SPECIFICATION No.**

**(To be filled up by the tenderer as indicated in the excel sheet)**

Signature of Tenderer

Name, Designation and Seal

NB: -

- 1. The tenderer should fill up the schedule properly and in full in Excel file of e-tender mode.** The tenderer should fill up the schedule properly and in full. The tender will be rejected, if the schedule of price is submitted in incomplete form. No post tender correspondence will be entertained on break-up of prices. Also, the supplier should agree for delivery at sub-station site.
2. The Tenderer shall give an undertaking in part-I of the bid that, any implication of lower Tax and Input Tax Credit benefit have been fully passed on to the purchaser as per anti-profiteering and other provisions under GST Laws while quoting the tender price.
3. Conditional offers will not be acceptable.



**ANNEXURE VI**

**PROFORMA FOR BANK GUARANTEE FORM FOR EARNEST MONEY DEPOSIT**

**(To be Stamped in accordance with Stamp Act and the Non-Judicial Stamp Paper of appropriate value should be in the name of Issuing Bank)**

**Ref No:** .....

**Bank Guarantee No.** .....

**Date:**.....

**BG Amount:**.....

**Validity Period:**.....

This Guarantee Bond is executed this..... day of ..... by us the..... Bank at ....., P.O....., Dist....., State..... and Code No.....

Whereas the ODISHA POWER TRANSMISSION CORPORATION Limited, Janpath, Bhubaneswar, a company constituted under the Companies Act 1956 (hereinafter called OPTCL) has invited Tender vide e-NIT No..... Dated..... for the purpose of ..... work under Package(s) No...../ purchase of .....

1. Now, therefore, in accordance with Notice Inviting Tender (e NIT) No..... Dated..... of OPTCL, Ms/Shri.....Address..... Wish / wishes to participate in the said tender and as a Bank Guarantee for the sum of Rs..... [ Rupees in words..... ] valid for a period of .....days is required to be submitted by the bidder, as per Tender Specification, we the ..... ) [indicate the name, Address & Code of the bank] [hereinafter referred to as "Bank"] at the request of Ms/Shri..... [hereinafter referred to as "Bidder"] do hereby unequivocally and unconditionally guarantee and undertake to pay during the above said period on written request by the <Tender Issuing Authority, Central Procurement Cell (CPC) ODISHA POWER TRANSMISSION CORPORATION Ltd. , Bhubaneswar an amount not exceeding Rs..... to OPTCL., without any reservation. The guarantee would remain valid up to ..... [Date] and if any further extension to this is required, the same will be extended on receiving instruction from ..... on whose behalf this Bank Guarantee has been issued.

2. We, the ..... [indicate the name of the Bank, Address, Code] do hereby further undertake to pay the amounts due and payable under this guarantee without any demur, merely on a demand from OPTCL. Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs..... ( Rupees in words.....)

3. We undertake to pay to OPTCL any money so demanded notwithstanding any dispute or disputes so raised by the bidder in any suit or proceeding instituted/pending before any court or tribunal relating thereto, our liability under this present being absolute and unequivocal. The payment so made by us under this bond shall be a valid discharge of our liability for payment thereunder and the bidder shall have no claim against us for making such payment.

4. We, the ..... Bank further agree that the guarantee herein contained shall remain in full force and effect during the aforesaid period of ..... days [in words]..... (as per Tender Specification) and it shall continue to be so enforceable till all the dues of OPTCL under or by virtue of the said Bid have been fully paid and its claims satisfied or discharged or till OPTCL certifies

that the terms and conditions of the said Bid have been fully and properly carried out by the said bidder and accordingly discharges this guarantee. Unless a demand or claim under this guarantee is made on us or our Branch Office at Bhubaneswar <Mention Name, Address & Code of the Branch Office at Bhubaneswar of Issuing Bank> in writing on or before \_\_\_\_\_ we shall be discharged from all liability under this guarantee thereafter.

5. We the \_\_\_\_\_ Bank further agree with OPTCL that OPTCL shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Bid or to extend time of performance by the said Bidder from time to time or to postpone for any time or from time to time any of the powers exercisable by OPTCL against the said Bidder and to forbear or enforce any of the terms and conditions relating to the said Bid and we shall not be relieved from our liability by reason of any such variation, postponement or extension granted to the Bidder or for any forbearance, act or omission on the part of OPTCL or any indulgence by OPTCL to the said Bidder or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision, have the effect of so relieving us.

6. This guarantee will not be discharged due to the change in the name, style and constitution \_\_\_\_\_ of the Bank and/or of the Bidder.

7. We \_\_\_\_\_ [indicate the name of Bank, Address & Code] lastly undertake not to revoke this guarantee during its currency except with the previous consent of OPTCL in writing.

8. We, the \_\_\_\_\_ Bank (Name, Address & Code) further agree that this guarantee shall also be invocable at our place of business at \_\_\_\_\_ Branch of **Bhubaneswar** (indicate Name, Address & Code of the Branch at Bhubaneswar) in the State of Odisha.”

**“Notwithstanding anything contained herein”**

a) Our liability under the bank guarantee shall not exceed Rs. \_\_\_\_\_ (Rupees in words \_\_\_\_\_) only.

b) This Bank guarantee shall be valid up to \_\_\_\_\_.

c) We or our Branch at Bhubaneswar <Mention Name, Address & Code.....> shall be liable to pay guaranteed amount or any part thereof under this guarantee only if you serve upon us at \_\_\_\_\_ Branch of Bhubaneswar a written claim or demand on or before \_\_\_\_\_.

The Bank Guarantee is issued in paper form and Advice transmitted through SFMS with required details to the beneficiary’s advising bank (ICICI Bank Bhubaneswar, IFSC Code ICIC0000061).

Dated, the \_\_\_\_\_ Day of \_\_\_\_\_

For \_\_\_\_\_ [Indicate name of Bank]

Signature .....  
Full name .....  
Designation .....  
Power of Attorney No. ....  
Date.....  
Seal of the Bank.....

**WITNESS: (SIGNATURE WITH NAME AND ADDRESS)**

(1)

Signature .....

Full name .....

(2)

Signature .....

Full name .....

**N.B.:**

1. Name of the Bidder: .....

2. BG No & Date : .....

3. Amount (In Rs.): .....

4. Validity up to : .....

5. E-NIT No. ....

6. Package/Works No. ....

7. Name, Address & Code of Issuing Bank: .....

8. Name, Address & Code Bhubaneswar Branch of the Issuing Bank: .....

9. The Bank Guarantee shall be accepted after getting SFMS advice as per details below.

**Format for SFMS details**

**(The Unique Identifier for field 7037 is "OPTCL541405793")**

Sl. No	PARTICULARS	TYPE	DETAILS
1	Type of Bank Guarantee	Mandatory	EMD
2	Currency & Amount	Mandatory	
3	Validity Period(from to )	Mandatory	
4	Effective Date	Mandatory	
5	End date of lodgment of Claim	Mandatory	
6	Place of lodgment of claim	Mandatory	Bhubaneswar, Branch Name of Bhubaneswar Branch code of Bhubaneswar Branch Address at Bhubaneswar
7	Issuing Branch IFSC Code	Mandatory	
8	Issuing Branch name & address	Mandatory	

9	Name of applicant and its details	Mandatory	
10	Name of Beneficiary and its details	Mandatory	
11	Beneficiary's Bank/Branch and IFSC Code	Mandatory	ICICI Bank Ltd IFSC Code ICIC0000061
12	Beneficiary's Bank/Branch name and address	Mandatory	ICICI Bank Ltd Bhubaneswar Main Branch, Bhubaneswar
13	Sender to receiver information	Mandatory	
14	Purpose of Guarantee	Mandatory	EMD
15	Reference/Description of the underlined tender/contract	Mandatory	NIT No

ANNEXURE-VII

[PROFORMA FOR COMPOSITE BANK GUARANTEE FOR SECURITY DEPOSIT PAYMENT AND PERFORMANCE]

(To be stamped in accordance with Stamp Act and the Non-Judicial stamp paper of appropriate value should be in the name of the Issuing Bank.)

Ref No:- .....

Bank Guarantee No. ....

Date: .....

BG Amount:.....

Validity Period:.....

This Guarantee Bond is executed this..... day of ..... by us the..... Bank at ..... , P.O..... , Dist....., State..... and Code No.....

Whereas the ODISHA POWER TRANSMISSION CORPORATION Limited, Janpath, Bhubaneswar, a company constituted under the Companies Act-1956 (hereinafter called OPTCL) has issued Letter of Award (LOA) No..... Dated..... for the purpose of ..... work under Package No..... (herein after called "the Agreement") to M/s/Shri ..... , Address..... (herein after called the "Contractor") for supply, erection, installation & commissioning and associated civil works under the above LoA and whereas OPTCL has agreed (1) to exempt demand of security deposit under the terms and conditions of the LOA (2) to release payment of the cost of the Contract Price to the Contractor on furnishing by the Contractor to OPTCL a Contract Performance Bank Guarantee (CPBG) of the value of 10% of the Contract Price of the said Agreement.

- 1. Now therefore, in accordance with the terms and conditions of LOA No. \_\_\_\_\_ dated \_\_\_\_\_ for the due fulfillment by the said Contractor of the terms and conditions contained in the said agreement, on production of a Bank Guarantee for Rs. \_\_\_\_\_ (Rupees \_\_\_\_\_) only, we the bank \_\_\_\_\_ [Indicate bank Name , Address & Code ] (hereinafter referred to as "the Bank") at the request of M/s/Shri \_\_\_\_\_ contractor do hereby undertake to pay to OPTCL, an amount not exceeding Rs. \_\_\_\_\_ (Rupees \_\_\_\_\_) only .
2. We, the \_\_\_\_\_ Bank [indicate the name of the Bank, Address & Code] do hereby undertake to pay the amounts due and payable under this guarantee without any demur, merely on a demand from OPTCL. Any such demand made on the bank shall be conclusive as regards the amount due and payable by the bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. \_\_\_\_\_ (Rupees----- In Words).
3. We, the ..... Bank also undertake to pay to OPTCL any money so demanded notwithstanding any dispute or disputes raised by the Contractor in any suit or proceeding instituted / pending before any court or tribunal relating thereto, our liability under this present being absolute and irrevocable. The payment so made by us under this bond shall be a valid discharge of our liability for payment thereunder and the Contractor shall have no claim against us for making such payment.
4. We, the \_\_\_\_\_ Bank further agree that the guarantee herein contained shall remain in full force and effect during the aforesaid period of \_\_\_\_\_ days and it shall continue to be so

enforceable till all the dues of OPTCL under or by virtue of the said Agreement have been fully paid and its claims satisfied or discharged or till OPTCL certifies that the terms and conditions of the said Agreement have been fully and properly carried out by the said contractor and accordingly discharges this guarantee.

Unless a demand or claim under this guarantee is made on us or our Branch Office at Bhubaneswar <Mention Name, Address & Code of the Branch Office at Bhubaneswar of issuing Bank> in writing on or before ..... (Date), we shall be discharged from all liability under this guarantee thereafter.

5. We, the \_\_\_\_\_ Bank [indicate the name of the Bank, Address & Code] further agree with the Board that OPTCL shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Bid or to extend time or performance by the said contractor(s) from time to time or to postpone for any time or from time to time any of the powers exercisable by OPTCL against the said contractor(s) and to forbear or enforce any of the terms and conditions relating to the said Bid and we shall not be relieved from our liability by reason of any such variation postponement or extension being granted to the said contractor(s) or for any forbearance, act or omission on the part of OPTCL or any indulgence by OPTCL to the said contractor(s) or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision, have the effect of so relieving us.

6. This guarantee will not be discharged due to the change in the name, style or constitution of the Bank and/or of the contractor(s).

7. We, the \_\_\_\_\_ Bank [indicate the name of the bank, Address & Code ] lastly undertake not to revoke this guarantee during its currency except with the previous consent of OPTCL in writing.

8. We, the \_\_\_\_\_ Bank (Name, Address & Code) further agree that this guarantee shall also be invocable at our place of business at **Bhubaneswar** (indicate Name, Address & Code of the Branch at Bhubaneswar) in the State of Odisha.

**“ Notwithstanding anything contained herein”**

a) Our liability under the bank guarantee shall not exceed Rs.------(Rupees in words----- --) only.

b) This Bank guarantee shall be valid up to -----.

c) We or our Branch at **Bhubaneswar** <Mention Name, Address & Code.....> shall be liable to pay guaranteed amount or any part thereof under this guarantee only if you serve upon us at----- Branch of Bhubaneswar a written claim or demand on or before .....

The Bank Guarantee is issued in paper form and Advice transmitted through SFMS with required details to the beneficiary’s advising bank (**ICICI Bank Bhubaneswar**, IFSC Code ICIC0000061).

Dated, the \_\_\_\_\_ Day of \_\_\_\_\_  
For \_\_\_\_\_ [Indicate name of Bank]

Signature.....

Full Name.....

Designation.....

Power Of Attorney.....

Dated.....

Seal of the Bank.....

**WITNESS: (SIGNATURE WITH NAME AND ADDRESS)**

1. Signature.....

Full Name.....

2. Signature.....

Full Name.....

**N.B.:**

1. Name of the Contractor.: .....
2. BG No & Date :.....
3. Amount (In Rs.):.....
4. Validity up to :.....
5. LOA No.....
6. Package No.....
7. Name, Address & Code of Issuing Bank:.....
8. Name, Address & Code of Bhubaneswar Branch of the Issuing Bank:.....
10. The Bank Guarantee shall be accepted after getting SFMS advice as per details below.

**Format for SFMS details**

**(The Unique Identifier for field 7037 is “OPTCL541405793”)**

Sl. No	PARTICULARS	TYPE	DETAILS
1	Type of Bank Guarantee	Mandatory	Contract Performance
2	Currency & Amount	Mandatory	
3	Validity Period(from—to --)	Mandatory	
4	Effective Date	Mandatory	
5	End date of lodgment of Claim	Mandatory	
6	Place of lodgment of claim	Mandatory	Bhubaneswar, Branch Name----- of Bhubaneswar Branch code----- of Bhubaneswar Branch Address ----- at

			Bhubaneswar
7	Issuing Branch IFSC Code	Mandatory	
8	Issuing Branch name & address	Mandatory	
9	Name of applicant and its details	Mandatory	
10	Name of Beneficiary and its details	Mandatory	
11	Beneficiary's Bank/Branch and IFSC Code	Mandatory	ICICI Bank Ltd IFSC Code-ICIC0000061
12	Beneficiary's Bank/Branch name and address	Mandatory	ICICI Bank Ltd Bhubaneswar Main Branch, Bhubaneswar
13	Sender to receiver information	Mandatory	
14	Purpose of Guarantee	Mandatory	Contract Performance
15	Reference/Description of the underlined tender/contract	Mandatory	LOA No----



## ANNEXURE-VIII

~~[CHART SHOWING PARTICULARS OF EARNEST MONEY DEPOSIT FURNISHABLE BY  
TENDERERS]~~

1.	<del>Central and State Government Undertakings</del>	<del>Exempted</del>
2.	<del>All other inside &amp; outside state units.</del>	<del>The amount of EMD as specified in the specification /Tender Notice in shape of bank guarantee /DD.</del>

~~NB: REFUND OF E.M.D.~~

~~[a] In case of unsuccessful tenderers, the EMD will be refunded immediately after the tender is decided. In case of successful tenderer, this will be refunded only after furnishing of Composite Bank Guarantee referred to in clause No.19 of Section II of this specification.~~

~~Suits, if any, arising out of EMD shall be filed in a court of law to which the jurisdiction of High Court of ODISHA extends.~~

~~[b] Earnest Money will be forfeited if the tenderer fails to accept the letter of intent/purchase order, issued in his favour or revises the bid price[ s] within the validity period of Bid.~~

**ANNEXURE-IX**

**DATA ON EXPERIENCE**

- [a] Name of the manufacturer.
- [b] Standing of the firm as manufacturer of equipment quoted.
- [c] Description of equipment similar to that quoted [supplied and installed during the last two years with the name of the organizations to whom supply was made].
- [d] Details as to where installed etc.
- [e] Testing facilities at manufacturer's works.
- [f] If the manufacturer is having collaboration with another firm, details regarding the same and present status.
- [g] A list of purchase orders, executed during last three years.
- [h] A list of similar equipments of specified rating, voltage class, short circuit rating, Designed, manufactured, tested and commissioned which are in successful operation for at least two years from the date of commissioning with legible user's certificate. User's full complete postal address/fax/phone must be indicated. (Refer clause No.7 of the Part-I, Section-II of the specification).

Place:

Date:

Signature of tenderer

Name, Designation, Seal

**ANNEXURE-X**

**SCHEDULE OF SPARE PARTS FOR FIVE YEARS OF NORMAL OPERATION & MAINTENANCE**

SL. No	Particulars	Quantity	Unit delivery rate	Total price

Place:

Date:

Signature of Bidder

Name, Designation, Seal

**ANNEXURE-XI**

**SCHEDULE OF INSTALLATIONS.**

Details of equipment, offered	Rated Voltage	Place of installation and complete postal address	Year of commissioning

Place: -

Date

Signature of Bidder:

Name, Designation, Seal

**ANNEXURE-XII**

**DEVIATION SCHEDULE**

**Bidder shall enter below particulars of his alternative proposal for deviation from the specification, if any.**

**(To be filled up by the tenderer as indicated in the excel sheet)**

**ANNEXURE – XIII**  
**LITIGATION HISTORY**

Name of the Bidder:

Bidder should provide information on any history of litigation or arbitration resulting from contracts executed in the last five years or currently under execution.

Year.	Award for or against bidder	Name of client, cause of litigation and matter in dispute	Disputed amount (current value in Rs.)

Place: -

Date

Signature of Bidder:

**(Annexure-XIV)**  
**(Reverse Auction Process Compliance Form)**

(To be submitted on letter head of the bidding company with sign and stamp and along with Technical bid)

To,  
CGM (CPC), OPTCL  
Bhubaneswar-751010, Odisha

Sub: Agreement to the Process related Terms & Conditions for e-Reverse Auction.

Dear Sir,

This letter is to confirm that:

- The undersigned is authorized representative of the company.
- We have studied the Commercial Terms and the Business rules governing the Reverse Auction as mentioned in your tender and confirm our agreement to that.
- We also confirm that we have gone through the auction manual and have understood the functionality of the same thoroughly.
- We, hereby, confirm that we will honour the Bids placed by us during the tendering/ e-Reverse auction process as called as e-RA.
  
- We also confirm that we will accept our Rank / Position that will be displayed when the Bidding Time for the Online Reverse Auction is over.

With regards,

Signature with Designation with company seal Name & Address

Person having power of attorney for the subject package.

[Redacted Signature Area]

Annexure-XV

Certificate ( to be furnished in bidder company's letter head)

I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India and on sub-contracting to contractors from such countries; I certify that this bidder is not from such a country or, if from such a country, has been registered with the Competent Authority and will not sub-contract any work to a contractor from such countries unless such contractor is registered with the Competent Authority. I hereby certify that this bidder fulfils all requirements in this regard and is eligible to be considered. [Where applicable evidence of valid registration by the Competent Authority shall be attached.]

Authorized signatory

Company seal

## **SECTION – IV**

### **TECHNICAL SPECIFICATION.**

#### **TECHNICAL SPECIFICATION: PROTECTION AND CONTROL PANELS**

##### **1.0 Panels**

###### **General**

Simplex and/or duplex panels shall be provided to suite the substations site. Bidder shall be fully responsible for his bids to match the dimensions, colour and fittings with those in the existing control rooms where the extensions are required. In no case any proposal for increase in price at a later date shall be entertained by the Employer. However panels not matching those already installed may be acceptable to the Project Manager. Specific approvals will be required on a case by case basis. The Panels shall be free standing mounted on floors fitted with embedded channels, insert plates or foundation bolts. The panels shall be made vibration and shock proof by providing anti vibration strips.

The base frame of all panels shall have a smooth bearing surface such that when fixed on the embedded foundation channels/insert plates it shall be free standing and provide a level surface.

The panels shall be completely metal enclosed, dust, moisture and vermin proof. The enclosure shall provide a degree of protection not less than IP-31 in accordance with IS 13947

The design, materials selection and workmanship shall be such that it provides a neat appearance both inside and outside without signs of welds, rivets or bolt heads from outside. The exterior surfaces shall be smooth and sleek.

Relay panels of modern modular construction in 19 inch hinged racks would also be acceptable.

Cable entry to the panels shall be from the bottom. The provision of all cable glands and shrouds of the panel shall be part of the scope of supply. 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.

###### **1.1 Simplex Panel**

Simplex panels shall be provided with equipment mounted on front panel vertically. The wiring access shall be from rear for control panels and either from front or rear for relay panels. Where panel width is more than 800 mm, double leafed doors shall be provided. Doors shall be fitted with either built-in locking facility or with padlock.

