Volume – I

Tender Notification for

SUPPLY OF VARIOUS RATINGS OF PACKAGE SUBSTATION IN BRPL

CMC/BR/23-24/RB/PR/RJ/1144

Due Date for Submission of Bids: 18.07.2023

BSES RAJDHANI POWER LTD (BRPL)
BSES Bhawan, Nehru Place, New Delhi-110019
Corporate Identification Number: U74899DL2001PLC111527
Telephone Number: +91 11 3009 9999
Fax Number: +91 11 2641 9833
Website: www.bsesdelhi.com

BSES
RAJDHANI POWER LIMITED

Section – I

REQUEST FOR QUOTATION

Tender Notification: CMC/BR/23-24/RB/PR/RJ/1144

Supply Of Various Ratings of Package Substation In BRPL

INDEX

BSES
RAJDHANI POWER LIMITED

SECTION – I: REQUEST FOR QUOTATION

1.0 Event Information

1.01 BRPL invites sealed tenders for supply of various ratings of Package Substation from the manufacturers. The bidder must qualify the technical requirements as specified in clause 2.0 stated below. The sealed envelopes shall be duly super scribed as — **"BID FOR SUPPLY OF VARIOUS RATINGS OF PACKAGE SUBSTATION FOR VARIOUS SITES OF BRPL ,TENDER NOTICE CMC/BR/23-24/RB/PR/RJ/1144 DUE FOR SUBMISSION ON DT. 18.07.2023"**.

Sl. No.	Item Description	Specification	Requirement	Estimated Cost
			Total Qty.	
BRPL, DELHI				
1	Various Ratings of Package Substation for Various Sites in BRPL	SECTION V	22 Nos	7.00 Cr

Note: Quantity may vary to any extent of +/- 30% of above mentioned total quantity.

1.02 The schedule of specifications with detail terms & conditions can be obtained from address given below against demand draft/Pay Order of **Rs.1180/- with GST**-, drawn in favour of **BSES RAJDHANI POWER LTD**, payable at New Delhi. The sale of tender documents will be issued from **27.06.2023** onwards on all working days upto **18.07.2023**. The tender documents can also be downloaded from the website "**www.bsesdelhi.com**".

In case tender papers are downloaded from the above website, then the bidder has to enclose a demand draft covering the cost of bid documents as stated above in a separate envelope with suitable superscription —"Cost of Bid Documents: Tender **Notice Ref: CMC/BR/23-24/RB/PR/RJ/1144"**.This envelope should accompany the Bid Documents.

1.03 Offers will be received upto **1530 Hrs. on dt. 18.07.2023** as indicated earlier and will be opened at the address given below dt. **18.07.2023 at 1600 Hrs.** in the presence of authorized representatives of the bidders. The schedule of specifications with detail terms & conditions are enclosed. It is the sole responsibility of the bidder to ensure that the bid documents reach this office on or before the due date.

HEAD OF THE DEPARTMENT, 1st FLOOR, 'C' BLOCK,
CONTRACTS & MATERIALS DEPARTMENT, BSES RAJDHANI POWER LTD,
BSES BHAWAN,
NEHRU PLACE, NEW DELHI-110019.

1.04 BRPL reserves the right to accept/ reject any or all Tenders without assigning any reason thereof and alter the quantity of materials mentioned in the Tender documents at the time of placing purchase orders. Tender will be summarily rejected if:

i) Earnest Money Deposit (EMD) @ 1% (One percent) of the Tender value i.e. **Rs. 7,00,000/-** is not deposited in shape of Bank Draft in favour of BSES RAJDHANI POWER LTD, payable at New Delhi or Bank Guarantee executed on favour of BSES RAJDHANI POWER LTD.

ii) The offer does not contain "FOR, NEW DELHI price indicating break-up towards all taxes & duties".

iii) Complete Technical details are not enclosed.

iv) Tender is received after due time due to any reason.

1.05 BRPL reserves the right to reject any or all bids or cancel/ withdraw the invitation for bids without assigning any reason whatsoever and in such case no bidder/ intending bidder shall have any claim arising out of such action time of placing purchase orders.

2.0 Qualification Criteria:-

The prospective bidder must qualify all of the following requirements to be eligible to participate in the bidding. Bidders who meet following requirements will be considered as successful bidder and management has a right to disqualify those bidders who do not meet these requirements.