###### **1.2 Duplex Panel**

Duplex panels shall be walk-in, tunnel type comprising of two vertical front and rear panels connected back to back by formed sheet steel roof as tie members and a central corridor in between. The corridor shall facilitate access to internal wiring and external cable connections. Where a number of duplex panels are located in a row side by side, the central corridor shall be aligned to form a continuous passage. Both ends of the corridor shall be provided with double leaf doors with lift off hinges. Doors shall be fitted with either built-in locking facility or with padlock. Separate bottom cable entries shall be provided for the front and rear panels. The inter-connections between front and back panels shall be established by providing wiring at the top of the panel.

**IMP: Only Relay panel front side should be provided with protective front door with PRESPEX cover with flush type handle with locking facility to protect the relays from the external.**

###### **1.3 Constructional Features**

It is the responsibility of the Contractor to ensure that the equipment specified and such unspecified complementary equipment required for completeness of the protective/control schemes can be properly accommodated in the panels without congestion. Panels shall be free standing, floor mounting type and shall comprise of structural frames completely enclosed with smooth finished, cold rolled sheet steel of thickness not less than 3 mm for all weight bearing members such as base frame, front panel, door frames. All other

parts may be provided with 3.0 mm thick steel sheet. There shall be sufficient reinforcement to provide level surfaces, resistance to vibration and rigidity during transportation and installation. All doors, removable covers and panels shall be gasketed all around with neoprene or superior material. Ventilating louvres, where provided shall have screens and filters. The screens shall be made of either brass or GI wire mesh.

#### **1.4 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 be mounted flush. Equipment shall be mounted such that removal and replacement can be accomplished individually without interruption of service to adjacent devices. Equipment shall be readily accessible without use of special tools. Terminal marking on the equipment shall be clearly visible. The Contractor shall carry out cut-out, mounting and wiring of all equipment and items which are to be mounted in his panel. Cut-outs if any, provided for future mounting of equipment shall be properly blanked off with blanking plates. The center lines of switches, push buttons and indicating lamps shall be not less than 750 mm from the bottom of the panel. The center lines of relays, meters and recorders shall be not less than 450 mm from the bottom of the panel. The center lines of switches, push buttons and indicating lamps shall be matched to give a neat and uniform appearance. The top lines of all meters, relays and recorders etc. shall be matched. No equipment shall be mounted on the doors. All the equipment connections and cabling shall be designed and arranged to minimise the risk of fire and damage which may be caused by fire.

#### **1.5 Terminal Blocks**

Terminal blocks and boards shall conform to the requirements of the relevant sections of this Specification. De-link type terminal blocks shall be provided in all the circuits and Terminals.

#### **1.6 Supporting steel**

All necessary embedded levelling steel, sills, anchor bolts, channels and other parts for supporting and fastenings the panels and vibration damping shall be supplied by the Contractor.

### **Instruments, Meters, Recorders and Transducers**

#### **2.0 General**

All instruments, meters, recorders and transducers shall be enclosed in dust proof, moisture resistant, black finished cases and shall be suitable for tropical use. All indicating instruments and recorders shall be digital type and provided with individual transducers and shall be calibrated along with the transducers to read directly the primary quantities. They shall be accurately adjusted and calibrated at works and shall have a means of calibrations check and adjustment at site. The Contractor shall confirm that the indicating instruments, recorders along with transducers and energy meters offered by him are suitable for connecting to the instrument transformers having the technical particulars given in reference drawing. Synchronizing Instruments shall also meet the requirements of the relevant clause of this section of the Specification. Digital bus voltage and frequency meters shall be of class 0.5 and shall have digital readouts of five and four digits respectively, with display size, not less than 50 mm (height)

#### **2.1 Metering Instruments**

##### **Energy-meters (NOT REQUIRED)**

Energy meters shall be provided on all line feeders, transformer feeders, buscoupler and bus transfer bays as per the requirements stated in the schedule of requirement of this specification.

On 400/220/132 kV feeders emanating from various substations, where commercial metering is required redundant energy metering in form of MAIN shall be employed.

All 33 kV feeders emanating from various substations shall be treated as feeders with commercial metering requirements. Only single energy meters shall be employed.

Energy meters shall be solid state tri vector type. The energy meters are intended to measure, record and display active energy (kWh/MWh), reactive energy (kVARh/MVARh), apparent energy (kVAh/MVAh), Maximum Demand (MVA/kVA/MW/kW/ etc. They should be of three phase two element type or three element type suitable for measurement of unbalanced loads in three phase, three wire circuits. The meters shall be provided with at least six registers for TOD metering purposes. The meters shall have LCD or cyclometer type registers.



Energy meters shall be of draw out or non-drawout type and suitable for flush mounting with back connected terminals.

Energy meters shall be suitable for operation from the secondary of CT's and VT's. Separate test blocks for the testing of the meters (without disturbing the CT and VT secondary connections) shall be provided.

Energy Meters shall have reverse running stops. Meters shall conform to IEC 687 /IS 13779. All watt-hour meters shall have accuracy class of 0.2. All VARh-hour meters shall have accuracy class of 3.0. The energy meters shall also conform the requirements stipulated in Technical Report of Central Board of Irrigation and Power, India.

Energy Meters shall be compensated for temperature errors and factory calibrated to read the secondary quantities. The number of digits provided shall be adequate to cover at least 1500 hours of operation.

Current coils of the meters shall have continuous overload capacity of at least 200% for both accuracy and thermal limits, and shall withstand at least 20 times of rated current for 0.5 seconds without loss of accuracy.

Energy meters should have facilities for data transfers remote metering with proper security via an optically isolated communication port using serial communication. Where, required, output ports shall be provided for summation and time synchronisation.

Energy meters shall be provided with features for monitoring tamper and fraud. The possible cases of tamper and fraud shall be proposed by the Project Manager to Contractor for incorporation in to the metering software.

Energy meters should be provided with adequate software and hardware to store the load survey data from the last reset time. Energy meters shall also be provided with self-diagnostic features.

Technical requirement for energy meters.

**Table 9.3.2. Technical requirements for energy meters**

<b>Description</b>	<b>Requirement</b>
Operating voltage	110V Phase to phase, 65.3V Phase to neutral
Operating current	1A
Measurement	Real and reactive energy Maximum demand Bi-directional power flow
Display	Digital type (electronic type). In case of electronic type of display the minimum retention time for non- volatile memory shall not be less than 5 years
Communication	Optical Port / E— Port

## **2.2 Recording instruments**

Recording instruments shall have the following characteristics features:

Static/Digital type voltage and frequency recorders in individual units for the sub-station with time tagged information shall be acceptable. It shall meet the accuracy of +/-:1.0% span and full span response time of less than 2 seconds. It shall also meet the high voltage susceptibility test, impulse voltage withstand test, high frequency disturbance test – class III and fast transient disturbance test level III as per IEC 602555.

## **2.3 Transducers**

### **General**

The transducers used for recording/indicating instruments and telemetry/data communication applications shall in general conform to IEC 688-1.

Transducers shall be suitable for measurement of active power, reactive power, voltage, current and frequency in three phase, four wire system. These could be separate or combined type. Serial port on combined type is also acceptable.

The input to the transducers will be from substation current and potential transformers. The output shall be in milli ampere DC proportional to the input. It shall be possible to feed the output current directly to the telemetry terminals, indicating instruments or recording instruments.

The transducer characteristic shall be linear throughout the measuring range.

The transducer output shall be load independent.

The input and output of the transducers shall be galvanically isolated.

The transducer shall derive its auxiliary supply from the quantity to be measured without need for any external supply.

Each transducer shall be housed in a separate compact case and have suitable terminals for inputs and outputs. Input side terminal connectors (from CT's and PT's) to be suitable for three phase, four wire connection.

The transducers shall be suitably protected against transient high peaks of voltage and current.

The transducer shall withstand indefinitely without damage and work satisfactorily at 120% of the rated voltage and 200% of the rated input current as applicable.

Voltage, frequency and current transducers associated with the ISCS shall have an output to 0-10 mA and the active and reactive power transducers shall have an output of 10-0-10 mA.

Voltage, frequency and current transducers associated with conventional systems shall have an output to 4-20 mA and the active and reactive power transducers shall have an output of 10-0-10 mA.

The response time of the transducers associated with ISCS shall be less than 500 milliseconds. Response time for transducers associated with conventional systems shall be less than one second.

The transducers shall have a working temperature range of 0-50C.

The accuracy class of transducers shall be 0.5 or better except for frequency transducer which shall be 0.2.

The transducers shall have an AC ripple on output of less than 1%

The transducers shall be suitable for load resistance of 1000-1500 ohms

The CT and PT ratios and scale ranges for the voltage, current and frequency transducers shall be suitable for the various CT and PT ratios (as applicable) furnished with the specification and compatible with the feeder/transformer voltage levels and ratings.

The transducer shall be provided with terminal connectors for wire of maximum cross section of 4 mm., with dual screws, for rigid connections.

The transducer shall have dual output.

### **Transducers (recording/indicating instruments and telemetry/data communication application)**

The transducers shall in general conform to IEC 688-1 and have the following features:

- Each transducer shall be housed in a separate compact case and have suitable terminals for inputs and outputs.
- The transducers shall have an output of 4-20 mA.
- The response time of the transducers shall be less than one second.
- The accuracy class of transducers shall be 0.5 or better except for frequency transducer which shall be 0.2.
- The PT ratios and scale ranges for the voltage and frequency transducers shall be as follows:

	<b>PT Ratio</b>	<b>Scale range</b>
Voltage transducer:	400kV/110V	0-500kV
	220kV/110V	0-300kV
	132kV/110V	0-200kV
	33kV/110	0-50kV

Frequency transducers: as above 45-55 Hertz.

All the transducers shall be suitable for CT and PT parameters specified.

- The transducer shall have dual output.

## **2.4 Annunciation System:**

### **General**

The annunciation shall be of visual and audible type. The visual annunciation shall be provided by annunciation facia, mounted flush on the top of the control panels. The audible alarm shall be provided by alarm buzzer or bell. The annunciation facia shall be provided with translucent plastic windows for alarm

points with minimum size of 35 mm x 50 mm. The fascia plates shall be engraved in black lettering with inscriptions. The list of such inscriptions shall be furnished by the Contractor for the Project Manager's approval. The inscriptions shall be engraved on each window in not more than three lines with letter sizing not less than 5 mm. Where annunciation systems are already provided, the annunciation scheme shall be engineered as an extension to the existing scheme. Each annunciation window shall be provided with two white lamps in parallel to provide safety against lamp failure. Long life lamps shall be used. The lamp circuit shall include series resistor of adequate rating. The cover plate of the fascia windows shall be flush with the control panel and shall be capable of easy removal to facilitate replacement of lamps. The cover plate transparency and the lamps wattage in the fascia windows shall be designed to ensure clear visibility of the inscriptions in the control rooms ( having an illumination level of 350 lux) from the location of the Operator's desk.

**TRIP** and **NONTRIP** fascia shall be differentiated. All **TRIP** fascia shall have red colour and all **NONTRIP** fascia shall have green colour.

Sequence of operation of the annunciator shall be as given in Table 10.1.

<b>Alarm Condition</b>	<b>Fault Contact Status</b>	<b>Visual Annunciation</b>	<b>Audible Annunciation</b>
Normal	Open	OFF	OFF
Abnormal	Close	Flashing	ON
Accept push button is pressed	(a) Close (b) Open	Steady on Steady on	OFF OFF
Reset push	(a) Close (b) Open	ON ON	OFF OFF
Lamp test push button pressed	Open	Steady on	OFF

**Table 10.1. Sequence of annunciator operation**

Visual and audible annunciation for the failure of DC supply to the annunciation system shall also be provided and this annunciation shall operate on 240 Volts AC supply with separate fuses. On failure of the power supply to the annunciation system for more than two or three seconds (adjustable setting) a fascia shall light up and an audible alarm shall sound. A separate push button shall be provided for the cancellation of this audible alarm alone, however the fascia window shall remain steadily lit till the supply to the annunciation system is restored. The sound of the audible alarm (bell) provided for this annunciation shall be different from the audible alarm provided for the annunciation system.

A separate voltage check shall be provided to monitor the failure of supply (240V AC) to the scheme mention above. If the failure of supply exists for more than two to three seconds this relay shall initiate visual and audible annunciation.

The annunciation system shall be capable of catering to at least 20 simultaneous signals at time.

One self resetting push button shall be provided on each panel for testing the fascia window lamps. Push buttons for testing flasher and audible alarm circuits of the annunciation system and for testing the annunciation supply failure monitoring circuit shall be provided. These testing circuits shall be so connected that while testing is being done it shall not prevent the registering of any new annunciation that may occur during the test.

One set of the following push buttons shall be provided on each panel as shown in the sample front view drawing attached to this Specification.

- Reset push button for annunciation system.
- Accept push button for annunciation system.

The annunciation shall be repetitive type and shall be capable of registering fleeting signals. Minimum duration of the fleeting signal registered by the system shall be 15 milliseconds.

Auxiliary relays for the annunciation system shall have adequate auxiliary potential free contacts for use in event logger.

The annunciation shall be suitable for operation with normally open contacts which close on a fault or contacts which open on a fault. It shall be possible at site to change annunciators from “close to fault “ to “ open to fault “ and vice-versa.

In case of a static annunciator scheme, special precautions shall be taken by Contractor to ensure that spurious alarm conditions do not appear due to the influence of external electro-magnetic or electrostatic interference on the annunciator wiring, and switching disturbances from the neighboring circuits within the panels.

Annunciation systems to be supplied for existing substations should be matched with the existing scheme in co-ordination with the Project Manager during detail engineering stage.

## 2.5 PANEL INTERNAL WIRING

1. 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 connected to 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

2. 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.

3. All circuits except current transformer circuits and voltage transfer circuits meant for energy metering one 2. sq. per lead.

4.1 All current transformer circuits one 4.0 sq. mm lead.

4.2 Voltage transformer circuit (for energy meters): Two 2.5 mm sq per lead.

4.3. 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.

4.4. 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.

4.5. Wire germination 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.

4.6. Longitudinal troughs extending throughout the full length of the panel shall be 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.

4.7. Contractor shall be solely responsible for the completeness and correctness of the internal wiring and for the proper functioning of the connected equipments.

4.8. All wiring shall be switch board type single conductor tinned annealed copper wire insulated with varnished cambric, faulted asbestos, single braided cotton cover painted overall with flame proof moisture resistant paint and suitable for 660 volt service or equivalent polynychloride insulation which has proved its utility in tropical regions against hot and moist climate and vermin (Misc. white ants and cockroaches etc) Rubber insulated wiring will not be accepted. The sizes of wiring in different circuits shall not be less than those specified below.

### Table – I

Circuit	Minimum permissible Size of wire.
Metering and relaying circuits connected to Current Transformers.	4.0 mm sq.

Potential circuits for metering and Relaying,	4.0 mm sq.
Other control, visual and audible alarm signaling circuits etc.	2.5 mm sq

The following colour scheme shall be used for the wiring.

**Table – II**

Circuit where use.	Colour of wire and ferrule.
Red phase of instrument transformer circuit	Red.
Yellow phase of instrument transformer	Yellow.
Blue phase of instrument transformer circuits	Blue.
Neutral connections earthed or not earthed in the instrument transformer circuit	Green.
A.C. Control wiring circuits using D.C. supply	Grey

All wiring inter-connecting the front cubicles with the rear cubicles of the panel board over the access corridor shall be wired in gutters held against the ceiling of the corridor by means of screws. All potential bus wiring, audible alarm bus wiring, AC and DC control supply bus wiring, wiring for cubicles lighting and such other wiring which runs from cubicle to cubicle within the switch board shall be laid out in gutters and shall be carefully screened. As the front and rear cubicles with be detachable, the inter-connection shall be made through suitable terminal connectors securely fixed on the panel.

Wiring connected to the space heaters in the cubicles shall have porcelain braided insulation over a safe length from the heater terminals.

Each wire shall be continuous from end to end without having any joint within itself. Individual wires shall be connected only at the connection terminals or studs of the terminal blocks, meters, relays, instruments and other switchboard devices.

Terminal ends of all wires shall be provided with numbered ferrules suitable coloured (Ref : Table-II) for phase identification. At point of inter/connection where a change of number is necessary, duplicate ferrules shall be provided with the appropriate numbers on the changing end.

At the terminal connection, washers shall be interposed between terminals, wire terminals and the holding nuts. All holding nuts shall be secured by locking nuts. The connection stud shall project at least 6 mm. from the lock nut surface.

Wire ends shall be so connected at the terminal studs that no wire terminal number ferruled gets masked due to succeeding connections. All wires shall be suitable for bending to meet the terminal stud at rectangles with the stud axis, and they shall not be skewed.

All studs, nuts, bolts, scores, etc. shall be threaded according to the British Standard practice unless Employer's prior approval to any other practice of threading is obtained. Spare quantities of nuts, lock nuts and washers of all varieties used on the panel board shall be supplied to the extent of 10% of the used quantities.

## 2.6 **TERMINAL BLOCKS**

All the terminal blocks to be used in the panel shall be provided with 1100V grade stud type terminal block of Polyamide material of Elmex) / Connectwell. At least 20% spare terminals shall be provided.

(i) All internal wiring to be connected to external equipment shall terminate on terminal blocks. Disconnecting type Terminal blocks shall be 1100 V grade and have 20 Amps. Continuous rating,

molded piece, complete with insulated barriers, stud type terminals, washers, nuts and lock nuts,. Markings on the terminal blocks shall correspond to wire number and terminal numbers on the wiring diagrams. All terminal blocks shall have shrouding with transparent unbreakable material.

(ii) Disconnecting type terminal blocks for current transformer and voltage transformer secondary leads shall be provided. Also current transformer secondary leads shall be provided with short-circuiting and earthing facilities.

(iii) At least 20% spare terminals shall be provided on each panel and these spare terminals shall be uniformly distributed on all terminal blocks.

(iv) Unless otherwise specified, terminal blocks shall be suitable for connecting the following conductors of external cable on each side.

(v) There shall be a minimum clearance of 250mm between the first row of terminal blocks and the associated cable gland plate or panel sidewall. Also the clearance between two rows of terminal blocks edges shall be minimum of 150mm

(vi) Arrangement of the terminal block assemblies and the wiring channel within the enclosure shall be such that a row of terminal blocks is run in parallels 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 be 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 firmly and to enable free and flexible termination without causing strain on terminals.

(i) The number and sizes of the Owner's multi core incoming external cables will be furnished to the contractor 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 suppl

## 2.7 PAINTING:-

### **Powder coating type is preferable.**

All sheet steel work shall be phosphated in accordance with the IS:6005 Code of practice for phosphating iron and steel.

(1) All unfinished surface of the steel panels and frame work shall be sand blasted to remove rust, scale, foreign, adhering matter of grease.

(2) A suitable rust resisting primer shall be applied on the interior and exterior surfaces of the steel, which shall be followed by application of an under coat suitable to serve as base and binder for the finishing coat. The finishing coat on the exterior of the panels shall be deep gray powder coated. Polished cellulose appearance while on the interior faces the finishing coat shall be of light gray shaded paint sprayed to give a contrasting effect with the cubicle wiring.

**A small quantity of finishing paint shall be supplied with each consignment of the panels to panel boards may alternatively be given a plastic durable covering coat for protection of the finish during the transshipment, which shall be capable of being peeled off after installation.**

## 2.8 TERMINAL BLOCK CONNECTION

Terminal Block connectors built from cells of moulded dielectric and brass stud inserts shall be provided for terminating the outgoing ends of the cubicle wiring and the corresponding incoming tail ends of the control cables. All the terminal connectors shall have de-link (disconnecting) facilities.

Provision shall be made on each pillar for holding 20% extra connection (10% incoming + 10% outgoing). All blocks shall be shrouded by easily removable shroud molded of transparent dielectric materials. The terminal blocks shall be suitable for 660 volts service and connection with both aluminum and copper cable.

## 2.9 SPACE FOR CONTROL CABLES AND CABLE GLANDS

Sufficient space for receiving the control cables inside the board at the bottom of the cubicles and mounting arrangement for the terminal cable glands shall be provided. The specification does not

cover supply of control cables and cable glands for which the employer will make separate arrangement.

## **2.10 SPACE HEATERS**

60 W. 240 V. 50 HZ tubular space heaters with thermostat auto suitable for connection to the single phase AC supply complete with on-off switches located at convenient positions shall be provided at the bottom of the switch board cubicle to prevent condensation of moisture. The watt loss per unit surface of heater shall be low enough to keep surface temperature well below sensible heat.

## **2.11 DISTRIBUTION AND CONTROL OF AUXILIARY POWER CIRCUIT**

### **2.11.1 D.C. CIRCUIT**

There shall be separate D.C. incomers for the each control and relay board panel fed from D.C. distribution boards through a suitable fuse switch unit, provided there. M.C.B.s. of required Amps rating shall be provided in the panel as D.C. incomer (source I one number and source II one number). A continuous D.C. bus shall be provided in the control and relay board panel and D.C. supply for control, protection, supervision and indication of circuit breaker and other equipments shall be teed off in each panel from D.C. bus through a set of HRC Fuse (both on +ve and -ve side) D.C. supply to individual panel thus teed off shall be distributed within the panel as below.