1) The bidder should have own manufacturing facility in India for PSS of similar rating or higher since last 3 years. *Manufacturing and factory incorporation certificate/undertaking are submitted by bidder. The details of manufacturing units, locations and works from where supply against this tender shall be proposed to be furnished.*

2) The Bidder should have successfully supplied/ Executed at least 30 nos of 250 kVA Package Substation or higher ratings to any major Utilities/SEB's/other reputed firm in last 7 years from the date of bid opening *.i. Summary list of executed Purchase orders ii. Purchase order copies iii. Material delivery clearance certificate copy or delivery completion certificates or invoice copies.*

3) Performance certificate for minimum 2 year satisfactory performance for PSS of similar rating or higher ratings supplied in last 7 years from the date of bid opening from at least two utilities/ SEB's/ PSU's/ Govt. organization/other reputed firm.
In case of bidder has a previous association with BRPL/BYPL for similar product and service, the performance feedback for that bidder by BRPL/BYPL shall only be considered irrespective of performance certificate issued by any third organization. *Performance Certificate*

4) The bidder should have servicing, repairing, testing & refurbishment facility in INDIA with necessary spares and testing equipments for providing prompt after sales service for Package Substation. *Relevant Details/certificates/Undertaking. Details of the set-up*

available shall be brought out in the offer. The bidder shall submit undertaking along with the bid confirming the infrastructure details submitted.

5) The bidder should have plant installed capacity to supply of minimum 8 nos of PSS per month, The bidder shall submit undertaking along with the bid confirming compliance to qualifying criteria for bidder.- *Installed Capacity Certificate.*

6) Supplier must be the OEM of 11KV RMU or Transformer – *Documentary proof required*

   Or
   They can take equipment (11 kV RMU& Dry Type Transformer & ACB) from BRPL approved make mentioned in technical specification

7) The Bidder must posses valid ISO 9001:2015 certification- *Valid copy of Certification*

8) Bidder should have Average Annual Sales Turnover of Rs 10 Crores or more in last 3 financial Years *Balance Sheet /CA Certificate to be submit*

9) The Bidder shall submit an undertaking "No Litigation" is pending with the BRPL or its Group/Associates Companies as on date of bid opening.- *Undertaking*

10) An undertaking (self-certificate) that the bidder has not been blacklisted/debarred by any central/state government institution including electricity utilities as on date of bid opening. – *Undertaking*

11) The bidder must have valid PAN No., GST Registration Number, in addition to other statutory compliances. The bidder must submit the copy of registrations and submit an undertaking that the bidder shall comply all the statuary compliances as per the laws/rules etc. before the start of the work- *Relevant Statutory Documents Copy/Undertaking*

3.0 Bidding and Award Process

Bidders are requested to submit their questions regarding the RFQ or the bidding process after review of this RFQ. BRPL response to the questions raised by various bidders will be distributed to all participating bidders through website.

a. Time schedule of the bidding process

The bidders on this RFQ package should complete the following within the dates specified as under:

S.No.	Steps	Activity description	Due date
1	Technical Queries	All Queries related to RFQ	On or before

			10.07.2023 1500 Hrs.
2	Technical Offer	Documentary evidence in support of qualifying criteria. Technical Literature/ GTP/ Drawings/ Type test report, if any, etc., Testing facilities, any other relevant document, acceptance to commercial terms & conditions viz. delivery Schedule/ Period, Payment terms, PBG etc. Quality assurance plan, Deviation from the specification, list of plant & machinery and testing equipments Un priced items.	18.07.2023, 1530 Hrs
3	Commercial Offer	Prices for Transformer and Break up regarding basic price and taxes. Delivery commitment	18.07.2023, 1530 Hrs
4	Opening of technical bid	As per RFQ	18.07.2023, 1600 Hrs

This is a two part bid process. Bidders are to submit the bids (a) Technical Bid (b) Price Bid. Both these parts should be furnished in separate sealed covers super scribing with specification no., validity etc, with particulars as **Part-I "Technical Particulars & Commercial Terms & Conditions"** and **Part-II "Financial bid"** and these sealed envelopes should again be placed in another sealed cover which shall be submitted before the due date & time specified.

Bidders are requested to submit the bid in one original plus one copy in duplicate.

- **The Part-I (Technical Bid) -** Technical Bid should not contain any cost information whatsoever. In case of Bids where the qualification requirements, technical suitability and other requirements are found to be inadequate, Part-II "Financial Bid" will be returned unopened.

- **The Part-II (Financial Bid) -** Qualified bidders will be intimated after technical evaluation of all the bids is completed. The date and time of same shall be intimated in due course to the qualified bidders. Notwithstanding anything stated above, the Purchaser reserves the right to assess bidder's capability to perform the contract, should the circumstances warrant such assessment in the overall interest of the purchaser. In this regard the decision of the purchaser is final.

4.0 Award Decision

Purchaser intends to award the business on a lowest bid basis, so suppliers are encouraged to bid competitively. The decision to place purchase order / letter of acceptance solely depends on purchaser on the cost competitiveness across multiple lots, quality, delivery and bidder's capacity, in addition to other factors that Purchaser may deem relevant.

The purchaser reserves all the rights to award the contract to one or more bidders so as to meet the delivery requirement or nullify the award decision without any reason.

BSES reserves the right to split the tender quantity amongst techno commercially qualified bidders on account of delivery requirement in tender, quantity under procurement etc.