### **2.11.2 SWITCHES & FUSES:**

Each panel shall be provided with necessary arrangement 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 fuses. The selection of the main and sub circuit fuses rating shall be such as to ensure selective clearance of sub-circuit faults. Voltage transformer circuits for relaying and metering shall be protected by fuses. All fuses shall be HRC cartridge type conforming to IS: 3703 mounted on plug in type fuse bases. The short time fuse rating of fuses shall be not less than 9 KA. Fuse carrier base shall have imprints of the fuse rating and voltage.

A D.C. operated no-volt, auxiliary relay provided with hand reset reverse flag and two set of self reset N/C contacts with test push button shall be provided in the operating circuit of each control and relay panel to supervise the breaker control supply. One N/C contact shall be used for visual alarm and the other N/C contact shall be used for audible alarm and shall be connected to the alarm bus of the annunciation scheme.

A.D.C. operated no-voltage auxiliary relay provided with hand reset reserve flag indicator and two sets of self reset N/C contacts with test push button shall be provided in the main alarm bus to supervise the alarm but supply. One N/C contact shall be used for visual alarm and the other for audible alarm. The visual and audible alarm of alarm bus fail and those of incoming D.C. bus fail shall be common and shall be operated by 240 V single phase A.C. auxiliary supply as described in the Specification.

(\*\* DC sources supervision relays are to be mounted in the panel)

## **2.12 A.C. CIRCUIT**

240 volts, single phase, A.C. auxiliary supply to the control and relay board will be fed from A.C. distribution board through a suitable fuse switch provided thereof. A continuous A.C. bus shall be provided at the control and relay board where from A.C. supply to each panel shall be teed off through a set of links. One 16 Amp rated M.C.B. shall be provided at the control and relay board for the incoming A.C. supply. A set of fuse and link rated for 6 amps for 3 pin plug circuit, 6 amps for 2 pin ply circuit and 6 amps for heater and illuminating lamp circuits shall also be provided. A hand reset type no-volt auxiliary relay rated for 240 volts A.C. and provided for monitoring the auxiliary A.C. supply from D.C. operated facial annunciation scheme.

## **2.13 MCB's**

The incoming DC supply sources (source I and source II) circuits in the control and relay panels shall be controlled by required Two pole DC MCB's. In each control and relay panel there shall be separate

DC MCB as incoming to the panels and the sub circuits shall be controlled by HRC fuses of different circuits having both “+” ve and “-“ ve control. The incoming MCB’s also followed by HRC fuses for better protection. The ratings of the MCB’s are to be designed to take care of the continuous rating and also during short ckt or in the event of faults. For AC incoming circuits and other distributed circuits also to be provided with MCB of proper ratings.

## 2.14 MIMIC DIAGRAMS

10 mm. wide, 2mm thick colour mimic diagrams and symbols showing the exact representation of the system shall be provided in the front of control panel. The mimic strips shall be made with anodized aluminum materials, which shall be screwed on to the panel and can be easily cleaned. The colour code of such aluminium strips are as given in the following table. Upper bus and lower bus of the mimic shall represent the main bus and transfer bus of the station respectively. Central line of the upper bus mimic shall be at a distance of 695 mm from the top of the panel and center to center distance between the bus mimic shall be 610 mm.

When semaphore indicators are used for equipment position they shall be so mounted in the mimic that the equipment close position shall complete the continuity of the mimic.

Indicating lamp , one for each phase, for each bus shall be provided on the mimic to indicate bus charged condition.

**TABLE**

**COLOUR SCHEME FOR MIMIC DIAGRAMS**

Equipment	Colour	I.S. Code No.(IS.5)
400 KV	Orange	
220KV	Signal Red	537
132KV	Lemon Yellow	
33 KV	Brilliant Green	414
415/250V	Black	221
Earth	White	309
110 V	Canary Yellow	-

Automatic semaphore indicators shall be provided for isolators and earth switch position indication and incorporated in the mimic diagram

## 2.15 DISCREPANCY TYPE CONTROL SWITCHES.

Control switches for circuit breakers shall be incorporated in the mimic diagram to represent the relevant circuit breakers as also the sequence of the mimic diagram. The switches shall be provided with a built-in two lamp. The switches shall have maintained contact positions for ‘ON’ and ‘OFF’ positions respectively and two momentary contact positions for ‘ON’ and ‘OFF’ impulse.

2.15.1 The switches shall be provided with a notching mechanism which should accurately limit the angles of actuation. A strong restoring spring is to be provided to return the switch mechanism automatically from the momentary contact position to the maintained contact position. Such control springs shall be strong enough to prevent any inadvertent operation due to light touch or some other different arrangement should be provided to prevent any inadvertent operation. Such springs shall not be used as current carrying parts in these switches. The rating of the switch contacts shall be suitable for the duty imposed by the circuit breaker closing mechanism and shall conform to the recommendations to be given by the circuit breakers manufacturers. The built-in-pilot lamp of the control switch shall give a steady light when the position of the control switch corresponds to the position of the associated circuit breaker. A flickering light shall be given by the same lamp when due to hand operation or due to automatic tripping of the breaker, the



position of the control switch does not coincide with that of the corresponding circuit breaker. The arrangement to provide the flickering voltage for the above purpose shall be made. In order to avoid continuous burning of the aforesaid built-in lamps associated with the control switches under steady state condition, the said lamps shall be connected through a switch. The circuit should be such that irrespective of the position of the aforesaid switch, winking of the lamp shall not be affected by change in respective control switch position. The winking of the control switch pilot lamp shall be followed by an alarm annunciation after a preset time adjustable between 0-10 secs. Switches complete with accessories for the above function shall be supplied.

## 2.16 INDICATING LAMPS

5/7 Watt Indicating cluster LED type Lamps shall be provided on the control panel mounting with rear terminal connections. Lamps shall be provided with series connected resistor preferably built in the lamp assembly. Lamps shall have translucent lamp covers to difuse lights coloured red,green,amber,clear white or blue as specified as per the following:

	Function	Quantity	Colour of lens
1.	Circuit Breaker spring charged/normal pressure indication.	1 No.	Blue
2.	Circuit Breaker trip circuit healthy indication.	2 Nos.	White
3.	Circuit Breaker Low Air Pressure indication	1 No.(where necessary)	White
4.	Incoming D.C. fail indication.	2 Nos.	White
5.	A. C. fail indication.	1 No.	White
6.	P. T. supply indication.	3 Nos.(where necessary)	Red/Yellow/Blue.
7.	Indication lamps for CB closing ,opening Isolator closing and opening		Red and Green
8.	Auto trip	1 No.	Amber
9.	Protection on Transfer Mode	1 No.	White
10.	CB on Local/Remote	2 Nos	White

All the indicating lamps under (1) and (2) shall be provided with push button control. All the lamps shall be connected to the auxiliary D.C. supply of the sub-station except Sl.No 4 and Sl. No.6 which should be connected to the auxiliary A.C. supply and P.T. secondary supply. The lamps shall be suitable for switch board purpose and shall be of low watt consumption. Lamp and lenses shall be interchangeable and easily replaceable from the front of the panel.Tools if required for replacing the bulbs and lenses shall aalso be included in the scope of supply. The indicating lamps with resistors shall withstand 120% of rated voltage on a continuous basis. In initial supply, 20% of the lamps actually used on the switch boards and 10% of the lamp covers used shall be supplied in excess to serve as spares.

## 2.17 TEST BLOCKS

Switchboard type, back connected, test blocks with contacts shall be provided with links or other devices for shorting terminals of C.T. leads before interrupting testing instruments in the circuit without causing open circuit of the C.T. The potential testing studs shall preferably be housed in

narrow recesses of the, block molding insulation to prevent accidental short-circuit across the studs. All Test Blocks for meters, relays, etc. shall be placed as close to the respective equipment as possible.

## **2.18 NAME PLATES & MARKING OF IDENTITY**

All equipments, instruments, relays and such other similar electrical devices mounted on the front and rear side as well as mounted inside control and relay panels shall be provided with name plates bearing the manufacturer's name, serial number and the electrical rating data.

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 equipment and meter shall be prominently marked with the quantity measured e.g. KV, A, MW, MVAR, etc. All relays and other devices shall be clearly marked with manufacturers name, type, sl No & electrical rating.

Name plates shall be made out of non-rusting metal or 3 ply lamicaid. Name plate 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 otherwise identified. Switches also have clear inscription for each position indicating e.g. "TRIP-NEUTRAL-CLOSE", "ON-OFF", "R-Y-B-OFF" etc.

All panel shall be provided with name plate mounted inside the panel bearing LOA NO. & Date, Name of the sub-station & Feeder and reference drawing number.

## **2.19 SAFETY EARTHING FOR THE PANEL**

All panels shall be equipped with an earth bus securely fixed. Location of earth bus shall ensure no radiation interference for earth system under various switching conditions of isolators and breakers. The materials and size of the bus shall be atleast 25X6 sq.mm perforated copper threaded holes at gap of 50mm with a provision of bolts and nuts for connection with cable armours 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. Provision shall be 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 earth grid. Necessary clamps and connectors shall be included in the scope of contract.

All metallic case of the 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 shall be green.

Looping of earth connections which would result in loss of earth connections to other devices when loop is broken shall not be permitted. However looping of earth connections between equipment to provide alternative path to earth bus shall be provided.

VT and CT secondary neutral or common lead shall be earthed at one place only at the terminal blocks where they enter the panel. Such earthing shall be made through links so that earthing may be removed from one group without disturbing the continuity of earthing system for other groups.

## **2.20 PANEL BOARD LIGHTING**

The panel interior (both control panel and relay panel) shall be illuminated by 18W, **LED** tube light connected to 240 V. single phase A.C. The illumination of the interior shall be free from hand shadows and shall be planned to avoid any strain or fatigue to the fireman likely to be caused due to subnormal or non-uniform illumination. One emergency D.C. light (**LED** type) shall also be provided for each relay panel with individual switch, with proper identification mark.

A door operated button switch shall be provided for control of the A.C. lighting for all the control and relay panel interiors.

One 5 amps. two pin socket and one 15 amps. 3 pin power socket outlets together with plugs shall be provided at convenient points in the panel board for A.C. supply.

## **2.21 ANNUNCIATOR**

Each control and relay panel shall be provided with **microprocessor based** annunciator(s) facial on the front of the control panel for projecting mal-operation in the system equipment due to fault. The annunciation board shall be of the switch board type, back connected suitable for semi-flush mounting provided with dust tight cases. The single relays shall be suitable for tropical use. The alarm concealing visual signal resetting and annunciation testing buttons shall be mounted on the front of each control panel at convenient height, preferably under the annunciation board.

a) One part of the annunciation shall comprise of one electrical D.C. operated bell and one D.C. operated hooter for trip and non-trip alarm mounted inside or on top of the switch board cubicle on vibration absorbent mountings. A suitable hand reset relay device shall be employed in the suitable hand reset relay device shall be employed in the suitable alarm circuit to permit manual cancellation of the audible alarm in token of its acceptance by an operator before rectification of the abnormality. The wiring shall be such that a single set of bell and alarm cancellation relay will be sufficient and serve in commons with all the alarm actuating devices.

b) The other part of the annunciator shall discriminate and sort out the cause of alarm and project visual alarm signals by tokens of telephone type flush lamps illumined windows on facial plate. There shall be an independent token for each abnormal condition announced and the wiring of all the tokens shall be so done that each token will operate independently of the other without causing any maloperation on the enunciator. A reset device, manually operated by an operator, shall be provided

for each column of the visual alarms to enable the operator to cancel each visual alarm at will after removal of the discrepancy or abnormal condition. Suitable testing device shall be provided on each enunciator to be assembled for routine checking of enunciator alarm and indication.

The enunciator shall be suitable for operation across the D.C. supply voltage of the sub-station.

Momentary closing of fault contacts shall also cause operation of enunciator system as above and shall require canceling and resetting operations by the operator to silence the bell and reset the enunciator window.

c) Minimum of 4 Nos spare windows each for trip and non trip are to be provided in each annunciator

## **2.22 INCOMING D.C. FAIL ALARM SCHEME**

Control and Relay Board shall have a common "Incoming D.C. Fail" alarm scheme operated by 240 V single phase A.C. auxiliary supply for audible as well as visual alarm in case of failure of D.C. incoming supply to the board.

All auxiliary relays, test relays, canceling, resetting and testing push buttons, alarm bells etc. required to render the annunciation system operative as above shall be considered to be within the scope of the tender.

Separate scheme for each source of DC supply shall be considered.

## **2.23 INCOMING A.C FAIL ALARM SCHEME**

Control and Relay Board shall have a common "Incoming A.C. Fail" alarm scheme operated by 240 V D.C. auxiliary supply for audible as well as visual alarm in case of failure of A.C. incoming supply to the board.

## **3.0 INDICATING INSTRUMENTS AND METERS**

**3.1** All electrical indicating instruments shall be of digital Type suitable for flush mounting having size **144X72 mm.**

**3.2** Instruments shall have 4- digit display, display height being not less than 25 mm.

**3.3** Instrument shall conform to relevant IS and shall have an accuracy class of 1.0 or better. For energy meters it should be of minimum 0.2. watt and VAR meters shall have an indication of (+) and (-) to indicate EXPORT and INPORT respectively

**3.4** Digital voltage and frequency meters shall be of class 0.5 and shall have digital display of 5 and 4 digits respectively, with display size, not less than 25 mm height.

**3.5** All instrument shall be switchboard type, back connected suitable for flush mounting and provided with dust tight cases for tropical use with dull black enamel finish.

**3.6** All fixing screws, nuts and treated parts shall be designed to Indian Standards.

**3.7** All instruments shall have a practicable laboratory means of adjustment of accuracy. The limits of error shall be those permissible for industrial grade instruments of switch board type. The calibration of the instruments shall function satisfactorily when mounted on steel panels or alternatively magnetically shielded instruments shall be used.

**3.8** Instruments shall be capable of indicating freely when operated continuously at any temperature from 0 to 50 deg. C.

**3.9** All circuits of instruments shall be capable of withstanding the effect of shock vibration and humidity and a dielectric test of 2500 volts r.m.s to ground for one minute as per relevant BSS/ISS

#### **4.0 NON-TARIFF ENERGY METERS (Not Required)**

a) Export/Import KWH and KVARH meters for 33KV , 132 KV , 220 KV & 400 KV KV. Line shall be supplied by the Bidder. Necessary cut-out, wiring and 3 element Test Terminal Block are to be supplied by the bidder as specified in the Schedule of requirement of control panel. Export/Import meters for non-tariff use shall be of the commercial grade accuracy i.e 0.2 Class, and shall be of 3 element type and suitable for 3-phase, 3–wire connection.

b) One 3 element type KWH meter with M.D.I. for each 33 KV. 132 KV,220 KV. Transformer panel shall also be provided and shall be connected preferably on H.V. side.

c) One Trivector metre of solid state type with KWH, KVAH, KVARH with MDI is to be provided both for 33 KV. 132 KV,220 KV control panel.

#### **4.1 MW INDICATOR (digital Type suitable for flush mounting having size 144X72 mm)**

In all the 33KV, 132 KV,220,400 KV lines and transformer feeders, indicating MW meters with M.D.I. (three) element type shall be mounted on the front side of the control panels to indicate the instantaneous MW flowing. The MW meters shall be connected to the measuring C.T. core. Scale range for line feeders shall be 200-0-200 MW and for transformer feeders 0-150 MW or as suitable for the proposed system for different voltage level.

#### **4.2 MVAR INDICATOR (digital Type suitable for flush mounting having size 144X72 mm)**

In all the 400 KV,220KV. 132 KV line feeders indicating MVAR meters shall be mounted on the front side of the control panel to indicate the instaneous MVAR following through the feeder in either direction. The scale should be center zero. The MVAR meters shall be connected to the measuring C.T. core. The scale shall be 200-0-200 MVAR or as suitable for the proposed system for different voltage level.

**4.3 VOLTMETER,AMMETER & FREQUENCY (digital Type suitable for flush mounting having size 144X72 mm).**

Other specification shall be as under clause 3.0 above.

### **5.0 Relays**

A. General The Numerical Relays in general shall comply with the following requirements:

**1.** All relays shall conform to the requirements of IS: 3231/IEC60255/IEC 61000 or other applicable standards. Relays shall be suitable for flush or semiflush mounting on the front with connections from the rear.

**2. *The offered relays shall be completely numerical.***

- The communication protocol shall be as per IEC 61850 & IEC60870-5-103
  - The test levels of EMI as indicated in IEC 61850 shall be applicable to these relays.
  - Protection elements should be realised using software algorithm.
  - Hardware based measurement shall not be acceptable.
- 3 The relay shall be provided with both 1A and 5A CT inputs and shall be selectable at site.
4. It shall be possible to energise the relay from either AC or DC auxiliary supply.
5. The offered relay shall have a comprehensive local MMI for interface. It shall have the following minimum elements so that the features of the relay can be accessed and setting changes can be done locally.

At least 48 character alphanumeric backlit LCD display unit Fixed LEDs (for trip, Alarm, Relay available & Relay out of service) & programmable LEDs which can be assigned to Tactile keypad for browsing and setting the relay menu any protection function for local annunciation.

6. *The minimum pickup voltage of relay for 220 V DC systems must be 176 V for binary input in order to prevent pick up during DC earth fault condition.*

7. *The relays supplied should be compatible to redundant communication architecture, shall be complied with the IEC 62439-3 standards of parallel redundancy protocol (PRP).*

8. *The relays provided should be complied with the international standards of NERC CIP for cyber security to provide protection against unauthorized disclosure, transfer, modification, or destruction of information and/or information systems, whether accidental or intentional.*

9. *All PCB used in relays should have harsh environmental coating as per standard IEC 60068 (HEC) to increase the particle repellency and thereby increasing the life of relay.*

10. *The offered relays shall be completely numerical and should comply to IEC 61850 protocol. The relay must support following requirements for communication ports and protocols,*

- *The relays shall generate GOOSE messages as per IEC 61850 standards for interlocking and also to ensure interoperability with third party relays.*
- *The relay must have front RS232/USB/RJ45 port for local communication with the device*
- *The communication protocol shall be as per IEC 61850*
- *The relay should be compatible to redundant communication architecture and shall be complied with IEC 62439-3 standards of parallel redundancy protocol (PRP)*
- *The relays shall generate GOOSE messages as per IEC 61850 standards for interlocking and also to ensure interoperability with third party relays.*
- *Necessary user friendly configuration tool shall be provided to configure the relays. It should be compatible with SCL/SCD files generated by a third party system.*
- *GOOSE signals shall be freely configurable for any kind of signals using graphic tool/user friendly software.*
- *The offered relay must support at least 4 no's of 61850 clients*
- *The relay must support time synchronization through SNTP/IRIG B demodulated.*
- *The relays provided should be complied with the international standards of NERC CIP for cyber security to provide protection against unauthorized disclosure, transfer, modification, or destruction of information and/or information systems, whether accidental or intentional.*
- *The relay settings shall be provided with adequate password protection. The password of the relay should be of 4 character upper case text to provide security to setting parameter.*

11. *The relays shall have the following tools for fault diagnostics*

- *Fault record – The relay shall have the facility to store at least 5 last fault records with information on cause of trip, date, time, trip values of electrical parameters.*
  - *Event record – The relay shall have the facility to store at least 200 time stamped event records with 1ms resolution.*
  - *Disturbance records – The relay shall have capacity to store the waveforms for a minimum duration of at least 5 secs with settable pre and post fault duration times at a minimum sampling rate of 800 Hz or Higher.*
  - *Except for differential protection the disturbance recorder must have capability to capture at least 8 analogue channels (IA, IB, IC, IN, VA, VB, VC, and VN) and 15 digital channels (start of protection element, trip of protection element, binary input, trip output etc) selectable at site.*
  - *For differential protection relay, the disturbance recorder must have capability to capture at least 15 analogue channels and 30 digital channels.*
  - *Necessary software shall be provided for retrieving and analyzing the records.*
12. *The relay settings shall be provided with adequate password protection. The password of the relay should be of 4 character upper case text to provide security to setting parameter*

13. *The relay shall have comprehensive self-diagnostic feature. This feature shall continuously monitor the healthiness of all the hardware and software elements of the relay. Any failure detected shall be annunciated through a output watchdog contact. The fault diagnosis information shall be displayed on the LCD and also through the communication port.*

14. *The Numerical Relays shall be provided with 1 Set of common support software compatible with both Windows 7 and higher which will allow easy settings of relays in addition to uploading of event, fault, disturbance records, measurements.*

- *The relay settings shall also be changed from local or remote using the same software.*
- *Additional functions can be added to relay by software upgradation and downloading this upgraded software to the relays by simple communication through PC.*

15. *All protective relays shall be in draw out or plugin type/modular cases with proper testing facilities. Necessary test plugs/test handles shall be supplied loose and shall be included in contractor's scope of supply.*