Splitting of tender quantity amongst more than one bidder shall be governed by below mentioned guidelines:

- If the quantity is to be split among 2 bidders, it will be done in the ratio of 70:30 on L1 price.
- If the quantity is to be split among 3 bidders, it will be done in the ratio of 60:25:15 on L1 price.
- In case quantity needs to be distributed and order splitting is required, distribution of quantity shall be maximum among three (3) bidders.

In the event of your bid being selected by purchaser (and / or its affiliates) and your subsequent DEFAULT on your bid; you will be required to pay purchaser (and / or its affiliates) an amount equal to the difference in your bid and the next lowest bid on the quantity declared in RFQ.

In case any supplier is found unsatisfactory during the delivery process, the award will be cancelled and BRPL reserves the right to award other suppliers who are found fit.

Quantity Variation: The purchaser reserves the rights to vary the quantity by **+/- 30%** of the tender quantity.

Repeat Order: BRPL reserves the right to place repeat order at the same rates & terms and conditions as per this tender against additional requirement subject to mutual agreement between BRPL & supplier.

5.0 Market Integrity:

We have a fair and competitive marketplace. The rules for bidders are outlined in the Terms & Conditions. Bidders must agree to these rules prior to participating. In addition to other remedies available, we reserves the right to exclude a bidder from participating in future markets due to the bidder's violation of any of the rules or obligations contained in the Terms & Condition. Bidders who violate the marketplace rules or engage in behavior that disrupts the fair execution of the marketplace restricts a bidder to length of time, depending upon the seriousness of the violation. Examples of violations include, but are not limited to:

- Failure to honor prices submitted to the marketplace.
- Breach of the terms of the published in Request For Quotation.

6.0 Supplier Confidentiality

All information contained in this RFQ is confidential and may not be disclosed, published or advertised in any manner without written authorization from BRPL. This includes all bidding information submitted.

All RFQ documents remain the property of BRPL and all suppliers are required to return these documents to BRPL upon request.

Suppliers who do not honor these confidentiality provisions will be excluded from participating in future bidding events.

7.0 Contact Information

All communication as regards this RFQ shall be made (i) in English, (ii) in writing and (iii) sent by mail, facsimile to:

	Technical	Commercial
Contact Name	Mr. Amit Tomar Copy to Mr. Gopal Nariya	Ms Rachna Jain Copy to Mr. Pankaj Goyal
Address	BSES RAJDHANI POWER LTD, 2nd Floor, B Block, Nehru Place, New Delhi – 110019	C&M Deptt. 1st floor, D- Block, BSES Rajhdhani Power Limited, BSES Bhawan, Nehru Place, New Delhi -110019
Email-ID	amit.as.tomar@relianceada.com gopal.nariya@relianceada.com	rachna.jain@relianceada.com pankaj.goyal@relianceada.com

SECTION – II

INSTRUCTION TO BIDDERS (ITB)

SUPPLY OF VARIOUS RATINGS OF PACKAGE SUBSTATION IN BRPL

CMC/BR/23-24/RB/PR/RJ/1144

A. GENERAL

1.00 BSES Rajdhani power Ltd, hereinafter referred to as the Purchaser are desirous of implementing the various Systems Improvement/Repair & Maintenance works at their respective licensed area in Delhi. The Purchaser has now floated this tender for procurement of Package Substation as notified earlier in this bid document.

2.00 SCOPE OF WORK

The scope shall include Design, Manufacture, Testing at works conforming to the Technical Specifications enclosed along with Packing, Forwarding, Freight and Unloading and proper stacking at Purchaser's stores.

3.00 DISCLAIMER

3.01 This Document includes statements, which reflect various assumptions, which may or may not be correct. Each Bidder/ Bidding Consortium should conduct its own estimation and analysis and should check the accuracy, reliability and completeness of the information in this Document and obtain independent advice from appropriate sources in their own interest.

3.02 Neither Purchaser nor its employees will have any liability whatsoever to any Bidder or any other person under the law or contract, the principles of restitution or unjust enrichment or otherwise for any loss, expense or damage whatsoever which may arise from or be incurred or suffered in connection with anything contained in this Document, any matter deemed to form part of this Document, provision of Services and any other information supplied by or on behalf of Purchaser or its employees, or otherwise a rising in any way from the selection process for the Supply.

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

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

4.00 COST OF BIDDING

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

B BIDDING DOCUMENT

5.00 BIDDING DOCUMENTS

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

Volume –I

a)	Request for Quotation (RFQ)	- Section – I
b)	Instructions to Bidders (ITB)	- Section – II
c)	General Conditions of Contract	- Section - III
d)	Quantity and delivery requirement	- Section –IV
e)	Technical Specifications (TS)	- Section –V

Volume – II

a)	Bid Form	- Annexure – I
b)	Bid Format	- Annexure – II
c)	Price Schedule	- Annexure – III
d)	Commercial Terms & Conditions	- Annexure - IV
e)	No Deviation Sheet	- Annexure - V
f)	Qualification Criterion	- Annexure - VI

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

6.00 AMENDMENT OF BIDDING DOCUMENTS

6.01 At any time prior to the deadline for submission of Bids, the Purchaser may for any reasons, whether at its own initiative or in response to a clarification requested by a prospective Bidder, modify the Bidding Documents by Amendment.