16. *All AC operated relays shall be suitable for operation at 50 Hz. AC Voltage operated relays shall be suitable for 110 Volts VT secondary and current operated relays for 1 amp CT secondary. All DC operated relays and timers shall be designed for the DC voltage specified, and shall operate satisfactorily between 80% and 110% of rated voltage. Voltage operated relays shall have adequate thermal capacity for continuous operation.*

17. *The protective relays shall be suitable for efficient and reliable operation of the protection scheme described in the specification .Necessary auxiliary relays and timers required for interlocking schemes for multiplying of contacts suiting contact duties of protective relays and monitoring of control supplies and circuits, lockout relay monitoring circuits etc. also required for the complete protection schemes described in the specification shall be provided. All protective relays shall be provided with at least two pairs of potential free isolated output contacts. Auxiliary relays and timers shall have pairs of contacts as required to complete the scheme; contacts shall be silver faced with spring action. Relay case shall have adequate number of terminals for making potential free external connections to the relay coils and contacts, including spare contacts.*

18. *Timers shall be of solid state type. Time delay in terms of milliseconds obtained by the external capacitor resistor combination is not preferred and shall be avoided.*

a. *No control relay, which shall trip the power circuit breaker when the relay is deenergised, shall be employed in the circuits.*

b. *Provision shall be made for easy isolation of trip circuits of each relay for the purpose of testing and maintenance.*

c. *Auxiliary sealinunits provided on the protective relays shall preferably be of shunt reinforcement type.*

d. *The setting ranges of the relays offered, if different from the ones specified shall also be acceptable if they meet the functional requirements.*

19. *Any alternative/additional protections or relays considered necessary for providing complete effective and reliable protection shall also be offered separately. The acceptance of this alternative/ additional equipment shall lie with the OPTCL*

20. The relay must be able to continuously measure following parameters with a typical accuracy of  $\pm 1\%$ .

- Current (0.05 to 3 In)  $\pm 1.5\%$  of reading,
- Voltage (0.05 to 2 Vn)  $\pm 1.0\%$  of reading
- Frequency (40 to 70 Hz)  $\pm 0.03$  Hz
- Phase  $0^\circ$  to  $360^\circ$   $\pm 5.0\%$
- Power (W)  $\pm 5.0\%$  of reading at unity power factor
- Reactive power (VARS)  $\pm 5.0\%$  of reading at zero power factor
- Apparent power (VA)  $\pm 5.0\%$  of reading

## 6.0 Protection System

### Protective system

#### 6.1 Protection discrimination

On the occurrence of a fault on the power system network the high speed discriminating protection systems (main protection) shall rapidly detect the fault and initiate the opening of only those circuit breakers which are necessary to disconnect the faulted electrical element from the network. Protection equipment associated with adjacent electrical elements may detect the fault, but must be able to discriminate between an external fault and a fault on the electrical element which it is designed to protect. Sequential time delayed tripping is not permitted except in the following specific circumstances:

- Protection for short connections between post current transformer housings and circuit breakers when the technical advantages of complete overlapping of the protection are outweighed by economic considerations, (i.e. short-zone protection)
- Operation of time graded back-up protection takes place as a result of either the complete failure of the communication links associated with the main protection systems, or the fault resistance is substantially greater than a value which can be detected by main protection systems.
- Operation of line back-up protection to disconnect primary system faults in the case of a circuit breaker failing to operate, (i.e. circuit breaker failure protection)
- All back-up protection systems shall be able to discriminate with main protection systems, circuit breaker fail protection and with other back-up protection systems installed elsewhere on the transmission system.

#### 6.2 Protection settings

A list of the settings to be applied to all protection systems together with all associated calculations, shall be provided for review and approval not less than three months prior to the first programmed date for commissioning. The settings for line protection shall be such as to permit correct operation of the protection for earth faults with up to 100 ohms fault resistance. Any limitations imposed on the power system as a result of the settings proposed shall be explicitly stated. In the absence of system data required for calculation purposes, assumptions may be made providing these are clearly identified as such in the relevant calculations.

#### 6.3 Fault clearing time

The protection equipment shall be capable of achieving the following discriminative fault clearing times, inclusive of circuit breaker and signaling times:

- One millisecond for all electrical elements whose boundary connections are defined by circuit breakers located within a given substation.
- For interconnecting tie lines in which the boundary connections of the electrical element being protected are defined by circuit breakers located in adjacent switching stations, an additional 20 ms fault clearance time is allowed at the substation remote from the fault point. This additional fault clearance time is permitted subject to the requirement that the positive sequence impedance of the primary circuit from the switching terminal to the point of fault shall not be less than ten ohms.

The Contractor shall supply the Project Manager with details of the operating times under defined conditions of all protection equipment proposed. Any limitation in operating time performance shall be declared by the Contractor, e.g. end of zone faults where distance protection is applied, high resistance faults, faults at high



X/R with significant DC component and time constant, faults coincident with communication channel noise. The Contractor shall specify the increase in operating time which could occur under such conditions.

#### **6.4 Signalling equipment operating times:**

For design purposes the operating times of signalling equipment to provide a contact signal for use with associated distance protection shall be assumed to be as follows:

- Intertripping (transfer trip) not greater than: 20 milliseconds
- Permissive transfer trip: 15 to 20 milliseconds
- Blocking signal operate time: 10 milliseconds
- Blocking signal reset time: 10 milliseconds

### **Protection Schemes**

#### **6.5 Line protection**

##### **General requirement for line protection relays**

The line protection relays shall protect the line and clear faults on line in the shortest possible time with reliability, selectivity and full sensitivity to all types of line fault. The general concept for

1) 400kV and 220kV levels is to have primary and back-up protection systems having equal performance requirement especially in respect of time as would be provided by two Main protections called **Main-I** and **Main-II**. It is desirable that Main-I and Main-II protection should work on two different principles of operation and one back up dir O/C & E/F protn is envisaged.

2) For 132 kV level the concept of one main distance protection and one backup directional O/C and E/F protection is envisaged.

3) For 33 kV level, the requirement is that of modular directional O/C and E/F protection.

The protection requirements are summarised below, and illustrated in the single line diagrams in the schedules.

##### **400kV and 220kV lines**

- Main I Numerical non switched distance protection meeting performance levels.
- Main II Numerical non switched phase comparison, carrier aided or of numerical distance using a different principle of operation
- Phase segregated teleprotection facility
- Power swing detection blocking and tripping
- Synchronising.
- Line overvoltage ( Only for 400kV and 220kV line □ 200kM long )
- Autoreclosure
- Numerical directional overcurrent and earth fault
- Three phase to ground
- Numerical local breaker back up
- Pole discrepancy protection

##### **6.5.1 Distance Protection Relay (Numerical IEC-61850 Protocol compliance)**

The relay shall Comply:

a. The IEC 60255-121 standard “Functional requirements for distance protection” published in March 2014, specifies the minimum requirements for functional and performance evaluation of distance protection relays,

describes the tests to be performed and how to publish the test results. The relay should conform to above standard.

b. The protection should be fully numerical and be based on a non-switched scheme.

c. Provide protection for the transmission line from all types of faults-phase to earth faults as well as multiphase faults. The protection algorithm shall have dual redundant distance protection algorithms to detect all types of power system faults so as to arrive at a secure trip decision with correct phase selection and proper direction discrimination in the shortest possible time.

d. The protection should have non-switched measurement, which implies processing of six possible fault loops ( six –loop measurement )

e. It should have polygonal characteristics with independently adjustable reactive and resistive reaches for maximum selectivity and maximum fault resistance coverage. The zones shall have independent settable earth fault compensation factors to cater to adjacent lines with different zero sequence to positive sequence ratios

f. Selection shall be so that the first zone of the relay can be set to about 80% - 85% of the protected line without any risk of non-selective tripping.

g. The second and third zone elements shall provide back up protection in the event of the carrier protection or the first zone element failing to clear the fault, zone-2 shall cover full protected section plus 50 % of the next section, zone-3 shall normally cover the two adjacent sections completely.

h. It must have load encroachment features and must support blocking of the selected zones during heavy load condition.

i. It should have adequate number of forward zones (minimum three) and a reverse zone. The zone reach setting ranges shall be sufficient to cover line lengths appropriate to each zone. Carrier aided scheme options such as permissive under reach, over reach, & blocking and non-carrier aided schemes of zone 1 extension and Loss of load accelerated tripping schemes shall be available as standard. Weak in feed logic and current reversal guard also shall be provided.

j. In case the carrier channel fails, one out of the non-carrier based schemes cited above should come into operation automatically to ensure high speed and simultaneous opening of breakers at both ends of the line.

k. In addition to the conventional impedance measuring algorithm the distance protection relay should have a separate measuring technique in the same hardware completely different to the conventional impedance measuring principal. Both the algorithms should run in parallel and should take trip decisions independently.

l. Have a maximum operating time up to trip impulse to circuit breaker (complete protection time including applicable carrier and trip relay time) with CVT being used on the line :

- For SIR 0.01-4 : as 40ms at the nearest end and 60ms at the other end of line
- For SIR 4-15 : as 45ms at the nearest end and 65ms at the other end of line
- With carrier transmission time taken as 20ms.

m. Have a secure directional response under all conditions, achieved by memory voltage polarizing and/or healthy phase voltage polarizing as appropriate.

n. Shall have an independent Directional Earth Fault ( DEF ) protection element to detect highly resistive faults. This element shall have an inverse time/definite time characteristic with a possibility to configure the DEF as a channel-aided DEF or a channel-independent DEF

- o. Have logic to detect loss of single/two phase voltage input as well as three phase voltage loss during energisation and normal load conditions. The voltage circuit monitoring logic should in addition to blocking the distance protection element, enable an emergency overcurrent element to provide a standby protection to the feeder till the re-appearance of voltage signal.
- The VT fuse failure function shall function properly irrespective of the loading on the line. In other words the function shall not be inhibited during operation of line under very low load conditions.
- p. Have necessary logic to take care of switch-on-to-fault condition. Energisation of transformers at remote line ends and the accompanying inrush current shall not cause any instability to the operation of relay.
- q. The line protection IED should have power swing blocking feature, with facilities for :
- i. fast detection of power swing
  - ii. selective blocking of zones
  - iii. settable unblocking criteria for earth faults, phase faults and three phase faults.
- r. Also the Distance protection IED should have following features in built in it.
- suitable for single pole or three pole tripping.
  - Shall have inbuilt CT supervision facility. A time-delayed alarm shall be issued if a CT open circuit is detected.
  - Shall have inbuilt Trip circuit supervision facility to monitor both pre- and post close supervision facilities. An alarm shall be generated.

Shall have inbuilt Circuit Breaker Failure protection based on undercurrent detection and/or circuit breaker auxiliary contact status and/or distance protection reset status. Provision shall be given to initiate the breaker fail logic using a digital input from external protection devices.

- Shall have inbuilt in broken conductor detection by measuring the ratio of  $I_2$  &  $I_1$  . The sensitivity of the logic shall not be affected during operation under low load.
  - Shall have a fault locator with an accuracy of  $\pm 3\%$ . The display shall be in kilometers, miles or percentage impedance . The fault locator should have built in mutual compensation for parallel circuit.
- s. Be capable of performing basic instrumentation functions and display various instantaneous parameters like Voltage, current, active power, reactive power etc. in primary values. Additionally all sequence current and voltage values shall be displayed on-line. Also the direction of power flow shall be displayed.
- t. The relay shall have a built-in auto-reclose function with facilities for single pole / three pole / single and three pole tripping. It shall be possible to trigger the A/R function from an external protection. A voltage check function which can be programmed for dead line charging/dead bus charging / check synchronising shall be included.
- u. Records containing discrete data on the last five faults shall be made available. In particular the fault resistance value shall be available for each record.
- v. Facility for developing customized logic schemes inside the relay based on Boolean logic gates and timers should be available. Facility for renaming the menu texts as required by operating staff at site should be provided.
- w. The protection relay should have the following additional elements

i. Under / Over voltage protection. The relay shall have two stages of voltage protections where each stage can be set as under/over voltage. The drop off/Pickup ratio can be set up to 99.5%.

- ii. The relay shall have built in Circuit Breaker Supervision Functions for Condition based Circuit Breaker Maintenance
- iii. The relay shall be able to detect any discrepancy found between NO & NC contacts of breaker
- iv. The relay shall monitor number of breaker trip operations
- v. The relay shall record the sum of the broken current quantity
- vi. The relay shall also monitor the breaker operating time
- vii. In all the above cases the relay shall generate an alarm if the value crosses the threshold value.

## 6.5.2 NUMERICAL TRANSFORMER DIFFERENTIAL RELAY

### a. General requirements for transformer protection scheme : The differential protection IED

- The offered relay must be suitable providing complete protection for 2 winding transformer, 3 winding transformer and auto transformer
- **Category-A:** For 3 winding differential Protection, it must have 12 CT input, 3 for phase CT HV side, 3 for phase CT LV side, 3 for Phase CT TV side, 1 for neutral CT HV, 1 for neutral CT LV, 1 for neutral CT TV.
- **Category-B:** For 2 winding differential protection, it must have 8 CT input, 3 for phase CT HV side, 3 for phase CT LV side, 1 Neutral CT HV side, 1 Neutral CT LV side.
- The relay must be suitable for providing low impedance REF protection for auto transformer.
- For 2 Winding transformer, 1 VT input and for 3 winding transformer 4 VT input are required.
- The protection function requirement for Transformer protection relays are as mentioned below,
- Differential protection (Low Impedance type with 3 slope characteristic)
- 2 elements of REF Protection for 2 winding transformer and must be selectable between Low Impedance and High impedance REF as per the site requirement's
- 3 elements of REF protection for 3 winding transformer and must be selectable between Low and High impedance REF
- REF protection for autotransformers.  Backup Over current and Earth fault for each winding
- Thermal overload protection
- Over excitation protection
- Over and Under frequency protection
- CB Fail protection for each Winding (CT) input
- Shall be stable during magnetizing inrush and over fluxing conditions. Stabilization under inrush conditions shall be based on the presence of second harmonic components in the differential currents. The second harmonic blocking threshold shall be programmable one.
- Shall have facility to deactivate harmonic restraint and over fluxing restraint functions.
- Shall have saturation discriminator as an additional safeguard for stability under through fault conditions.
- The relay should be capable of detecting the CT saturation. Relay should use appropriate algorithm to detect light saturation condition.
- It shall be possible in the relay to individually set MVA rating of transformer per winding.
- Relay should have vector group and magnitude correction. Relay should have facility for filtering zero seq. current for stability of X-mer differential protection (87T) during through fault.
- Thermal overload protection as per IEC 60255.

- The relay shall have through fault monitoring element to monitor the HV, the LV or the TV winding to give the fault current level, the duration of the faulty condition, the date & time for each through fault.
- The relay shall have REF protection, be selectable separately for each winding and programmable as either high or low impedance. The REF function should be able to share CT's with the biased differential function. The REF protection provided should be suitable for auto transformer also.
- Shall have all output relays suitable for both signals and trip duties.
- Shall be stable during magnetizing inrush and over fluxing conditions. Stabilization under inrush conditions shall be based on the presence of second harmonic components in the differential currents. The second harmonic blocking threshold shall be programmable one.
- Shall have facility to deactivate harmonic restraint and over fluxing restraint functions.
- Shall have saturation discriminator as an additional safeguard for stability under through fault conditions.
- Shall have software for interposing current transformers for angle and ratio correction to take care of the angle & ratio correction.
- Shall have all output relays suitable for both signals and trip duties.
- Shall have transient bias to enhance the stability of differential element during external fault condition.
- The relay should have combined harmonic blocking and restraint features to provide maximum security during transformer magnetizing inrush conditions

## **b. Functional Description.**

### **i. Differential Protection**

- The relay shall be biased differential protection with triple slope tripping characteristics with faulty phase identification / indication . The range for the differential pick-up shall be from 0.1 to 2.5 pu. Its operating time shall not exceed 30 ms at 5 times rated current.
- The relay shall have adjustable bias slopes m1 from 0 % to 150 % and slope m2 from 15% to 150 % so as to provide maximum sensitivity for internal faults with high stability for through faults.
- The relay shall have an unrestrained highset element to back up the biased differential function and the setting range for it shall have a minimum setting of 5pu and a maximum setting of 30pu.
- The relay shall have the stability under inrush conditions . The ratio of the second harmonic component to the fundamental wave for the differential currents of the measuring system shall serve as the criterion.
- The device shall have reliable detection technique, preferably no gap detection technique to ensure stability during inrush. Any type of time delay is not acceptable to differentiate inrush and fault condition.
- The relay shall provide restraint for over fluxing condition for the transformer by measuring the ratio of the fifth harmonic to the fundamental for the differential current if subjected to transient over fluxing. The fifth harmonic blocking feature should have variable percentage setting.

### **ii. Restricted Earthfault Protection ( 64 R )**

This function should be provided to maximise the sensitivity of the protection of earthfaults. The REF function should be selected separately for each winding and programmable as either high or low impedance. The REF function should be able to share CT's with the biased differential function. As in

traditional REF protections, the function should respond only to the fundamental frequency component of the currents. The REF protection provided should be suitable for auto transformer also.

**iii. Overfluxing Protection ( 99 GT )**

The relay shall Over fluxing protection Volts/Hertz protection to the transformers protected. By pairs of v/f and t , it shall be possible to plot the overfluxing characteristics in the relay so that accurate adaptation of the power transformer Over fluxing characteristics is ensured.

In addition the relay should have a definite time element for alarm. The reset ratio for Overfluxing Protection shall be 98%.

**i. Overload Protection.**

Shall have thermal overload protection for alarm and trip condition with continuously adjustable setting range of 10-400% of rated current

**ii. Overcurrent Protection ( 50,51 )**

The relay shall have three stages of definite time overcurrent protection as backup operating with separate measuring systems for the evaluation of the three phase currents ,the negative sequence current and the residual current. In addition the relay shall have three stages of Inverse time overcurrent protection operating on the basis of one measuring system each for the three phase currents ,the negative sequence current and the residual current.

**iii. Over / Under frequency**

The relay shall have four stages of frequency protections where each stage can be set as under/over frequency, under/over frequency with df/dt

**iv. Over / Under Voltage**

The relay shall have two stages of voltage protections where each stage can be set as under/over voltage. The adjustable drop off/Pickup ratio better than 97% should be available.

**v. Local Breaker Back up protection:**

The relay shall in built LBB protection to detect the failure in the local breaker using the undercurrent criteria and trip the upstream breaker.

### **6.5.3: FEEDER MANAGEMENT RELAY**

#### **Protection and Control function requirements for feeder Management Relay.**

- The Relay provides the following current based protection functions:
- Phase/Neutral/Ground instantaneous overcurrent
  - Phase/neutral/ground time overcurrent
  - Negative sequence Timed overcurrent
  - Phase/neutral directional overcurrent
  - Restricted Ground Fault (87REF)
  - Breaker Failure (50BF)
  - Thermal Model (49)
  - Cold Load Pickup (CLP)
- The Relay provides the following voltage based functions:
  - Phase Over and Under Voltage
  - Neutral Over Voltage
  - Directional Power
  - Forward Power
- The Relay provides the following control functions:
  - 4 Shot Auto Reclose (79)
  - VT Fuse failure (VTFF)
  - Over/Under Frequency (81O/81U)
  - Rate of change of Frequency (81df/dt )

- Synchrocheck (25)
- Breaker Failure (50BF)
- At least 5 user configurable commands for local and remote (Remote through SCADA on MMS)
- Configurable one line diagram for the substation bay
- The relay should have 2 switchable setting groups for dynamic reconfiguration of the protection elements due to changed conditions
- Programmable LOGIC
- Relay supports user defined logic to build control schemes supporting logic gates, timers, nonvolatile latches.
- The Relay configuration tool has an embedded graphical user interface to build programmable logic.

#### **FRONT-PANEL VISUALIZATION**

- The front panel includes user-programmable LEDs and pushbuttons and navigation keys.
- For bay information that includes user programmable screens for:
  - One line diagram displaying
  - Switchgear operation
  - Access to metering information
  - Alarm panel display.
  - I/O status display.
  - Relay settings

#### **6.5.4: BACKUP RELAYS (Current Protection).**

The combined overcurrent and earth-fault relay is connected to the current transformers of the object to be protected. The overcurrent unit and the earth-fault unit continuously measure the phase currents and the neutral current of the object. On detection of a fault, the relay will start, trip the circuit breaker, provide alarms, record fault data, etc., in accordance with the application and the configured relay functions.

#### **FUNCTIONAL DESCRIPTION;**

##### **Three-Phase Overcurrent (50/51) & Earth Overcurrent (50N/51N)**

Three independent stages are available either for phase and earth fault protection. For the first and second stage the user may independently select definite time delay (DTOC) or inverse time delay (IDMT) with different type of curves (IEC, IEEE/ANSI, IS 3231:1987).

##### **Three-Phase & Earth-Fault Directional Overcurrent (67/67N)**

Each of the three-phase overcurrent stages & earth fault stages can be independently configured as directional protection and with specific characteristic angle (RCA) and boundaries as per IEC, IEEE/ANSI, IS . The phase fault directional elements should be internally polarised by quadrature phase to phase voltages. A synchronous polarising function or any other suitable algorithm may be provided to ensure a correct operation of the overcurrent elements for close-up three phase faults where the collapse of the polarising line voltages occurs.

##### **Under / Over Voltage (27/59)**

Independent under-voltage stage and two or more over-voltage stages may be provided. They should be definite time elements. Each stage can be configured to operate from either phase-neutral or phase-phase voltages. The drop off to pick up ratio should be 99.5%.

##### **Under / Over Frequency (81U/O)**

Time delayed under and over frequency protection on the fundamental form of frequency protection is to be provided When the frequency measured is crossed 6 predefined thresholds, the relays should generate a start signal and after a user settable time delay, a trip signal.

## **Circuit Breaker Failure Protection (50BF)**

The circuit breaker failure verifies the effective opening of the CB by a dedicated undercurrent threshold. The circuit breaker failure function can be activated by trip of a generic protection or/and external command by the relevant digital input. The circuit breaker failure protection can be used for tripping upstream circuit breakers too.

### **6.5.5: For numerical relays, the scope shall include the following:**

1. Necessary software and hardware to up/down load the data to/from the relay from/to the personal computer installed in the substation. However, the supply of PC is not covered under this clause.
2. The relay shall have suitable communication facility for connectivity to SCADA.
3. IED should be IEC 61850 compliant.
4. IED should support PRP (Parallel Redundancy Protocol)
5. In case of line protection and transformer/reactor protection, the features like fault recorder and event logging function as available including available as optional feature in these relays shall be supplied and activated at no extra cost to the owner. Also necessary software/ hardware for automatic uploading to station HMI/DR work station (as applicable) shall be supplied.

### **6.5.6. Technical Particulars of IED**

#### **2. Standards and regulations:**

IEEE/IEC/ANSI/CE/IS	IS: 3231/IEC60255/IEC 61000
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#### **2. Analogue Inputs and Outputs**

Nominal Frequency fN	50 Hz
Nominal Current	1A/5A
Power Consumption Current	0.05VAat IN=1A, 0.3VAat IN=5A
Overload Capability per Current	100* IN for 1Sec

Input thermal (rms)	30*IN for 10Sec 4*IN continuous
Dynamic (pulse Current)	1250A (half cycle)
Nominal Voltage Ph-Ph rms (VN)	110V
Operating range Ph-Ph rms	0-200V
Continuous	2*VN
10 seconds	2.6*VN

#### **3. Auxiliary voltage**

Nominal Range	Operative Range
220V dc	180-300Vdc
Power Consumption dc	< 50W
Ripple superimposed AC Voltage	≤ 15% auxiliary nominal voltage
230VAC	90-270VAC
Power Input AC	< 30VA

#### **4. Input / output modules**

##### **Binary inputs**



a) number of input	a) Minimum 6 Nos for Backup relays. b) Minimum 16 Nos for feeder management relays c) Minimum 12/04 Nos for Transformer Differential Relays. (Category-A/B) d) Minimum 24/12 Nos for Distance Protection Relays(Category-A/B)
b) voltage range	240V $\pm$ 20%
c) power consumption	< 0.4W
<b>output contact</b>	
1. number of output contact	a) Minimum 8 Nos for Backup relays. b) Minimum 12 Nos for feeder management relays c) Minimum 12/08 Nos for Transformer Differential Relays. (Category-A/B) d) Minimum 32/16 Nos for Distance Protection Relays(Category-A/B)
2. Nominal Voltage	240V DC $\pm$ 20
3. permissible current	Make & carry 30A for 0.2sec. ANSI C37.90 Continuous; 5A IEEE C37.90

## 5. LED

LED displays:	
Status LED	17.2. Relay Healthy 17.3. Relay Start 17.4. Relay Trip
Alarm Indication	Configurable LED for indication. Minimum 8Nos for Backup relays. Minimum 8 Nos for feeder management relays Minimum 8 Nos for Transformer Differential Relays. Minimum 14Nos for Distance Protection Relays.

## 6. Protection Function

DISTANCE PROTECTION RELAY:

21P	Distance protection 21
21G	Distance protection zones (PDIS)
25	Synchocheck
27/59	Under/Over Voltage (2 stage over voltages)
46	Negative Phase Sequence
46BC	Broken Conductor
50/51,50N/51N	Instantaneous/Time overcurrent.
50BF	Breaker failure
67/67N	Direction Over current
79	Auto Reclose
81	Frequency Function.
FL	Fault Locator
DR	Disturbance Recorder
EL	Event Log.
MES.	Measurement.

CTS	CT Supervision
VTS	VT Supervision
TCS	Trip Ckt Super vision
<b>TRANSFORMER DIFFERENTIAL RELAY</b>	
24	Over-excitation.
27/59	Under/Over Voltage
49	Thermal Overload
46	Negative Phase Sequence
50/51,50N/51N	Instantaneous/Time overcurrent.
50BF	Breaker failure
87G	Restricted Earthfault.
<del>67/67N</del>	<del>Direction Over current</del>
87	Differential Protection.
81	Frequency Function.
FL	Fault Locator
DR	Disturbance Recorder
EL	Event Log.
MES.	Measurement.
CTS V	CT Supervision
TS	VT Supervision
TCS	Trip Ckt Super vision
<b>BACK UP RELAYS(CURRENT PROTECTION)</b>	
50	Instantaneous phase overcurrent protection
51/67	Four step phase overcurrent protection
50N	Instantaneous residual overcurrent protection
51N/67N	Four step residual overcurrent protection
50BF	Breaker failure protection (RBR)
81	Under frequency
<b>FEEDER MANGEMENT RELAY</b>	
50	Instantaneous phase overcurrent protection
51/67	Four step phase overcurrent protection
50N	Instantaneous residual overcurrent protection
51N/67N	Four step residual overcurrent protection
27 /59	Under Over Voltage
50BF	Breaker failure protection
81U	Under frequency
81R	df/dt
25	Check synchronise
32	Power Protection
79	Multi shot Auto Recloser
Control	Switchgear Control Capability.

## 7. Secondary Supervision & Communication

<b>Secondary system supervision</b>	
	Current circuit supervision Fuse failure supervision
<b>Monitoring</b>	
	Measurements Event counter Disturbance report Fault locator

Communication	
	IEC61850-8-1 Communication IEC60870-5-103 communication protocol Single command, 16 signals Multiple command and transmit. PRP compliant
a)Synchronization facility with GPS Cloak b)Front port communication c)Rear port d)Optional port	a) IRIG-B/ Sntp b) RS 232/Ethernet/USB c) FO and RJ45 port for IEC 61850-8-1 d) RS232/485
Process Bus Interface IEC 61850-9-2LE	
	If asked

### 8. Mechanical design

1. type of mounting	Rack or panel mounting
2. degree of protection	IP52 & above
iii. permissible mechanical stress during operation b. permissible mechanical stress during transport Impedance starter	•Vibration IEC 60255-21-1:1996 Response Class 2 Endurance Class 2 •Shock and bump IEC 60255-21-2:1995 Shock response Class 2 Shock withstand Class 1 •Seismic IEC 60255-21-3:1995 Class 2

### 9. Insulation test:

	As per IEC 60255-5:1977
a) high voltage test on all circuits except auxiliary voltage	2KV for 1 min
b) high voltage test on voltage circuit only	2KV for 1 min
c) impulse voltage test on all circuits	5KV peak,1.2/50 micro s ,0.5

### 10. Noise immunity test

1.	
2. high frequency	IEC 60255-22-1:1988 Class III At 1MHz,for 2s with 200 Source Impedance: 2.5kV peak between independent circuits and independent circuits and case earth. 1.0kV peak across terminals of the same circuit.
3. electrostatic discharge	Electrostatic discharge IEC 60255-22-2:1996 Class 4 15kV discharge in air to user interface, display and exposed metal work. IEC 60255-22-2:1996 Class 3 8kV discharge in air to all communication ports.6kV point contact discharge to any part of the front of the product.
4. radio frequency electromagnetic field, non modulated	C37.90.2:1995 25MHz to 1000MHz,zero and 100%square wave modulated. Field strength of 35V/m.
5. radio frequency electromagnetic field, amplitude modulated	
6. power frequency magnetic field	
7. radio frequency electromagnetic field, pulse modulated	
8. fast transient	IEC 60255-22-4 :1992 Class IV 4kV,2.5kHz applied directly to auxiliary supply 4kV,2.5kHz applied to all inputs.

9. conducted disturbance induced by radio frequency field, amplitude modulated	IEC 61000-4-6:1996 Level 3 10V,150kHz to 80MHz at 1kHz 80%am
Interference emission test	89/336/EEC
a. radio interference voltage	EN50081-2:1994
b. radio interference field strength	EN50082-2:1995

### **11. Climate stress test**

1. permissible ambient temperature during operation	-25 °C to +55 °C
2. permissible ambient temperature during storage	-25 °C to +55 °C
3. permissible ambient temperature during transport	-25 °C to +70 °C
4. permissible humidity	56 days at 93%RH and +40 °C

### **ELECTROMECHANICAL AUXILIARY RELAYS:-**

Relays shall be suitable for semi flush mounting on the panel board. All the relays shall be back connected, protected with dust tight cases for tropical use and finished with dull black enamel paint. The adjusting devices, shall be accessible with the relay mounted on the panel board. Flag type operating indicators and flag indicator reset devices shall be provided. The latter shall be suitable for operation from the front of the relay case, without opening the cover. The relays shall comply in all respects with the requirements of IS: 3231 (latest edition) or equivalent standards and shall be suitable for operation under the climatic condition specified. The relays shall be suitable for operation within a temperature range of 0 deg. to 50 deg. C. The current coils shall be rated for a continuous current of 1 ampere and the voltage coils for 110 V normal. The contacts of the relays shall be silvered and precautions shall be taken to prevent or minimize damage due to arc which have to be successfully broken against 240 V D.C. When open, the contacts shall withstand a voltage of 115% of the normal circuit voltage. The relays shall preferably be provided with suitable seal-in-devices.

### **OTHER PARTICULARS OF AUXILIARY RELAYS:-**

1. The auxiliary relays shall be, designed for continuous operation at 250 V. D.C. and shall withstand 110% rated voltage continuously. This shall also be suitable for satisfactory operation at 85% rated Voltage.

2. All protective relays, auxiliary relays and timers except the lock out relays and interlocking relays specified shall be provided with self reset type contacts. All protective relays and timers shall be provided with externally hand reset positive action operation indicators with inscription subject to Purchaser's approval. All protective relays which do not have built-in hand-reset operation indicators shall have additional auxiliary relays with operating indicators (Flag relays) for this purpose. Similar separate operating indicator (auxiliary relays) shall also be provided in the trip circuits of protections located outside the board such as buchholtz relays, oil and winding temperature protection, sudden pressure devices, fire protection etc.

3. Self reset auxiliary voltage relays rated for specified D.C voltage shall be provided for use in the interlocking schemes for multiplication of contacts suiting contact duties of protective relays and for monitoring of control supplies and circuits. Monitoring relays for lockout relay circuits shall be connected in series with lockout relays coils. The Bidder shall be responsible to ensure that the monitoring relay ratings are such that they shall positively pick-up through the breaker coils / lockout relays coils monitored, but the breakers / lockout relays shall not operate with such a connection.

d) The supply and circuit monitoring relay shall be connected to initiate an alarm upto failure of respective supply / circuit . They shall preferably have reverse flags, which drop when relay is de-energised. Otherwise, an indicating lamp shall be provided with each monitoring relay for indication of its operation.

e) Close positions relays of main supply circuit breakers initiating automatic closure of stand by supply breakers shall have adequate time delay on drop out so that complete closure of stand by supply breaker is ensured . This feature will be used for obtaining limitation of duration of impulse for automatic closure of stand by supply breakers. In case the close position relays with such time delay are not available, additional slugged D.C auxiliary with adequate time delay on drop out may be supplied for automatic reverse closure . The exact arrangement will depend on the actual control schemes and shall be subject to the approval of purchaser.

6. The lockout trip relays shall be multi contact, hand reset type . The latching mechanism shall be positive and insensitive to vibration and shock. The reset devices on the front of the relay panel shall not permit manual tripping . Each lock-out relay shall be furnished with a panel mounted isolating arrangement to permit opening of trip circuits for testing .

1. **AUX. Relay Type- (ALARM ANNUNCIATION), 250 V DC**

- Case Size-3 element
- 18 Terminal
- 19 Flag -Required M
- 20 Mounting -Flush
- 21 Aux. Contacts-4 N/O

**THREE POLE VOLTAGE OPERATED AUXILIARY RELAY.**

Technical specification

Relay type

Aux.current or voltage	220 - 230V dc
Contacts - unit L.H	3 N/O 1 N/C H/R
Contacts - unit CTR	3 N/O 1 N/C H/R
Contacts - unit R.H	3 N/O 1 N/C H/R
Flag	Yes
Mounting	Flush

**COIL RATING**

D.C.75%-120% of rated voltage

AC.80%-115% of rated voltage

Operating voltage- not greater than 70% of voltage rating.

Operating time-15-20ms typical minimum at nominal voltage.

**Burden**

2watts for 30,125v

6watts for 50,250v.

**Operation indicator**

Hand reset operation indicator provided

**1. RESTRICTED EARTH FAULT RELAY (ATTRACTED TYPE ELECTRO- MECHANICAL):**

**TYPE: Electro-mechanical**

The REF relay (attracted armature type) to be used along with a stabilising resistor & Metrosil, which is designed for applications where sensitive settings with stability on heavy through faults are required. It is recommended for balanced and restricted earth fault, buszone and certain forms of differential protection for auto-transformers, Power Transformers etc. The relay shall operate as a high impedance unit protection scheme & to be connected in the system accordingly. The relay shall be attracted armature unit of simple and robust construction.

The operating coil shall be provided with the accessories like series resonant circuit.

Current tapping should be provided for different current setting by making suitable arrangement. The construction of the relay should be simple & electromechanical construction, detection element, and the output contacts should be in the same device, which will make the Operation fast and highly reliable.

The relay circuit, connected & tuned to the supply frequency must rejects the harmonics produced by current transformer saturation & due to system disturbances.

The current transformers may develop voltages during maximum internal faults and the relay may be damaged. Therefore total impedance of the relay to be decided by using external series stabilising resistor (non-linear resistor) to prevent over voltage developed. The relay shall be single pole operated.

#### **Features:**

- High stability on external faults
- Tuned to rated frequency
- 25ms operating time at 5 times current setting
- Simple and robust construction.
- High stability on external faults.
- Sensitive high speed protection on internal faults.
- Tuned to rated frequency.

#### **Application**

- Differential/REF protection of Power Transformers, auto-transformers and busbars.
- Balanced and restricted earth fault protection of transformer windings.
- Transverse differential protection of generators and parallel feeders.

#### **General description**

In circulating current protection schemes, the sudden and often asymmetrical growth of the system current during external fault conditions can cause the protective current transformers to go into saturation, resulting in a high unbalance current. To ensure stability under these conditions the relay should be designed to take care, may be by using a voltage operated, high impedance relay, set to operate at a voltage slightly higher than that developed by the current transformers under maximum external fault conditions. The stabilising resistor to be designed for such applications where sensitive settings with stability on heavy through faults are required.

A slight time delay on operation of relay helps to provide stability on heavy external faults and is to be taken care. This limits the current supplied, and the output unit operates only on the slower part of its time/current curve. The external stabilising resistor to be supplied separately with the relay allows continuous adjustment of the relay voltage setting over a wide range. y spaced current settings. The relay circuit, tuned to the supply frequency, rejects the harmonics produced by CT saturation. A slight time delay on operation helps to provide stability on heavy external faults and is obtain

#### **TECHNICAL DATA**

**Current rating** : 1A

**Frequency** : 50 Hz

**Settings** : 10 - 40% in seven equal steps as standard. Continuously variable external stabilising resistors of 200 ohms or any suitable value for 1A.

**Operating time** :

25 milliseconds at 5 times the current setting (see time/current characteristic in Figure 1).

**Burdens** :

0.9VA at current setting on lowest tap. 1.0VA at current setting on high set tap.

**Accuracy** :

Error class Index E 5.0 as per BS 142-1966 and 5.0 as per IS 3231-1965.

**Operation indicator** : Hand reset operation indicator provided.

**Contacts** : Two pairs of make self-resetting contacts are provided on single element relays.

**Short time** :

20 times the setting current for 3 seconds.

**Thermal rating continuous** :

(for 60 degree C rise in coil temperature): Times current setting To be furnished for different taps. **Case and finish** :

Single pole relays fitted in size 3 MIDOS cases. The relay comply fully with the requirements of IS 3231-1965 and are suitable for use in normal tropical environments

**Provision of Thermistor/ Metrosil** :

To protect from high voltage- Suitable rating thermistor shall be provided.

**Insulation** :

The relay meets the requirements of IS 3231-1965/IEC 255-5 Series C-2 KV for 1 minute

### 3. HIGH SPEED TRIP RELAY

#### A. General

The relay should be multi-contact attracted armature relays conforming to IEC 60255-1 and ESI 48 – 4 EB 2.

1. The relay should be of high speed, high burden, positive action, instantaneous cutoff type.
2. It should be of high burden to give immunity to capacitance discharge current.
3. It should be of robust design for reliable service.
4. Should be draw out type.
5. The number of contacts:
  - i. 10 contacts (8NO+ 2NC)
6. It should have hand and electrical contact reset and hand flag reset.
7. The trip relay should be suitable for use in Substation Automation System.

#### A. Technical Data

Rated voltage VN	220 V DC
Operating range	50% to 120% of rated voltage
Operating time	10 ms at rated voltage
Reset time	< 20 ms at rated voltage VN
Contacts	Hand reset and Electrical reset
Flag	Hand reset
No of contacts	10 (8 NO + 2 NC)
Nominal Burden	Operating Coil: < 170 Watts
	Reset Coil: < 70 watts for 10 contacts
Contact Rating	Make and carry continuously 1250 VA AC or 1250 W DC within limits of 660 V and 5 A
	Make and carry for 3 s 7500 VA AC or 7500 W DC within limits of 250 V and 30 A
	Break 1250 VA AC or 100 W (resistive) DC or 50 W (inductive) DC within limits of 250 V and 5 A
Case type & Size.	Panel Cut out Max for i. 10 contacts : (50 X 170mm) ii. 20 contacts : (100 X 170mm) depth should be less than 250mm.

**B. Tests.****i. Temperature :IEC 60068-2-1/ IEC 60068-2-2**

Operating	-10°C to +55°C
Storage	-25°C to +70°C

**ii. Humidity : IEC 60068-2-30/IEC 60068-2-78**

Damp heat test, Cyclic	6 days at 250C to 400C and 93% relative humidity
Maximum Altitude of Operation	Up to 2000 m

**iii. Mechanical Test**

Test	Reference	Requirement
Vibration	IEC60255-21-1	Response Class I
Shock and Bump	IEC60255-21-2	Shock response and withstand Class I, Bump Class I
Seismic test	IEC60255-21-3	Class I
Degree of protection	IEC60529	IP50 – Front IP20 – Rear IP40 – Side
Electrical Endurance	IEC 60255-1	10,000 operations at the rate of 600 operations per hour at 250 VAC, 5A (Ref: Std IEC 61810-1)

**iv Electrical Test**

Test	Standard
Insulation Resistance	IEC 60255-27# 500 V DC, >100M Ohms Between all terminals & earth Between coil terminals & contacts
Impulse Voltage Withstand	IEC 60255-27# 5.0 kV, 1.2/50 μs, 0.5J Between all terminals & earth Between coil terminals & contacts
High Voltage (Dielectric)	IEC 60255-27# 2 kV, 50Hz@1min (2.2 kV for 1 s) Between all terminals & earth Between coil terminals & contacts 1 kV AC RMS for 1 min



	across normally open contacts
Thermal Withstand Continuous	IEC 60255-6 1.2 VN
Thermal withstand for 10 s	IEC60255-6 1.30 VN
Maximum Allowable Temperature	IEC 60255-6 Max. temperature limit +1000C
AC Ripple on DC supply	IEC 60255-11 Withstand 15% AC ripple on DC

Power Frequency Magnetic Field Immunity	IEC 61000-4-8 Level 4, 30 A/m applied continuously 300 A/m applied for 3 s
Switching Rate	600 Operations per hour
Immunity to capacitance discharge	ENA TS 48-4 Issue 4 2010, Table

## Protective system

### 6.7 Unit and backup protection

Power system elements and the network shall be provided with independent high speed discriminative protection systems. Duplicate schemes (Main I and Main II) shall be provided for all

Test Standard Insulation Resistance IEC 60255-27# 500 V DC, >100M Ohms Between all terminals & earth  
Between coil terminals & contacts Impulse Voltage Withstand IEC 60255-27# 5.0 kV, 1.2/50  $\mu$ s, 0.5J  
Between all terminals & earth Between coil terminals & contacts High Voltage (Dielectric) IEC 60255-27#  
2 kV, 50Hz@1min (2.2 kV for 1 s) Between all terminals & earth Between coil terminals & contacts 1 kV  
AC RMS for 1 min across normally open contacts Thermal Withstand Continuous IEC 60255-6 1.2 VN  
Thermal withstand for 10 s IEC60255-6 1.30 VN Functional IEC 60255-1 Maximum Allowable Temperature  
IEC 60255-6 Max. temperature limit +1000C AC Ripple on DC supply IEC 60255-11 Withstand 15% AC  
ripple on DC

Power Frequency Magnetic Field Immunity

IEC 61000-4-8 Level 4, 30 A/m applied continuously 300 A/m applied for 3 s Switching Rate 600 Operations  
per hour Immunity to capacitance discharge ENA TS 48-4 Issue 4 2010, Table

400kV and 220kV systems. For all other systems up to 132kV, the protection equipment shall be divided into  
‘Main’ and ‘Backup’ systems.