6.02 The Amendment shall be part of the Bidding Documents, pursuant to Clause 5.01, and it will be notified in writing by Fax/e-mail to all the Bidders who have received the Bidding Documents and confirmed their participation to Bid, and will be binding on them.

6.03 In order to afford prospective Bidders reasonable time in which to take the Amendment into account in preparing their Bids, the Purchaser may, at its discretion, extend the deadline for the submission of Bids.

C PREPARATION OF BIDS

7.00 LANGUAGE OF BID

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

8.00 DOCUMENTS COMPRISING THE BID

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

a) Bid Form ,Price & other Schedules (STRICTLY AS PER FORMAT)and Technical Data Sheets completed in accordance with Clause 9.0, 10.0, 11.0 and Technical Specification;

b) All the Bids must be accompanied with the required EMD as mentioned in the Section-I against each tender.

c) Power of Attorney or Authorization letter indicating that the person(s) signing the Bid have the authority to sign the Bid and thus that the Bid is binding upon the Bidder during the full period of its validity, in accordance with clause 12.0.

9.00 BID FORM

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

9.02 **EMD**

Pursuant to Clause 8.0(b) above, the bidder shall furnish, as part of its bid, a EMD amounting to 1% of the total bid value (FOR Destination) i.e. Rs. **7,00,000/-**. The EMD is required to protect the Purchaser against the risk of Bidder's conduct which would warrant the security's forfeiture.

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

a) A bank guarantee issued by any scheduled bank strictly as per the form at enclosed and shall be valid for a period of thirty (30) days beyond the validity of the bid.

b) Bank Draft in favour of BSES RAJDHANI POWER LTD, payable at New Delhi.

Unsuccessful bidders' EMD will be discharged or returned as promptly as possible as but not later than thirty (30) days after the expiration of the period of bid validity.

The successful bidder's EMD will be discharged upon furnishing the performance security. The EMD may be forfeited:

a) If the Bidder:
i) Withdraws its bid during the period of bid validity specified by the Bidder in the Bid Form; or

b) in the case of a successful Bidder, if the Bidder fails:

i) to sign the Contract, or

ii) to furnish the required performance security.

10.00 BID PRICES

10.01 Bidders shall quote for the entire Scope of Supply with a break-up of prices for individual items. The total Bid Price shall also cover all the Supplier's obligations mentioned in or reasonably to be inferred from the Bidding Documents in respect of Design, Supply, Transportation to site, all in accordance with the requirement of Bidding Documents The Bidder shall complete the appropriate Price Schedules included herein , stating the Unit Price for each item & total Price.

10.02 The prices offered shall be inclusive of all costs as well as Duties, Taxes and Levies paid or payable during execution of the supply work, breakup of price constituents, should be there. Prices quoted by the Bidder shall be—Firm "and not subject to any price adjustment during the performance of the Contract. A Bid submitted with an adjustable price quotation will be treated as non -responsive and rejected.

11.00 BID CURRENCIES

Prices shall be quoted in **Indian Rupees (INR) only**.

12.00 PERIOD OF VALIDITY OF BIDS

12.01 Bids shall remain valid for **120 days** post bid date.

12.02 Notwithstanding Clause12.01 above, the Purchaser may solicit the Bidder's consent to an extension of the Period of Bid Validity. The request and the responses thereto shall be made in writing by Fax/e-mail.

13.00 ALTERNATIVE BIDS

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

14.00 FORMAT AND SIGNING OF BID

14.01 The original Bid Form and accompanying documents (as specified in Clause9.0),clearly marked "Original Bid", plus one copy must be received by the Purchaser at the date, time and place specified pursuant to Clauses15.0 and16.0. In the event of any discrepancy between the original and the copies, the original shall govern.

14.02 The original and copy of the Bid shall be typed or written in indelible ink and shall be signed by the Bidder or a person or persons duly authorized to sign on behalf of the Bidder. Such authorization shall be indicated by written Power-of-Attorney accompanying the Bid.

14.03 The Bid shall contain no interlineations, erasures or overwriting except as necessary to correct errors made by the Bidder, in which case such corrections shall be initialed by the person or persons signing the Bid.

D SUBMISSION OF BIDS

15.0 SEALING AND MARKING OF BIDS

15.01 Bid submission: One original & one Copy (hard copies) of all the Bid Documents shall be sealed and submitted to the Purchaser before the closing time for submission of the bid.