Protection schemes of different philosophy (Main I and Main II or Main and Back-up) shall preferably be fed  
from different DC supplies when available in the substation. This shall include energisation of trip coil  
circuits in case of 400 kV and 220 kV breakers. However in case of 132kV system where a duplicate DC  
source is available, the two trip coils shall be energised from the different sources. Protection equipment shall  
not initiate a trip signal following the normal and correct discharge operation of one or more surge arresters.

Measurement functions relays must be achieved through electronic circuits. Auxiliary relays, repeat relays,  
trip relays and any other simple auxiliary or contact multiplication function may be based on standard  
attracted armature or other electromechanical techniques.

Relays based on numerical design technique shall constitute all primary protections. The Employers intends to  
avail the improved benefits in the functionality, design, reliability and cost effectiveness of integrated  
substation control systems in future for which relays with numeric design only shall be required. It is the  
responsibility of the Contractor to demonstrate that all relay equipment offered has a reasonable level of in-  
service experience. For numerical relays, the following conditions apply :

1. The Bidder must be able to demonstrate that a minimum of 10 relays of each type offered have been in full service without relay failures for a minimum of three years in two different countries, one of which may be the country of manufacture. Experience involving trial installations is not acceptable.
2. The Bidder must include a statement of the number of years of guaranteed manufacturing and parts support which will be provided for the relays offered.
3. The Bidder is be required to state the full firmware version together with the version of relays for which experience records are offered. For relays which are provided with communication facilities, the communications facility should allow all information which is available locally at the relay front panel to be accessed remotely. It should also be possible to carry out bulk transfer of settings and fault record information using the appropriate PC based software.

## **6.8 Protection discrimination**

On the occurrence of a fault on the power system network the high speed discriminating protection systems (main protection) shall rapidly detect the fault and initiate the opening of only those circuit breakers which are necessary to disconnect the faulted electrical element from the network. Protection equipment associated with adjacent electrical elements may detect the fault, but must be able to discriminate between an external fault and a fault on the electrical element which it is designed to protect. Sequential time delayed tripping is not permitted except in the following specific circumstances:

- Protection for short connections between post current transformer housings and circuit breakers when the technical advantages of complete overlapping of the protection are outweighed by economic considerations, (i.e. short-zone protection)
- Operation of time graded back-up protection takes place as a result of either the complete failure of the communication links associated with the main protection systems, or the fault resistance is substantially greater than a value which can be detected by main protection systems.
- Operation of line back-up protection to disconnect primary system faults in the case of a circuit breaker failing to operate, (i.e. circuit breaker failure protection)
- All back-up protection systems shall be able to discriminate with main protection systems, circuit breaker fail protection and with other back-up protection systems installed elsewhere on the transmission system.

### **6.8.1 Codes and Standards**

The equipment supplied shall generally comply with the codes and standards indicated in relevant sections of this specification. Additionally the equipment shall also conform the requirements of this specification.

### **6.8.2 Environmental requirement**

The protection, control and metering equipment shall operate satisfactorily under the various atmospheric, mechanical, electrical and environmental conditions as stipulated in the relevant sections of this Specification. The equipment shall conform to EMC Class III.

### **6.8.3 Future network scada system**

At some time in the future the Employer intends to introduce a network SCADA system. All equipment to be installed under this Specification shall be suitable for future remote operation and remote data acquisition. The limit of responsibility with regard to this contract shall be to provide equipment suitable for future connection to and communication with a SCADA system, either by means of RTU or modem. Neither the RTU nor the modems form part of the scope of this Specification. The proposed protocol for the SCADA system is IEC 61850 compliance. Equipment necessary to interface the Integrated Substation Control System with the SCADA system are part of the scope of this Specification.

### **6.8.4 Control and monitoring levels**

The substation control and monitoring system shall allow for three levels of man machine interface. The number of levels initially employed will be limited to one i.e. substation levels. Provision shall be made for the future implementation of the second and third level of network control and monitoring

from a system control centre via SCADA. Selection of substation control shall be from the individual equipment basis i.e., from the control panels. At the station level, control panels should be located in the main control room. A mimic diagram representing the substation lay-out in single line diagram form should be provided. The mimic board is intended to give operating personnel an overall view of the switchgear state. It shall be made up from the individual circuit control panels mounted side by side. The arrangement should correspond to the primary equipment layout. Alarm annunciation equipment should be mounted adjacent to the mimic diagram, or form an integral part of the control panel. Operation of an alarm should cause the appropriate window to flash and sound an audible warning. Operation of an accept button will silence the audible warning, steady the flashing window and prepare the annunciation to respond to subsequent initiation. A reset button should be provided to extinguish alarms which have reset. A lamp test button shall be provided which will initiate steady state illumination of all alarm windows. Trip or protection initiated alarms should have windows distinct from others (e.g. red display instead of white). Control and selector switches should be of approved types complying with accepted standards such as IEC 337. Control switches shall have two independent motions or two handed operation to effect operation. Indicating instruments should be of approved types complying with accepted standards such as IEC 5 1.

## **6.9 Enclosures**

Protection systems shall preferably be accommodated in rack or hinged rack cubicles and be of modular construction with factory assembled and tested wiring. Conventional analogue relays may be mounted on conventional relay panels which must be mounted to allow access to the front and rear of the panel. Relays mounted on such panels shall be flush mounted. The construction method shall offer the benefits of minimum site construction times and circuit outage requirements. Interconnections shall be identified in accordance with the requirements for dependent local end marking as specified in IEC Publication 391 Sections 3.4.1.a.1 and 5.1.2. The interconnections shall be recorded on an appropriate schedule or diagram. For modular protection systems, means shall be provided to lock positively each withdrawable module or unit in the —service position. It shall not be possible to remove any module without first short-circuiting all associated current transformer circuits.

## **6.10 Operator interface**

### **6.10.1. General**

All numerical protection systems shall be provided with an integral local operator interface facility to enable communication with the relay without the use of external equipment. Any facilities provided for connection to an external computer shall be an additional feature to the local operator interface. No exceptions to this requirement shall be accepted.

### **6.10.2 Identification**

Each protection system shall have a unique identifier which is clearly visible. If the protection system is software operated the software reference and issue level shall be identified.

### **6.10.3 Settings**

Each protection system shall provide a means by which the user can easily access the protection system to apply the required settings. This facility shall be secure from inadvertent operation. A display of the selected settings shall be provided on the protection system.

### **6.10.4 Indications**

Each relay or protection scheme shall be provided with an adequate number of indications to ensure that the appropriate faulted phase, zone, etc. can be easily identified after a fault condition. Each indicator shall be visible and capable of being reset without removing the relay cover. For relays based upon numerical techniques, indication shall be provided for failures detected in the protection relay or communications equipment. The indications provided shall be designed to allow the defective item to be quickly identified. The status of the DC power supplies shall be permanently indicated. Details of the indication required for specific types of relay are provided in the individual parts of this section of the specification covering particular types of relay.

## **6.11 Protection system output contacts**

All protection systems shall be provided with an adequate number of contacts of suitable rating to carry out the required tripping functions, alarm indications, fault recorder functions and such supplementary signalling functions as may be necessary for initiation of automatic switching control,

inter tripping etc. In all cases contacts intended for tripping duty shall be designed such that they cannot inadvertently interrupt trip coil current.

#### **6.12 Testing and isolating facilities**

Each functional protection system shall be so arranged that operational and calibration checks can be carried out with the associated primary circuit(s) in service. Adequate test facilities shall be provided within the protection system to enable the protection and auto-reclosing equipment to be tested from the front of the protection equipment panel with the primary circuit(s) in service. The test points shall be clearly identified and labelled. Relays based on digital and numerical design techniques shall include supervision facilities which provide a periodic self check of the key elements within the relay and also provide continuous self monitoring of all internal power supplies and microprocessor operation. A defect in any of the self supervision facilities shall not cause maloperation of the protection relay internal self-test facilities and shall give an alarm should an internal fault occur. Adequate facilities shall be provided, preferably at the front of each protection equipment panel, to isolate all DC and AC incoming and outgoing circuits so that work may be carried out on the equipment with complete safety for personnel and without loss of security in the operation of the switching station. The isolation points shall be clearly identified and labelled. The labels on the isolation points shall either describe the function or be uniquely numbered. The Contractor shall provide a list of all of the protection and auto-reclose equipment being offered under the contract. The Contractor shall also provide a list of all of the test and ancillary equipment required for commissioning and routine testing of all protection and auto-reclose equipment.

#### **6.13 Service life and support**

The protection systems shall be designed for a service life of at least 15 years, and preferably 20 years, given that normal maintenance in accordance with manufacturers recommendations is carried out during the lifetime of the protection system. The Contractor shall state the service life of the protection system equipment in relation to that of the main HV plant and apparatus so that Employer can assess the cost of any replacement during the life of the substation. The Contractor shall state the period for which lifetime support will be provided for the protection system equipment and shall make recommendations for the provision of spare parts.

The Contractor shall supply circuit diagrams for each protection system and the associated tripping system(s). The diagrams shall provide sufficient information to enable fault finding and maintenance to be carried out and shall not consist solely of information used for equipment manufacture. When the Contractor has been notified of incorrect operation, or failure to operate when required, of any protection system supplied under the contract, the Contractor shall investigate the incident and inform Employer of any such incidents if they result in the necessity to modify the equipment. The Contractor shall also inform Employer of the details of the modifications required to prevent such incidents re-occurring.

The Contractor shall offer a service to enable any faulty item of protection equipment to be rectified or replaced within a stated period of the fault being reported. The Contractor shall state the repair/replacement period.

The Contractor shall, when requested, offer the Employer a maintenance contract for the protection equipment supplied under the contract. The Contractor shall supply details of the cost of the maintenance contract and information on test procedures and test frequencies that would be supplied under the maintenance contract.

The Contractor shall offer training for Employer's personnel in the operation and maintenance of the protection equipment.

#### **6.14 Thermal rating of equipment**

Relay equipment intended to perform a current measurement function shall be capable of continuous operation at a current of not less than 2.4 times the nominal rating or twice the setting value, whichever is the more onerous.

Relay equipment intended for use in a normally quiescent mode and having a short time rating - for example, high impedance differential protection - shall be rated in accordance with the intended function and taking account of such inherent protective devices as may be incorporated in the design.

The short time rating for all protection relaying schemes shall be 100 times the nominal relay rating for a duration of one second.

Voltage sensitive equipment intended for use on effectively earthed networks shall have a continuous withstand of not less than 1.2 times nominal voltage and a short duration withstand of not less than 1.5 times nominal phase-to-ground voltage for 30 s.

#### **6.15 Insulation**

The rated insulation voltage of circuits connected to current transformers of high impedance relays shall be 1000 V. All other circuits shall have an insulation voltage of 2500V.

All open contacts of the protection system shall withstand a voltage of 1000V. The protection system shall comply with the dielectric test requirements of IEC 255-5. The test voltage shall be selected according to the rated insulation voltage of the circuits being tested form SeriesC of Table1 of IEC 255-5. The protection system shall comply with the impulse test requirements of IEC 255-5 with test voltage of 5kV.

#### **6.16 Test requirements**

##### **6.16.1 General requirements**

The Contractor shall supply test results and/or in service operating evidence to confirm compliance with the general and performance requirements as detailed in this Specification.

##### **6.16.2 Pre-commissioning and energisation tests**

The Contractor shall submit details of all pre-commissioning and energisation tests to the Project Manager for approval prior to the tests, and shall provide the Project Manager with the opportunity to witness the commissioning tests.

##### **6.16.3 Testing, inspection and test certificates**

The Bidder shall enclose with his bid the reports of type and routine tests conducted on similar equipment earlier as a proof of designing and developing similar equipment. Bid documents, furnished without these test reports shall be considered as incomplete and shall be liable for rejection. All equipment furnished shall conform to the type tests and shall be subject to routine tests in accordance with the requirements stipulated for control and relay panel equipment. The Project Manager reserves the option to call for any or all the type tests to be repeated on the equipment. The Project Manager further reserves the option to intimate the type tests to be carried out on the equipment up to six months after the award of contract. Payments would be made for the type tests actually carried out in accordance with the rates given in the Bid Price Schedule.

The Project Manager will have the right to call for any other tests of reasonable nature to be carried out at the Contractor's premises or at site or in any other place, in addition to the aforesaid type and routine tests, to satisfy that the materials comply with the Specification. The Contractor shall advise the Project Manager three months in advance of the type tests to be conducted on the finished equipment giving a programme for conducting the tests and shall proceed to test the equipment only after approval of the Project Manager. All type tests shall be performed in presence of Project Manager should he so desire.

The Contractor shall give one months notice of routine tests and inspection to be carried out on the finished equipment. A programme for conducting the tests shall be furnished and the Contractor shall proceed to test the equipment after approval of the Project Manager. The tests shall be witnessed by the Project Manager should he so desire.

All inspections, type tests and routine tests shall be carried out after approval of all the relevant drawings required under the contract.

None of the equipment to be furnished or used in connection with this contract shall be despatched until factory tests are satisfactorily completed. Such factory tests on the equipment shall not however relieve the Contractor from full responsibility for furnishing equipment conforming to the requirements of this contract, nor prejudice any claim right or privilege which the Employer may have because of the use of defective or unsatisfactory equipment. Should the Project Manager waive the rights to inspect and test any equipment, such a waiver shall not relieve the Contractor, in any way, of his obligations under this contract.

Six (6) copies of test reports of successful tests shall be submitted by the Contractor to the Project Manager for approval before shipment of equipment.

For equipment tests for which IEC recommendations or Indian Standards are available, test reports confirming that the equipment has passed the specified type and routine tests shall be furnished for the approval of the Project Manager by the Contractor before shipment of the equipment.

For equipment/tests for which IEC/IS specifications do not exist, the Contractor shall propose a test procedure for the approval of the Project Manager before conducting tests. Test certificates for tests carried out shall be submitted for approval of the Project Manager before shipment of the equipment.

Failure of any equipment to meet the requirements of tests carried out at works or at site shall be sufficient cause for rejection of the equipment. Rejection of any equipment will not be held as a valid reason for delay in the completion of the works in accordance with the agreed programme.

The Employer reserves the right to call for field tests on the completely assembled equipment at site. The price for conducting all the type tests in accordance with relevant standards and specifications shall be indicated in Bid Price Schedule and these would be considered for bid evaluation. The breakup price of type tests shall be given in the relevant price schedule for payment purpose only. In case Bidder does not indicate charges for any of the type tests or does not specifically identify any test in the price schedules, it will be assumed that the particular test has been offered free of charge. Further, in case any Bidder indicates that he shall not carry out a particular test, his offer shall be considered incomplete and shall be liable to rejection.

Six (6) copies of all test reports shall be supplied for approval before shipment of equipment. The reports shall indicate clearly the standard values specified for each test, to facilitate checking of the test reports. Fourteen (14) bound copies of test reports shall be submitted along with the equipment after approval of test results.

#### **6.16.4 Soak test**

All solid state equipment/system panels shall be subject to the Hot Soak Test as a routine test in accordance with the procedure detailed in the following paragraph.

All solid state equipment shall be burn-in tested for minimum of 120 hours continuously under operational conditions. During the last 48 hours of testing, the ambient temperature of the test chamber shall be 50C. Each panel shall be complete with all associated sub-systems and the same shall be in operation during the above test. During the last 48 hours of the above test, the temperature inside the panel shall be monitored with all the doors closed. The temperature of the panel interior shall not exceed 65C.

#### **6.16.5 Type tests**

Impulse voltage withstand test as per Clause 6.1 of IS 8686 (for a test voltage appropriate to Class III as per Clause 3.2 of IS-8686)

High Frequency Disturbance test as per Clause 5.2 of IS 8686 (for a test voltage appropriate to Class III as per Clause 3.2 of IS 8686)

Type tests listed under IEC-Technical Committees recommendation 'TEC-57' and functional type tests listed under CIGRE Study Committee 34 (Protection) Report on simulator, Network analyser or PTL as applicable.

#### **6.16.6 Routine tests**

Contact insulation resistance test as per Clause 10.5 of IS-3231.

Insulation withstand capability as per Clause 10.5 of IS-3231 on all AC/DC relays.

### **7.0 Protection Schemes**

#### **7.1 General**

The following sections of this specification identify the protection requirements for specific schemes. Drawings showing single line diagrams for each type of circuit are included in this Specification. The arrangements shown on these drawings represent the minimum requirements. Other protection arrangements may be provided but the Bidder must clearly state the reasons for offering supplementary protection schemes.

#### **7.2 Technical requirements**

Technical requirements of the protection and auxiliary relays, recorders and meters to be provided as part of the scope are detailed in the following sub clauses. The setting ranges of the equipment offered, if different from that specified shall be acceptable if they meet the functional requirements. The Bidder

shall quote for protection equipment meeting the requirements given in these sub clauses. The Bidder may also quote alternative or additional protections or relays considered necessary by him for providing an effective and reliable protection scheme. These equipments shall be quoted separately as an alternative or addition to the main offer. The Employer reserves the right to accept or otherwise such equipment.

### **7.3 400kV Reactor protection**

#### **Protection requirement**

The 400 kV reactors provided with the lines shall have the following protections.

- Differential protection.
- Restricted earth fault protection.
- Backup impedance protection.

#### **7.3.1 Differential protection relay (87R)**

This relay shall :

1. Be triple pole type
2. Have operation time less than 25 milliseconds at five times setting.
3. Be tuned to system frequency.
4. Have three instantaneous high set units to ensure rapid clearance of heavy faults with saturated CT's.
5. Have current setting range of 10 to 40% of 1 Amp.
6. Be Low impedance type.
7. Be stable for all external faults.
8. Be provided with suitable non-linear resistors to limit the peak voltage to 1000 volts.

#### **7.3.2 Restricted earth fault protection relay (64 R)**

This relay shall: 1. Be single pole type 2. Be of current/voltage operated high impedance type 3. Have a current setting of 10-40% of 1A and a suitable voltage setting range.

4. Be tuned to system frequency.
5. Be fitted with suitable non-linear resistors to limit the peak voltage to 1000 volts.

#### **7.3.3 Back up impedance protection relay (21 R)**

This relay shall:

1. Be triple pole type
2. Be single step polarised 'mho' distance relay or impedance relay suitable for measuring phase to ground and phase to phase faults.
3. Have an ohmic setting range of 20-320 ohms and shall be continuously variable.
4. Have an adjustable characteristic angle of 30 to 80 degree.
5. Have a definite time delay with a continuously adjustable setting range of 0.2 - 2.0 seconds. Shall initiate three phase tripping

### **7.4 BUS BAR PROTECTION:**

Bus bar protection schemes shall be provided for each main and transfer bus of 400 KV and 200 KV provided in the switch yard. This shall constitute main and check features. The overall scheme shall be engineered such that operation of both main and check features connected to the faulty bus shall result in tripping of the same. The scheme shall be provided with necessary expansion capacity and interfaces for adding features when the switch yard is extended in future to its ultimate capacity. The bus bar relay shall be of latest numerical relay having IEC protocol 61850 compliance.

#### **7.4.1 Busbar protection (Latest version numerical having IEC-61850 protocol compliance)**

Bus bar protection schemes shall be provided for each main bus of 400kV and 220kV switchyard. The overall scheme shall be engineered so as to ensure that operation of any one out of two schemes connected to main faulty bus shall result in tripping of the same. However in case of transfer bus, where provided, only one busbar protection scheme shall be required. Each busbar protection scheme shall

1. Be of modular construction and have features of self monitoring facility to ensure maximum availability of scheme. The scheme shall be static/ microprocessor/ Numerical based.