15.02 The Technical Documents and the EMD shall be enclosed in a sealed envelope and the said envelope shall be superscribed with **—Technical & EMD**. The Financial bid shall be inside another sealed envelope with superscription — **Financial Bid**. Both these envelopes shall be sealed inside another big envelope. All the envelopes should bear the Name and Address of the Bidder and marking for the Original and Copy. The envelopes should be superscribed with —**"Tender Notice No, Due date of submission, Tender opening date"**.

15.03 The Bidder has the option of sending the Bids in person. Bids submitted by Telex/ Telegram/ Fax will not be accepted. No request from any Bidder to the Purchaser to collect the proposals from Airlines/Cargo Agents etc shall be entertained by the Purchaser.

16.0 DEADLINE FOR SUBMISSION OF BIDS

16.01 The original Bid, together with the required copies, must be received by the Purchaser at the address specified not later than **1530 HRS on 20.04.2023**.

16.02 The Purchaser may, at its discretion, extend the deadline for the submission of Bids by amending the Bidding Documents in accordance with Clause9.0, in which case all rights and obligations of the Purchaser and Bidders previously subject to the deadline will thereafter be subject to the deadline as extended.

17.0 ONE BID PER BIDDER

Each Bidder shall submit only one Bid. A Bidder who submits or participates in more than one Bid will cause all those Bids to be rejected.

18.00 LATE BIDS

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

19.00 MODIFICATIONS AND WITHDRAWAL OF BIDS

19.01 The Bidder is not allowed to modify or withdraw its Bid after the Bid's submission.

E. EVALUATION OF BID

20.00 PROCESS TO BE CONFIDENTIAL

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

21.00 CLARIFICATION OF BIDS

To assist in the examination, evaluation and comparison of Bids, the Purchaser may, at its discretion, ask the bidder for a clarification of its Bid. All responses to requests for clarification shall be in writing and no change in the price or substance of the Bid shall be sought, offered or permitted.

22.00 PRELIMINARY EXAMINATION OF BIDS / RESPONSIVENESS

22.01 Purchaser will examine the Bids to determine whether they are complete, whether any computational errors have been made, whether required sureties have been furnished, whether the documents have been properly signed, and whether the Bids are generally in order.

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

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

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

23.0 EVALUATION AND COMPARISON OF BIDS

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

23.02 The evaluation of the Bids shall be a stage-wise procedure. The following stages are identified for evaluation purposes: In the first stage, the Bids would be subjected to a responsiveness check. The Technical Proposals and the Conditional ties of the Bidders would be evaluated. Subsequently, the Financial Proposals along with supplementary Financial Proposals, if any, of Bidders with Techno-commercially Acceptable Bids shall be considered for final evaluation.

23.03 The Purchaser's evaluation of a Bid will take into account, in addition to the Bid price, the following factors, in the manner and to the extent indicated in this Clause:

(a) Supply Schedule
(b) Deviations from Bidding Documents

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

23.04 Any adjustment in price, which results from the above procedure, shall be added for the purposes of comparative evaluation only to arrive at an "Evaluated Bid Price". Bid Prices quoted by Bidders shall remain unaltered.

F. AWARD OF CONTRACT

24.0 CONTACTING THE PURCHASER

24.01 From the time of Bid submission to the time of contract award, if any Bidder wishes to contact the Purchaser on any matter related to the Bid, it should do so in writing.

24.02 Any effort by a Bidder to influence the Purchaser and/or in the Purchaser‘s decisions in respect of Bid evaluation, Bid comparison or Contract Award, will result in the rejection of the Bidder‘s Bid.

25.0 THE PURCHASER ’S RIGHT TO ACCEPT ANY BID AND TO REJECT ANY OR ALL BIDS

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

26.0 AWARD OF CONTRACT

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

27.0 THE PURCHASER’S RIGHT TO VARY QUANTITIES

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

28.0 LETTER OF INTENT/ NOTIFICATION OF AWARD

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

29.0 PERFORMANCE BANK GUARANTEE

The successful Bidder shall furnish the Performance Bank Guarantee for an amount of 10% (Ten percent) of the Contract Price in accordance with the format provided. The Performance Bond shall be valid for a period of twenty four months (24) from the date of the commissioning or thirty months (30) from the date of receipt of material (last consignment) at site/stores whichever is earlier plus 3 months towards claim period. Upon submission of the performance security, the EMD shall be released.

30.00 CORRUPT OR FRADULENT PRACTICES

30.01 The Purchaser requires that the Bidders observe the highest standard of ethics during the procurement and execution of the Project. In pursuance of this policy, the Purchaser:

(a) Defines, for the purposes of this provision, the terms set forth below as follows:

i) "Corrupt practice" means behavior on the part of officials in the public or private sectors by which they improperly and unlawfully enrich themselves and/or those close to them ,or induce others to do so, by misusing the position in which they are placed, and it includes the offering, giving, receiving, or soliciting of anything of value to influence the action of any such official in the procurement process or in contract execution; and

ii) "Fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Purchaser, and includes collusive practice among Bidders (prior to or after Bid submission) designed to establish Bid prices at artificial non-competitive levels and to deprive the Purchaser of the benefits of free and open competition.