2. Have maximum operating time up to trip impulse to trip relay for all types of faults of 15 milli seconds at 5 times setting value.
3. Operate selectively for each busbar.
4. Give hundred percent security up to 40kA fault level.
5. Incorporate a check feature.
6. Incorporate continuous supervision for CT secondaries against any possible open circuit and if it occurs, shall render the relevant zone of protection inoperative and initiate alarm.
7. Not give false operation during normal load flow in busbars.
8. Incorporate clear zone indication.
9. Be of phase segregated and triple pole type and provide independent zones of protection for each bus (including transfer bus if any). If a bus section is provided then each side of the bus section shall have separate busbar protection scheme.
10. Include individual high speed hand reset tripping relays for each feeder, including future ones.
11. Be of low/medium impedance biased differential type and have operate and restraint characteristics.
12. Be transient free in operation
13. Include continuous DC supplies supervision.
14. Shall include multitap auxiliary CT's for each bay including future bays as per SLD and also include necessary CT switching relays wherever CT switching is involved.
15. Include protection 'in/out' switch for each zone with at least six contacts for each switch.
16. Shall have CT selection incomplete alarm wherever CT switching is involved.

**17. Have necessary auxiliary relays to make a comprehensive scheme.**

At existing substations busbar scheme with independent zones for each bus will be available. All necessary co-ordination for 'CT' and 'DC' interconnections between existing schemes (panels) and the bays proposed under the scope of this contract shall be fully covered by the bidder. Any auxiliary relays, trip relays, flag relays required to facilitate the operation of bays covered under this contract shall be fully covered in the scope of the bidder.

The Contractor shall offer all equipment to meet the requirements as above to make the scheme full and comprehensive.

**7.4.2 Weatherproof relay panels**

Where required these panels shall be provided for busbar differential protection. The panels shall include necessary number of electrically reset relays each with at least eight contacts for isolator auxiliary contact multiplication and for changing the CT and DC circuits to relevant zone of protection.

The panel shall be sheet steel enclosed and shall be dust, weather and vermin proof. Sheet steel used shall be at least 3.0 mm thick and properly braced to prevent movement. The enclosures of the panel shall provide a degree of protection of not less than IP55 (as per IS 2147). The constructional requirements shall comply with the relevant section of this Specification. Two test terminal blocks



required for bus coupler bay CT connection shall be supplied and mounted inside the panel of adjacent bay.

The test terminal blocks shall be fully enclosed with removable covers and made of moulded, noninflammable plastic material with boxes and barriers moulded integrally. Such blocks shall have washer and binding screws for external circuit wire connections, a white marking strip for circuit identification and moulded plastic cover. All terminals shall be clearly marked with identification numbers or letters to facilitate connection to external wiring. Terminal block shall have shorting, disconnecting and testing facilities for CT circuits.

### **7.5 Bus coupler / transfer bus coupler protection**

The protection scheme for the above are to be provided with directional numerical over current and earth fault protection scheme . The relay shall be latest version numerical and IEC 61850 compliant for future SCADA purpose. The details as indicated under unit back up protection relay.

All 220 kV substations shall be of Double Main (DM) or Double Main and Transfer (DMT) busbar configuration and shall be provided with a single bus coupler circuit breaker. In addition 220 kV DMT busbar configurations shall be provided with a transfer bus coupler circuit breaker. The required protection equipment for these breakers comprises overcurrent and earth fault relays. These relays shall comply with the requirements for backup over current and earth fault protection as described elsewhere in this section, except that the relays shall not be directional. The earth fault element shall have a current setting range of at least 20 - 80 per cent in six equal steps.

All 132 and 33 kV substations shall be of Single Main and Transfer (SMT) busbar configuration and a bus section isolator. Overcurrent and earth fault protection, complying with the requirements as given elsewhere in this section but without directional feature, shall be provided.

In DMT/SMT configurations, whenever the main breaker of a feeder or transformer is substituted by the bus coupler or transfer bus coupler breaker, a facility for switching over of the trip function of the feeder or transformer relays from the main breaker to the bus coupler or transfer bus coupler breaker, shall be provided through provision of a lockable protection transfer switch. The provision of a key interlock on the above switch is to be so arranged that at one time only one feeder or transformer can be taken to transfer mode.

### **7.6 Circuit breaker monitoring auxiliary relays**

All circuit breakers shall be provided with several relay contacts for annunciation of circuit breaker conditions such as :

- Low air/hydraulic oil/gas pressure.
- Lockout conditions due to abnormally low air/hydraulic oil/gas pressure.
- Pole discrepancy trip.
- Compressor/hydraulic pump trouble.

The exact requirements for this shall be available in the circuit breaker drawings to be provided by the manufacturer. The programmable Inputs/Outputs of the numeric relays shall be used as much as possible for providing annunciation in the control room for such cases. In case this is found inadequate, suitable auxiliary flag relays may be provided in the relay panels to provide annunciation.

### **8.0 Event logger (\*\*)**

\*\*As per the customers requirement

All 400 and 220 KV sub-station shall have separate Event Logger panel provision.

### **8.1 General**

The event logger shall be used to record the open and close states of switch yard equipment, relays and changes of alarms. The function of the equipment should be based on programmes stored in it. The stored programmes should permit some degree of flexibility of operation. Facility should be provided to erase the existing programme and reprogram allowing changes to be made very easily.

The number of modules and different types of modules should be minimised. The modules should be of plug-in type and should be easily accessible to simplify maintenance and repair.

The equipment should be designed to operate satisfactorily in severely hostile electrical environment such as in 400kV/220kV switchyard which are prone to various interference signals, typically from large switching transients.

The equipment should be carefully screened, shielded, earthed and protected. Input/ Output circuits should withstand the following tests:

- Impulse test in accordance with IEC 255, Part-IV.
- High frequency disturbance test in accordance with IEC 255, Part-IV. Since the equipment will be used in dedicated non-attended situations, programme stability is vitally important. Programme must not be capable of being changed unintentionally during normal operation.

## 8.2 Construction

The equipment should be constructed in clearly defined plug-in modules. A monitor module should be provided for indicating internal faults such as processor failure, memory failure, other internal hardware failures, and also external plant failures. These failures should be displayed on the LED's mounted on the monitor module. The equipment is used to record changes in digital points, i.e. operations and resetting of alarms and switching of primary equipment within a substation. Approximately 500 points should be accommodated in a single equipment. When such changes occur, a print out on a local teletype writer, which forms a part of this contract, should result.

The date and time should be printed to the nearest 10 ms followed by a message describing the point which has operated. Such messages may be abbreviated or in full English forms. Events occurring whilst a previous event is in process of being printed are to be stored to await printing. Over 100 such events must be stored. Facility shall exist to synchronise the internal clock system which will give a pulse output every half an hour with a pulse duration of at least 50 milliseconds through potential free contacts. However, if master clock system is not available, time generator of any one of the disturbance recorder shall be taken as master and event logger(s) in that station will be synchronised with it. The event logger shall give annunciation in case of absence of synchronising pulse within a specified time window. The internal clock of the event logger shall be on. The print out of current alarm and plant stages must be available on request by the operator. the operator should also be able to enter the date and time from the key board.

## 8.3 Technical requirements

The event recorder shall record all changes of alarms and plant states of switchyard equipment, along with the date and time of all alarms and plant state changes to the nearest 10 ms.

Facility shall be provided to commit 50 points of sequential memory or 25% of alarm whichever is the greater. In addition the unit shall be capable of handling up to 40 changes in any one 10 ms interval and 500 alarms and changes of state of switchyard equipment. On receipt of an alarm the equipment must:  Print out a message on Printer

- Set off an audible alarm.
- Set off a beacon. Allow normal inputs of
- Accept
- Alarm demand log
- Plant state demand log
- Date and time

The Bidder shall furnish along with the offer a two copies on original paper typical print out for simulated conditions.

Only plain paper readily available in India shall be used for the printer. The arrangement of feeding and removing paper rolls or stacks shall be quick and simple. The width of paper shall be 216 mm approximately. The Bidder shall provide as part of his scope of supply, consumables for up to six months operation.

Event printout of the shall contain as a minimum the following:

- Station identification.
- Date and time (in hour, minutes, seconds and milliseconds).
- Event number.
- Event description (at least 40 characters).

The auxiliary power supply required for the event logger, VDU and printer shall be either 220V DC or 110V DC (as available in the station) with voltage variation of + 10% to -20%. Any other power supply that may be required for proper functioning of the equipment has to be derived by the Bidder from his own equipment which shall form an integral part of the event logger station.

Bidder shall supply VDU, printer and keyboard arrangement.

At existing substations where an event logger is provided, Bidder shall provide necessary potential free contacts of various relays/equipment for plant and alarm states and shall co-ordinate with existing event logger for proper logging of events. A combined solution of disturbance recorder and event logger function with a VDU, key board and a printer is also acceptable.

## **9.0 Synchronising equipment**

Where required synchronising equipment shall be provided along with this Contract.

The synchronising instruments shall be mounted on a synchronising trolley. The trolley shall be equipped with double voltmeter, double frequency meter, synchroscope and lamps fully wired. The trolley shall be of mobile type with four rubber padding wheels capable of rotating in 360 degree around the vertical axis. Suitable bumpers with rubber padding shall be provided around the trolley to prevent any accidental damage to any panel in the control room while the trolley is in movement.

The trolley shall have two metre long flexible cord fully wired to the instruments and terminated in a plug in order to facilitate connecting the trolley to any of the panels. The receptacle to accept the plug shall be provided on the panel.

Synchronising check relay with necessary ancillary equipment shall be provided. This shall permit breakers to close after checking the requirements of synchronising of incoming and running supply. The phase angle setting shall not exceed 35 degree and have voltage difference setting not exceeding 10%. This relay shall have a response time of less than 200 milliseconds when the two system conditions are met within present limits and with the timer disconnected. The relay shall have a frequency difference setting not exceeding 0.45% at rated value and at the minimum time setting. The relay shall have a continuously adjustable time setting range of 0.5-3 seconds. A guard relay shall be provided to prevent a closing attempt by means of synchronising check relay when control switch is kept in closed position before the two systems are in synchronism.

Suitable auxiliary voltage transformers, wherever necessary, shall also be provided for synchronising condition. In case the synchroscope is not continuously rated, a synchroscope cut-off switch shall be provided and an indicating lamp to indicate that the synchroscope is energised, shall also be provided. Each circuit for which a synchronous closure is required shall be provided with a lockable synchronising selector switch which shall be used to select the voltage signals (incoming and running voltage) appropriate for that circuit. The provision of a key interlock shall ensure that at any one time only one feeder / transformer can be synchronised.

## **10.0 Time synchronisation equipment for substation**

The Bidder shall offer necessary time synchronisation equipment complete in all respects including antenna, all cables, processing equipment etc. required to receive co-ordinated universal time (UTC), transmitted through GEO Positioning Satellite System (GPS).

The time synchronising system should be compatible for synchronisation with event loggers, disturbance recorders, relays, computer systems and all other equipment provided in the protection, control and metering system of the substation wherever required. Equipment should operate up to an ambient temperature of 50C and 100% humidity. The synchronisation equipment shall have two microsecond accuracy. Equipment should give real time corresponding to IST (taking into consideration all factors such as voltage and temperature variations, propagation and processing delays etc.

Equipment should meet the requirement of IEC 255 for storage and operation. The system should be able to track the satellites to ensure no interruption of synchronisation signal.

The output signal from each port shall be programmable at site for either one hour, half hour, minute or second pulse, as per requirement.

The equipment offered shall have six output ports. Various combinations of output ports shall be selected by the Project Manager, during detailed engineering, from the following:

1. Voltage signal : 0-5V continuously settable, with 50 ms. minimum pulse duration.
2. Potential free contact : minimum pulse duration of 50 ms
3. IRIG-B & SNTP
4. RS232C

The equipment should have a periodic time correction facility of one second periodicity. Time synchronisation equipment shall be suitable for operation from 220V DC as available at substation with a voltage variation of +10% and -20%. Any other power supply that may be required for proper functioning of the equipment shall be derived by the Bidder from his own equipment which shall form an integral part of the system.

Equipment shall have real time digital display in hour, minute, second (24 hour mode) and have a separate time display unit to be mounted on the top of control panels having display size of approximately 100 mm height.

Bidder shall quote unit rates for each type of output port for the purpose of addition/deletion. Schedule of Quantities

### 11.0 General

Protection, control, metering panels and associated equipment to be located in switchyard control rooms at various substations shall be offered as panels/systems/modules of following description. The quantities are given at the end of this section.

Sl. No.	Description of Panels	Control Panel type and designation	Relay Panels type and designation
1	Line protection panel:		
1.1	400kV line-4CT,5CT ( 1 1/2 breaker scheme)	CPF4H	RPF4H
1.2	220kV line-DMT	CPF2D	RPF2D
1.3	132kV line—MT	CPF1M	RPF1M
1.4	33kV line—MT	CPF0M	RPF0M
2	Transformer protection panel:		
2.1	400/220kV Auto-Transformer	CPH4H	RPH4H
		CPL2D	RPL2D
2.2	220/132kV Auto-Transformer	CPH2D	RPH2D
		CPL1M	RPL1M
2.3	220/33kV power Transformer	CPH2D	RPH2D
		CPL0M	RPL0M
2.4	132/33kV power Transformer	CPH1M	RPH1M
		CPL0M	RPL0M
3	Reactor protection panel:		
3.1	Bus reactor	CPR4H	RPR4H
3.2	Line reactor	CPS4H	RPS4H
4.1	Transfer bus coupler		
	220kV line-DMT	CPT2D	RPT2D
	220kV line-T	CPT2T	RPT2T

4.2	Bus coupler		
	220kV line—DMT	CPB2D	RPB2D
	132kV line—MT	CPB1M	RPB1M
	33kV line—MT	CPB0M	RPB0M
4.5	Bus sectionaliser	CPZ2D	RPZ2D

**11.1 Type designations for the various panels**

The panels are designated by an alpha-numeric code consisting of five characters (AAANA) throughout this schedule in this specification to represent their use for various applications. Their representation shall be as here under:

Character position	1	2	3	4	5
Character representation	A	A	N	A	A

- H 1<sup>1/2</sup> breaker scheme
- D Double main and transfer switching scheme
- M Main and transfer switching scheme
- S Single bus
- T Two mains bus switching
  
- R Ring main bus switching scheme
- 0 33kV
- 1 132kV
- 2 220kV
- 4 400kV
- F Feeder
- H Transformer High Voltage Side
- L Transformer Low Voltage Side
- R Bus reactor
- S Shunt(line) reactor
- T Transfer bus coupler
- B Bus coupler and Bus bar
- Z Bus sectionaliser
- C Capacitor bank protection
- V Bus bar
- M Diameter with Transformer and Feeder
- N Diameter with Feeder and Feeder
- O Diameter with Feeder and Feeder
- P 1/2 Diameter with Single Feeder
- Q 1/2 Diameter with Single Feeder with Reactor
  
- CP Control panel
- RP Relay panel
- KP Common panel

**11.2 Bill of quantities for individual panels**

Each panel described above shall constitute the equipment as detailed here under . The quantities of each type of equipment are minimum. The bidder may include additional devices in the panels depending upon the design and requirements as per stipulations of the specification.

### Control panel (CPANA)

		CPA4H / CPA2H	CPA2D /CPA1M /CPA2T	CPA1M /CPA0S /CPA0T
Sl. no	List of equipment	Quantities required for each panel		
		For 400kV / 220kV and 1 1/2 breaker scheme	For 220kV and 132kV	For 33kV
1.	Ammeter (Digital)	3 Nos. for each bay (1 for each bay in case of 220 kV ) + 1No. for reactor ( as per requirement)	1No. (2 Nos. for Bus section coupler)	1No.
2.	Wattmeter (Digital)	1 No. for each bay	1 No. (2 Nos. for Bus section coupler)	1 No.
3.	VARmeter (Digital)	1 No. for each bay + 1 No. for line reactor ( as per requirement)	1 No. (2 Nos. for Bus section coupler)	1 No.
4.	Voltmeter (Digital)	1 No. for each bay	1 No. for each bay	1 No. (only in bus coupler panel)
5.	Digital voltmeter with selector switch	1 set for new substation in any one specific control panel	1 set for new substation in bus coupler panel	Not required
6.	Digital frequency meter	1 set in any one specific control panel	1 set in bus coupler panel	1 set in bus coupler panel
7.	Solid state trivector type energy meter for recording export, import of MWH, MVA and MVARH with MDI.	NOT REQD	NOT REQD	NOT REQD
8.	Winding temperature indicator	Not required	Not required	Not required
9.	Discrepancy control switch for breaker	1No. for each circuit breaker	1No. for each circuit breaker	1 No. for each circuit breaker

10.	Discrepancy control for isolator	1No. for each isolator	1No. for each isolator	1No. for each isolator
11.	Discrepancy control for earth switch	one for each earth switch	one for each earth switch	one for each earth switch
12.	Mimic to represent SLD	one for each panel	one for each panel	one for each panel
13.	Ammeter selector switch	one for line reactor (as per requirement)	one for each panel	one for each panel
14.	Voltage selector switch	one for each bay	one for each bay	one for each volt meter ( only in buscoupler Bay)
15.	DC source selector switch	one for each panel	one for each panel	one for each panel
16.	Indicating lamps			
16.1.	Red indicating lamps for ON	one for each isolator, earth switch and circuit breaker	one for each isolator, earth switch and circuit breaker	one for each isolator, earth switch and circuit breaker
16.2.	Green indicating lamps for OFF	one for each isolator, earth switch and circuit breaker	one for each isolator, earth switch and circuit breaker	one for each isolator, earth switch and circuit breaker
16.3.	White indicating lamp for circuit breaker healthy	one for each circuit breaker	one for each circuit breaker	one for each circuit breaker
16.4.	Indicating bulb for circuit breaker control position (Local/Remote) (If required)	two for each circuit breaker	two for each circuit breaker	two for each circuit breaker
16.5.	Blue indicating lamp (for spring charge )	one for each circuit breaker	one for each circuit breaker	one for each circuit breaker
16.6.	for annutiation D.C. fail	one in any one specific control panel	one in bus coupler pannel	one in buscoupler pannel
16.7.	for Annunciation A.C. fail	one in any one specific control panel	one in buscoupler pannel	one in buscoupler pannel
16.8.	for flasher healthy	one in any one specific control panel	one in buscoupler pannel	one in buscoupler pannel
16.9.	for Busbar VT secondary healthy	three for each bus in any one specific control panel	three for each bus in buscoupler pannel	three for each bus in buscoupler pannel
17.	Push buttons			
17.5.	for alarm accept	one for each panel	one for each panel	one for each panel
17.6.	for alarm reset	one for each panel	one for each panel	one for each panel

17.7.	for lamp test	one for each panel	one for each panel	one for each panel
17.8.	for audio alarm reset	one in any one specific control panel	one in buscoupler pannel	one in buscoupler panel
17.9.	for annunciation D.C. fail accept	one in any one specific control panel	one in buscoupler pannel	one in buscoupler panel
17.10.	for annunciation D.C. fail test	one in any one specific control panel	one in buscoupler pannel	one in buscoupler panel
17.11.	for annunciation A.C. fail accept	one in any one specific control panel	one in buscoupler pannel	one in buscoupler panel
17.12.	for annunciation A.C. fail test	one in any one specific control panel	one in buscoupler pannel	one in buscoupler panel
18.	Annunciation windows with necessary annunciation relays	24 for each feeders bay 24 for each treansformer bay 24 for each Tie	24 for each feeders panel 24 for each transformer panel 24 for each Tie and each bus coupler panel	18 for each feeders panel 18 for each transformer panel 18 for each bus coupler panel
19.	Synchronising socket	one for each circuit breaker	one for each circuit breaker	Not required
20.	Bus CVT selector switch (as per requirment)	one for each panel	one for each panel	one for each panel
21.	Protection trip transfer switch (TTS)	not required	one for each panel	one for each panel
22.	Reactor de-interlocking push button	one for each circuit breaker bay (where applicale)	not required	not required
23.	Hooter	one for each new sub-station	one for each new sub-station	one for each new sub-station
24.	Buzzer	one for each new sub-station	one for each new sub-station	one for each new sub-station

### 11.3 Line protection panel (RPLNA)

The line protection panel or panels may be a single panel or more panels to accommodate all the equipments listed below. However, for bay extension, new panels must match the existing panels in all respect.