(b) Will reject a proposal forward if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question ;

(c) Will declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded a contract if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for, or in executing, a contract.

30.02 Furthermore, Bidders shall be aware of the provision stated in the General Conditions of Contract.

SECTION – III

GENERAL CONDITIONS OF CONTRACT (GCC)

SUPPLY OF VARIOUS RATINGS OF PACKAGE SUBSTATION IN BRPL

CMC/BR/23-24/RB/PR/RJ/1144

GENERAL TERMS AND CONDITIONS

1.0 General Instructions

1.01 All the Bids shall be prepared and submitted in accordance with these instructions.

1.02 Bidder shall bear all costs associated with the preparation and delivery of its Bid, and the Purchaser will in no case shall be responsible or liable for these costs.

1.03 The Bid should be submitted by the Bidder in whose name the bid document has been issued and under no circumstances it shall be transferred/ sold to the other party.

1.04 The Purchaser reserves the right to request for any additional information and also reserves the right to reject the proposal of any Bidder, if in the opinion of the Purchaser, the data in support of RFQ requirement is incomplete.

1.05 The Bidder is expected to examine all instructions, forms, terms & conditions and specifications in the Bid Documents. Failure to furnish all information required in the Bid Documents or submission of a Bid not substantially responsive to the Bid Documents in every respect may result in rejection of the Bid. However, the Purchaser's decision in regard to the responsiveness and rejection of bids shall be final and binding without any obligation, financial or otherwise, on the Purchaser.

2.0 Definition of Terms

2.01 "Purchaser" shall mean BRPL Limited, on whose behalf this bid enquiry is issued by its authorized representative / officers.

2.02 "Bidder" shall mean the firm who quotes against this bid enquiry issued by the Purchaser. "Supplier" or "Supplier" shall mean the successful Bidder and/or Bidders whose bid has been accepted by the Purchaser and on whom the "Letter of Acceptance" is placed by the Purchaser and shall include his heirs, legal representatives, successors and permitted assigns wherever the context so admits.

2.03 "Supply" shall mean the Scope of Contract as described.

2.04 "Specification" shall mean collectively all the terms and stipulations contained in those portions of this bid document known as RFQ, Commercial Terms & Condition, Instructions to Bidders, Technical Specifications and the Amendments, Revisions, Deletions or Additions, as may be made by the Purchaser from time to time.

2.05 "Letter of Acceptance" shall mean the official notice issued by the Purchaser notifying the Supplier that his proposal has been accepted and it shall include amendments thereto, if any, issued by the Purchaser. The "Letter of Acceptance" issued by the Purchaser shall be binding on the "Supplier" The date of Letter of Acceptance shall be taken as the effective date of the commencement of contract.

2.06 "Month" shall mean the calendar month and "Day" shall mean the calendar day.

2.07 "Codes and Standards" shall mean all the applicable codes and standards as indicated in the Specification.

2.08 "Offer Sheet" shall mean Bidder's firm offer submitted to BRPL in accordance with the specification.

2.09 "Contract" shall mean the "Letter of Acceptance" issued by the Purchaser.

2.10 "Contract Price" shall mean the price referred to in the "Letter of Acceptance".

2.11 "Contract Period" shall mean the period during which the "Contract" shall be executed as agreed between the Supplier and the Purchaser in the Contract inclusive of extended contract period for reason beyond the control of the Supplier and/or Purchaser due to force majeure.

2.12 "Acceptance" shall mean and deemed to include one or more of the following as will be stipulated in the specification:

a) The written acceptance of material by the inspector at suppliers works to ship the materials.

b) Acceptance of material at Purchaser site stores after its receipt and due inspection/ testing and release of material acceptance voucher.

c) Where the scope of the contract includes supply, acceptance shall mean issue of necessary equipment / material takeover receipt after installation & commissioning and final acceptance.

3.0 Contract Documents & Priority

3.01 Contract Documents: The terms and conditions of the contract shall consist solely of these RFQ conditions and the offer sheet.

3.02 Priority: Should there be any discrepancy between any term hereof and any term of the Offer Sheet, the terms of these RFQ shall prevail.

4.0 Scope of Supply - General

4.01 The "Scope of Supply" shall be on the basis of Bidder's responsibility, completely covering the obligations, responsibility and supplies provided in this Bid enquiry whether implicit or explicit.

4.02 Bidder shall have to quote for the Bill of quantities as listed in Section – IV of this RFQ.

4.03 Quantity variation and additional requirement if any shall be communicated to successful bidder during project execution.

4.04 All relevant drawings, data and instruction manuals.

5.0 Quality Assurance and Inspection

5.01 Immediately on award of contract, the bidder shall prepare detailed quality assurance plan / test procedure identifying the various stages of manufacture, quality checks performed at each stage, raw material inspection and the Customer hold points. The document shall also furnish details of method of checking, inspection and acceptance standards / values and get the approval of Purchaser before proceeding with manufacturing. However, Purchaser shall have right to review the inspection reports, quality checks and results of suppliers in house inspection department which are not Customer hold points and the supplier shall comply with the remarks made by purchaser or his representative on such reviews with regards to further testing, rectification or rejection, etc.

5.02 Witness and Hold points are critical steps in manufacturing, inspection and testing where the supplier is obliged to notify the Purchaser in advance so that it may be witnessed by the Purchaser. Final inspection is a mandatory hold point. The supplier needs to proceed with the work past a hold point only after clearance by purchaser or a witness waiver letter from BRPL.

5.03 The performance of waiver of QA activity by Purchaser at any stage of manufacturing does not relieve the supplier of any obligation to perform in accordance with and meet all the requirements of the procurement documents and also all the codes & reference documents mentioned in the procurement document nor shall it preclude subsequent rejection by the purchaser.

5.04 On completion of manufacturing the items can be dispatched only after issue of shipping release by the Purchaser.

5.05 All testing and inspection shall be done without any extra cost.

5.06 Purchaser reserve the right to send any material out of the supply to any recognized laboratory for testing and the cost of testing shall be borne by the Purchaser. In case the material is found not in order with the technical requirement / specification, the charges along with any other penalty which may be levied is to be borne by the bidder. To avoid any complaint the supplier is advised to send his representative to the stores to see that the material sent for testing is being sealed in the presence of bidders representative.

5.07 Bidder has to sign quality agreement before supply of the material.

6.0 Packing, Packing List & Marking

6.01 Packing: Supplier shall pack or shall cause to be packed all Commodities in boxes and containers and otherwise in such a manner as shall be reasonably suitable for shipment by road or rail to BRPL without undue risk of damage in transit.

6.02 Packing List: The contents of each package shall be itemized on a detailed list showing the exact weight and the extreme outside dimensions (length, width and eight) of each container or box. One copy of the packing list shall be enclosed in each package delivered. There shall

also be enclosed in one package a master packing list identifying each individual package, which is part of the shipment. On any packaging where it is not feasible to place the packing list inside the container, all pertinent information shall be stenciled on the outside and will thus constitute a packing list.

7.01 Prices basis for supply of materials

Bidders require quoting their prices on Landed Cost Basis and separate price for each item.
For Supply to BRPL Delhi the price shall be inclusive of packing, forwarding, GST and freights. The above supply prices shall also include unloading at site stores. Transit and storage insurance will be arranged by BRPL; however bidder to furnish required details in advance for arranging the same by BRPL.

8.0 Variation in taxes, duties & levies:

8.01 The total order value shall be adjusted on account of any variations in Statutory Levies imposed by Competent Authorities by way of fresh notification(s) within the stipulated delivery period only. However, in case of reduction in taxes, duties and levies, the benefits of the same shall be passed on to BUYER.

8.02 No other Taxes, Duties & Levies other than those specified above will be payable by BUYER except in case of new Levies, Taxes & Duties imposed by the Competent Authorities by way of fresh notification(s) subsequent to the issue of PURCHASE ORDER but within the stipulated delivery period.

8.03 Notwithstanding what is stated above, changes in Taxes, Duties & Levies shall apply only to that portion of PURCHASE ORDER not executed on the date of notification by Competent Authority. Further, changes in Taxes, Duties & Levies after due date of Delivery shall not affect PURCHASE ORDER Terms and Value.

8.04 PURCHASE ORDER value shall not be subject to any variation on account of variation in Exchange rate(s).

9.0 Taxes & Duties on raw materials & bought out components:

9.01 Taxes & Duties on raw materials & bought out components are included in Order Value and are not subject to any escalation or variation for any reason whatsoever.

9.02 Taxes & Duties on raw materials & bought out components procured indigenously are included in Order Value and are not subject to any escalation or variation for any reason whatsoever.

10.0 Terms of payment and billing

10.01 For Supply of Equipments:

- 100% payment shall be made within 45 days from the date of receipt of material at store/ site against submission of 10 % performance bank guarantee. (Refer 10.01)

10.02 Bidder to submit the following documents against dispatch of each consignment:

i) Consignee copy of LR

ii) Supplier detailed invoice showing commodity description, quantity, unit price, total price and basis of delivery.

iii) Original certificate issued by BRPL confirming receipt of material at site and acceptance of the same.

iv) Dispatch clearance / inspection report in original issued by the inspection authority

v) Packing List.

vi) Test Reports

vii) Guarantee Certificate.

viii) Insurance policy to be obtained by supplier

11.0 Price Validity

11.01 All bids submitted shall remain valid, firm and subject to unconditional acceptance by BRPL Delhi for 120 days post bid-date. For awarded suppliers, the prices shall remain valid and firm till contract completion.