Sl. No	Equipment	Quantities required			
		400kV RPL3H	220kV RPL2A	132kV RPL1A	33kV RPL0A



1	Main-I protection scheme (composite numerical distance protection relay with auto reclosing and check synchronising facility)	1 set	1 set	1 set	Not required
2	Main-II protection scheme(composite numerical distance protection or phase comparison relay with auto reclosing and check synchronising facility)	1 set	1 set	Not required	Not required
3	Composite numerical directional & or nondirectional over current and earth fault relay.(selectable Features Dir & Non Dir)	1 set	1 set	1 set	1 set
4	Over voltage/ Under voltage protection scheme (if not available in the main-I& II protection module)	1 set	1 set	1 set	Not required
5	Selector switch for carrier in/out for main-I and main-II protection scheme	2 Nos.	2 Nos.	1No.	Not required
7	Disturbance recorder (if not available in the distance protection or main protection module)	1 set	1 set	1 set	Not required
8	Distant-to-fault locator for phase and earth faults(if not available in the distance protection or main protection module)	1 set	1 set	1 set	Not required
9	CVT selecting relays or switches (depending on switching scheme)	1 set	1set	1set	Not required
10	Test terminal blocks for Main-I/ Main II/other protection relay	1 set for each module	1 set for each module	1 set for each module	1 set for each module
11	Auxiliary relays for carrier supervision of Main-I and Main II protection relays (depending on its application)	1 set	1 set	1 set	Not required
12	Carrier receive lockout relay (depending on its application)	1 set	1 set	1 set	Not required
13	Breaker failure protection scheme	1 set	1 set	1 set	1 set
14	Trip circuit pre and post supervision relays for trip coil I and II	1 set	1 set	1 set	1 set
15	DC supply supervision relay	1 set	1 set	1 set	1 set
16	Flag relays for circuit breaker trouble shooting	1 set	1 set	1 set	1 set
17	Trip relays single/three phase for group-A	1 set	1 set	1 set	1 set
18	Trip relays single/three phase for group-B	1 set	1 set	1 set	1 set
19	Trip relays single/three phase for LBB	1 set	1 set	1 set	1 set
20	Under Frequency Relay(in built feature of O/C & E/F relay)	1 set	1 set	1 set	1 set

#### 11.4 Transformer protection panel(RPHNA and RPLNA)

The transformer protection panel or panels may be a single panel or more panels to accommodate all the equipments listed below. However, for bay extension, new panels must match the existing panels in all respect.

	<b>Quantities required</b>
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Sl. No	Equipment	For each High Voltage panel of 400/220kV and 220/132kV transformers	For each High Voltage panel of 220/33kV and 132/33kV transformers	For each Low Voltage Panel of transformers
1	Main-I Transformer composite numerical protection comprising of the following: <ul style="list-style-type: none"> <li>Differential protection</li> <li>Restricted earth fault protection</li> <li>Over fluxing protection</li> </ul>	1 set	1 set	Not required
2	Main-II Duplicated numerical protection as Main-I	1 set	Not required	Not required
3	Composite numerical directional over current and earth fault protection relay(selectable Features Dir & Non Dir)	1 set	1 set	1 set
	Restricted earth fault protection (Electromechanical of high impedance with Stabilising resistor & metrosil)	1 set	1 set	1 set
4	Over load protection ( if not included in sl.no. 1 and 2 above)	1 set	1 set	1 set
5	Over voltage/ Under voltage protection scheme (if not available in the main protection module)	1 set	1 set	Not required
6	Flag relays for thermal imaging, MOG, WTI, OTI, Bucholz, PRV,OSR and status indication etc.. (1.MOG-A1,2.WTI,BUCH,OTI – AI & Trip,3. PRV,OSR – Trip)	1 set	1 set	Not required
7	Solid state trivector type energy meters for measurement of export/ import of MWH, MVA and MVARH with MDI.	1 set	1 set	1 set
8	CVT/PT selection relays (depending upon the the switching scheme of the system)	1 set	1 set	1 set
9	Breaker failure protection scheme	1 set	1 set	1 set
10	Trip circuit pre and post supervision relays for trip coil I and II.	1 set	1 set	1 set
11	DC supply supervision relay	1 No for each panel	1 set	1 set
12	Flag relays for circuit breaker trouble shooting	1 set	1 set	1 set
13	Trip relays three phase for group-A	1 set	1 set	1 set
14	Trip relays three phase for group-B	1 set	1 set	1 set
15	Test terminal blocks for all protection relays	1 set for each module	1 set for each module	1 set for each module

**11.5 Transfer bus coupler (RPT2D) / Bus coupler and Busbar (RPBNA) protection panel** Bus bar protection panel shall be equipped to accommodate all present and future bays.

Sl. No	Equipment	Quantities required			
		RPB4H	RPB2A	RPB1A/ RPB0A	RPT2D
1.	Composite numerical Directional Over current and earth fault protection (selectable Features Dir & Non Dir)	1 set	1 set	1 set	1 set
2.	Test terminal block for all protection relays	1 set for each module	1 set for each module	1 set for each module	1 set for each module
3.	Trip circuit pre and post supervision relays for trip coil I and II	Not required	1 set	1 set	1 set
4.	DC supply supervision relay	Not required	1 set	1 set	1 set
5.	Flag relays for circuit breaker trouble and status indication etc.	Not required	1 set	1 set	1 set
6.	Breaker failure protection scheme	Not required	1 set	1 set	1 set
7.	Trip relays single/three phase for group-A	Not required	1 set	1 set	1 set
8.	Trip relays single/three phase for group-B	Not required	1 set	1 set	1 set
9.	Bus bar differential relay for Bus-I	1 set	1 set	Not required	Not required
10.	Bus bar differential relay for Bus-II	1 set	1 set	Not required	Not required
11.	CT switching/selection relays(if required)	1 set	1 set	Not required	Not required
12.	Bus bar differential relay for Check Zone	1set	1set	Not required	Not required

At existing substations, necessary trip relays and auxiliary relays required shall be included in the offer to accommodate the new bays for existing bus bar protection schemes.

**11.6 Common equipment (RPKNA)**

Sl. No	Equipment	Quantities required
1.	Bus-I voltage recorder	1 No.
2.	Bus-II voltage recorder	1 No.
3.	Bus-I frequency recorder	1 No.
4.	Bus-II frequency recorder	1 No.

5.	Bus-I & Bus-II Digital Volt meter	1 Set
6.	Bus-I & Bus-II Digital Frequency meter	1 Set
7.	Event logger(Separate panel)	1 No.

### 11.7 Bus sectionalizer protection panel

Sl. No	Equipment	Quantities required
1.	Composite numerical directional Over current and earth fault protection relay(selectable Features Dir & Non Dir)	2 sets
2.	Test terminal block for all protection relays	1 set
3.	Trip circuit pre and post supervision relay for trip coil I and II	2 No
4.	DC supply supervision relay	1 No
5.	Flag relays for circuit breaker trouble and status indication etc.	2 No
6.	Breaker failure protection scheme	2 set
7.	Trip relays three phase for group-A	2 set
8.	Trip relays three phase for group-B	2 set
9.	Bus bar differential relay for Bus-I (numerical type- IEC -61850)	1 set
10.	Bus bar differential relay for Bus-II (numerical type- IEC -61850)	1 set
11.	CT switching/selection relays	1 set
12.	Bus bar differential relay for Check Zone (numerical type- IEC -61850)	1set

### 11.8 Synchronising panel

Synchronisation panels are required for new substations and addition of new voltage ( 132kV and above) to existing substation.

Sl. No	Equipment	Quantities required
1	Double Voltmeter (0-150v range)	1 no for each panel
2	Double Frequency meter (45-55Hz)	1 no for each panel
3	Synchroscope	1 no for each panel
4	Synchronizing relay	1 set for each panel

**\*\* ALL THE RELAYS SHALL BE OF NUMERICAL VERSION HAVING IEC 61850 PROTOCOL COMPLIANCE.ALL CARE SHALL BE TAKEN IN DESIGNING THE PROTECTION SYSTEM FOR FUTURE SCADA PROVISION. THERE SHALL BE ADEQUATE NO OF INPUT AND OUT PUT CONTACTS FOR USE. SHALL HAVE SELF SUPERVISING AND INTERNAL FAULT**

**DETECTING/DIAGNOSING FACILITY. SUFFICIENT FAULT /DISTURBANCE RECORDING FACILITIES.**

**12.0 ERECTION AND MAINTENANCE TOOL EQUIPMENT:**

All special testing equipment required for the installation and maintenance of the apparatus, instruments devices shall be furnished. The testing plug shall be supplied along with the panels for conducting testing of relays. These testing plug should be suitable for test terminal box provided in the panel.

**12.1 TROPICALISATION:**

Control room will be normally air-conditioned. All equipments shall however be suitable for installation in a tropical monsoon area having hot, humid climate and dry and dusty seasons with ambient conditions specified in the specification. All control wiring, equipment and accessories shall be protected against fungus growth, condensation, vermin and other harmful effects due to tropical environment.

**12.2 RELAY TEST KIT**

One relay test kit shall comprise of the following equipment as detailed hereunder.

1. Relay tools kits: 3 Sets
2. Test plugs: 2 Nos
3. Special type test plugs for using with modular type cases(if applicable): 1 No

**13.0 ADDITIONAL INFORMATION ON SWITCHES ETC.**

**13.1 SWITCHES:**

1. 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 flush mounting with only switch front plate and operating handle projecting out.
2. The selection of operating handles for the different types of switches shall be as follows.

<u>Purpose</u>	<u>Type</u>
Breaker, Isolator control switches	Discrepancy type
Synchronizing switches	Oval, Black, keyed handle (having common key for a group of switches)
Synchronizing selector switch	Oval or knob, black
Instrument switches	Round, knurled, black
Protection transfer switch	Pistol grip, lockable & black

\*\* In case the rotary switches are provided for breaker and isolator control Semaphores are also to be provided along with the switches.

3. 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 position to —after close| and —after tripl| position respectively.
4. 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 switch for AC shall be suitable for reading all line to line and line to neutral voltage for non effectively earthed systems and for reading all line to line voltages for effectively earthed systems.
5. Synchronising switches shall be of maintained contact (stay put) type having a common removable handle for a group of switches. The handle shall be removable only in the off position and it shall be coordinated to fit into all the synchronizing switches. These shall be arranged to connect the synchronizing equipment when turned to the —on| position. One contact of each switch shall be

connected in the closing circuit of the respective breaker so that the breaker cannot be closed until the switch is turned to the ON position.

6. Lockable type switches which can be locked in particular position shall be provided when specified. The key locks shall be fitted on the operating handles.
7. The contacts of all the switches shall preferably open and close with snap action to minimizing the arcing. Contacts of switches shall be spring assisted and contact faces shall be with rivets of pure silver or silver alloy Springs shall not be used as current carrying parts.
8. The contact combination and their operation shall be such as to give completeness to the interlock and function of the scheme.
9. The contact rating of the switches shall be as follows.

Description	Contact Rating In Amperes		
	220 V DC	50 V DC	230 V AC
Make & carry continuously	10	10	10
Make & carry for 0.5 sec	30	30	30
Break for			
i) Resistive load	3	20	7
ii) Inductive load (L/R=40ms)	0.2	-	-

### 13.2 INDICATING INSTRUMENTS, RECORDERS & TRANSDUCERS:

All instruments, meters, recorders and transducers shall be enclosed in dust proof, moisture resistant, black finished cases and shall be suitable for tropical use. All megawatt, megavar, bus voltage and frequency indicating instruments shall be provided with individual transducers and these shall be calibrated along with the transducers to read directly the primary quantities. They shall be accurately adjusted and calibrated at works and shall have means of calibration check and adjustment at site. The supplier shall submit calibration certificates at the time of delivery. However no separate transducers are envisaged for digital bus voltmeters and digital frequency meters and the indicating meters provided in the synchronizing equipment.

#### 13.2.1 Indicating Instruments:

1. All electrical indicating instruments shall be of digital type suitable for flush mounting.
2. Shall have 4 digit display, display height being not less than 25mm.
3. Shall conform to relevant IS and shall have an accuracy class 1.5 and or better watt and Var meters shall have an indication of (+) and (-) to indicate Export and Import respectively.
4. Digital voltage and frequency meters shall be of 0.5 class and shall have digital display of 5 and 4 digits respectively, with display size not less than 25mm height.

#### 13.14.2 Bus voltage & Frequency recording instruments:

1. Shall be static/digital type frequency and voltage recorder either as individual units or composite unit for total sub-station with time tagged information shall also be applicable if it meets the accuracy of  $\pm 1.0\%$  span and full span response time of less than 2 seconds. The static/digital shall also meet the high voltage susceptibility test, impulse voltage with stand test, high frequency disturbance test-class III and fast transient disturbance test level III as per IEC -60255.

#### 13.2.3 Transducers:

1. Transducers shall in general conform to IEC-688-1
2. Shall be suitable for measurement of active power, reactive power, voltage, current and frequency in three phase four wire unbalanced system.
3. Transducers shall have input from sub-station current and voltage from the instrument transformers. The output shall be in miliampere D.C proportional to the input and shall feed the output current to the indicating instruments /telemetry terminals.
4. Characteristic shall be linier throughout the measuring range.
5. Output shall be load independent.
6. Input and output shall be galvanically isolated.

7. Transducers should work satisfactorily at 120% of rated value continuously.
8. Shall have 4-20mAmp.
9. Response time shall be less than 1 sec.
10. Accuracy class shall be 1 or better voltage/current, 0.5 or better for watt/var and 0.2 or better for frequency transducers.
11. Shall have a low AC ripple on output less than 1%.
12. Shall be suitable for load resistance of 1000 – 1500.
13. Shall have dual output.

### Test programme for distance relays

**General Comments:**

1. These test cases are evolved from the report of working group 04 of study committee 34 (Protection) on evaluation of characteristics and performance of power system protection relays and protective systems. For any further guidelines required for carrying out the tests, reference may be made to the above document.
2. The test shall be carried out using network configuration and system parameters as shown in the figure-1
3. All denotations regarding fault location, breakers etc are referred in figure –1
4. The fault inception angles are referred to R- N voltage for all types of faults
5. The fault inception angle is zero degree unless otherwise specified
6. Where not stated specifically, the fault resistance (Rf) shall be zero or minimum as possible in simulator
7. Single pole circuit breakers are to be used
8. The power flow in double source test is 500 MW

**System Parameters** System voltage =400KV; CTR= 1000/1

PTR = 400000/110 (with CVT, the parameters of CVT model are shown in figure –2)

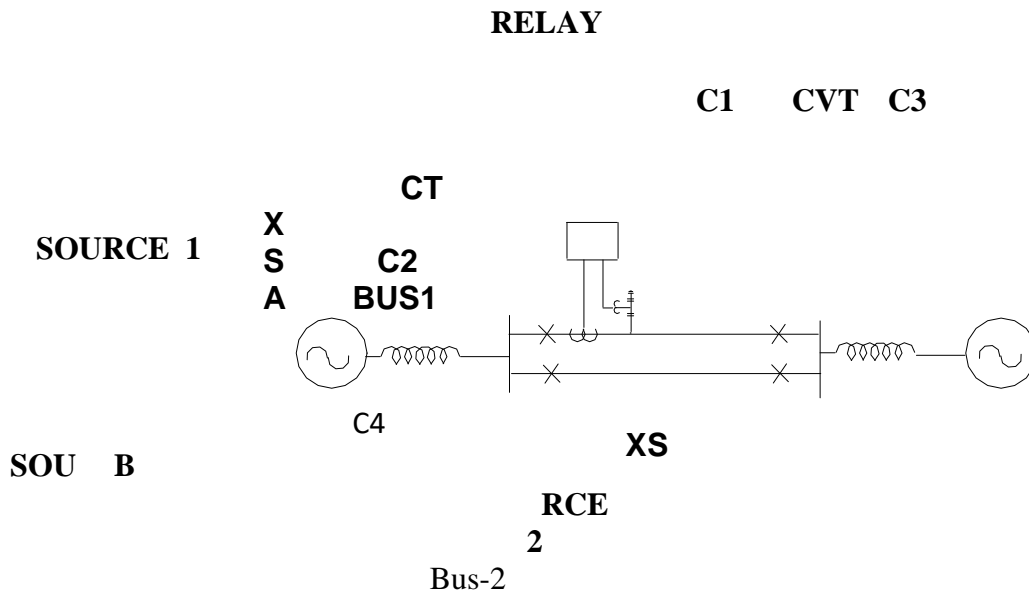


Figure-1

**Line parameters/km**

Positive Sequence Resistance, (r1) = 0.02897  $\Omega$   
 Positive Sequence Reactance (x1) = 0.3072  $\Omega$  Zero Sequence  
 Resistance (r0) = 0.2597  $\Omega$  Zero Sequence  
 Reactance (x1) = 1.0223  $\Omega$  Zero Sequence  
 Mutual Resistance (rm) = 0.2281  $\Omega$  Zero Sequence  
 Mutual Reactance (xm) = 0.6221  $\Omega$  Zero Sequence  
 susceptance (bo) = 2.347  $\mu$  mho Positive  
 Sequence susceptance (b1) = 3.630  $\mu$ mho

Types of Line	Short		Long
Secondary Line Impedance	2 $\Omega$		20 $\Omega$ *
Length of Line in Km	23.57		235.7
SIR	4	15	4
Source impedance (pry) (at a time constant of 50 ms)	29.09 $\Omega$ (5500 MVA)	109.09 $\Omega$ (1467 MVA)	290.9 $\Omega$ (550 MVA)

\* Alternatively , the tests can be done with 10  $\Omega$  secondary impedance and source impedance may accordingly be modified.



**CVT Model:**

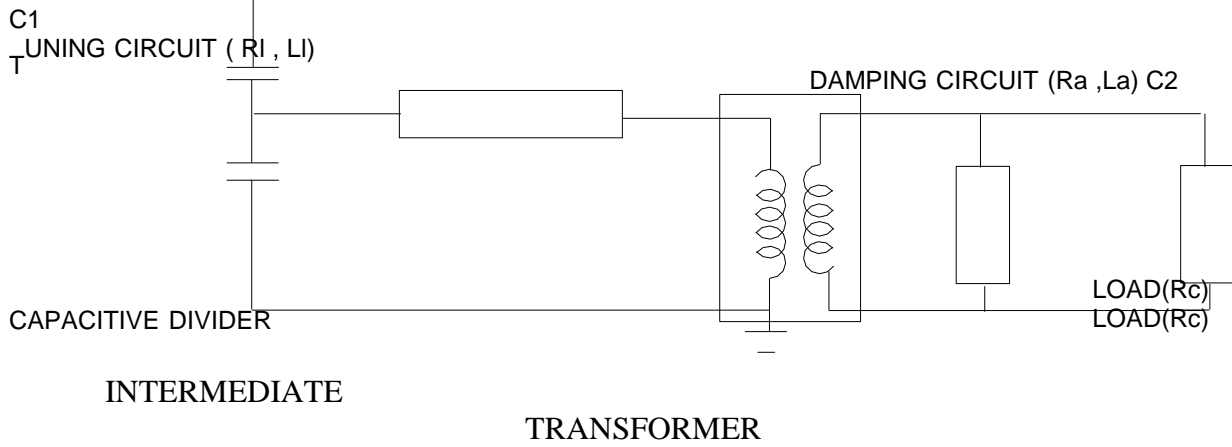


Figure-2

XC1 : 1.455  $\mu$  mho, XC2 : 27.646  $\mu$  mho R<sub>l</sub> : 320  $\Omega$  , X<sub>ll</sub> : 34243  $\Omega$  , R<sub>a</sub> : 4.200  $\Omega$  , X<sub>la</sub> : 197.92  $\Omega$ , R<sub>c</sub> : 14.00  $\Omega$  , Transformation ratio of : 181.8 Intermediate transformer.

## **PART – II**

### **PRICE BID**

#### **1. PRICE:**

- (i)** Bidders are required to quote their price(s) for goods offered indicating they are 'FIRM'
- (ii)** The prices quoted shall be FOR Destination only at the consignee's site/store inclusive of packing, forwarding, Freight & Insurance. In addition, the break-up of FOR Destination price shall be given as per schedule of Prices in Annexure-V of Section – III. The Bidder has to certify in the price bid that benefit of Input Tax Credit, Lower Implication of Tax if any, has been fully passed on to the Purchaser, while quoting the tender prices.

#### **2. INSURANCE :**

Insurance of materials/equipment, covered by the Specification should normally be done by the Suppliers with their own Insurance Company unless otherwise stated. The responsibility of delivery of the materials/equipment at destination stores/site in good condition rests with the Supplier. Any claim with the Insurance Company or Transport agency arising due to loss or damage in transit has to be settled by the Supplier. The Supplier shall undertake free replacement of equipment/materials damaged or lost which will be reported by the Consignee within 30 days of receipt of the equipments/materials at Destination without awaiting for the settlement of their claims with the carriers and underwriters.

#### **3. CERTIFICATE FOR EXEMPTION FROM GOODS AND SERVICES TAX:**

Offers with exemption from Goods and Services Tax shall be accompanied with authenticated proof of such exemption. Authenticated proof for this clause shall mean Photostat copy of exemption certificates, attested by Gazetted Officers of State or Central Government.

#### **4. PROPER FILLING UP OF THE PRICE SCHEDULE:**

- (i)** In case where Freight & Insurance charges are not furnished, 5% of the Ex-works price shall be considered as the freight & Insurance charges.
- (ii)** The Bidder should fill up the price schedule (Annexure-V of Section-III) properly and in full. The tender may be rejected if the schedule of **price is** submitted in incomplete form as per clause-34 (ix) of Section-II of the Specification.

#### **5. NATURE OF PRICE INDICATED IN SPECIFICATION SHALL BE FINAL.**

The nature of price indicated in the Clause-13, Section – I of PART –I of the Specification shall be final and binding.