12.0 Performance Guarantee

12.01 The successful Bidder shall furnish the Performance Bank Guarantee for an amount of 10% (Ten percent) of the Contract Price in accordance with the format provided. The Performance Bond shall be valid for a period of twenty four months (24) from the date of the commissioning or thirty months (30) from the date of receipt of material (last consignment) at site/stores whichever is earlier plus 3 months towards claim period. Upon submission of the performance security, the EMD shall be released.
Upon submission of the performance security, the EMD shall be released. It shall be in accordance with one of the following terms:

a) Depositing pay order /demand draft of the relevant amount directly with BRPL at the address listed above or as otherwise specified by BRPL, either of which shall constitute the Performance Bond hereunder; or

b) Bank guarantee from any nationalized bank in favour of BSES RAJDHANI POWER LTD (BRPL). The performance Bank guarantee shall be in the format as specified by BRPL.

13.0 Forfeiture

13.01 Each Performance Bond established under Clause 10.0 shall contain a statement that it shall be automatically and unconditionally forfeited without recourse and payable against the presentation by BRPL of this Performance Bond to the ICICI Bank at Mumbai, or to the

relevant company/ correspondent bank referred to above, as the case may be, together with a simple statement that supplier has failed to comply with any term or condition set forth in the Contract.

13.02 Each Performance Bond established under will be automatically and unconditionally forfeited without recourse if BRPL in its sole discretion determines that supplier has failed to comply with any term or condition set forth in the contract.

14.0 Release

All Performance Bonds will be released without interest within seven (7) days from the last date up to which the Performance Bond has to be kept valid (as defined in Clause 10.0) except for the case set forth in Clause 21.0.

15.0 Defects Liability Period

15.01 The bidder to Guarantee the materials / items supplied against any defect of failure, which arise due to faulty materials, workmanship or design for the entire defects liability period. The Defect liability period shall be 60 months from the date of commissioning or 66 months from the date of delivery whichever is earlier. If during the defects liability period any materials / items are found to be defective, these shall be replaced or rectified by the bidder at his own cost within 30 days from the date of receipt of intimation

16.0 Return, Replacement or Substitution.

BRPL shall give Supplier notice of any defective Commodity promptly after becoming aware thereof. BRPL may in its discretion elect to return defective Commodities to Supplier for replacement, free of charge to BRPL, or may reject such Commodities and purchase the same or similar Commodities from any third party. In the latter case BRPL shall furnish proof to Supplier of the cost of such substitute purchase. In either case, all costs of any replacement, substitution, shipping, labour and other related expenses incurred in connection with the return and replacement or for the substitute purchase of a Commodity hereunder should be for the account of Supplier. BRPL may set off such costs against any amounts payable by BRPL to Supplier. Supplier shall reimburse BRPL for the amount, if any, by which the price of a substitute Commodity exceeds the price for such Commodity as quoted in the Bid.

17.0 Effective Date of Commencement of Contract:

17.01 The date of the issue of the Letter of Acceptance shall be treated as the effective date of the commencement of Contract.

18.0 Time – The Essence of Contract

18.01 The time and the date of completion of the "Supply"" as stipulated in the Letter Of Acceptance / Purchase order issued to the Supplier shall be deemed to be the essence of the "Contract". The Supply has to be completed not later than the aforesaid Schedule and date of completion of supply.

19.0 The Laws and Jurisdiction of Contract:

19.01 The laws applicable to this Contract shall be the Laws in force in India.

19.02 All disputes arising in connection with the present Contract shall be settled amicably by mutual consultation failing which shall be finally settled as per the rules of Arbitration and Conciliation Act, 1996 at the discretion of Purchaser. The venue of arbitration shall be at Mumbai in India

20.0 Events of Default

20.01 Events of Default. Each of the following events or occurrences shall constitute an event of default ("Event of Default") under the Contract:

a) Supplier fails or refuses to pay any amounts due under the Contract;

b) Supplier fails or refuses to deliver Commodities conforming to this RFQ/ specifications, or fails to deliver Commodities within the period specified in P.O. or any extension thereof

c) Supplier becomes insolvent or unable to pay its debts when due, or commits any act of bankruptcy, such as filing any petition in any bankruptcy, winding-up or reorganization proceeding, or acknowledges in writing its insolvency or inability to pay its debts; or the Supplier's creditors file any petition relating to bankruptcy of Supplier;

d) Supplier otherwise fails or refuses to perform or observe any term or condition of the Contract and such failure is not remediable or, if remediable, continues for a period of 30 days after receipt by the Supplier of notice of such failure from BRPL.

21.0 Consequences of Default.

a) If an Event of Default shall occur and be continuing, BRPL may forthwith terminate the Contract by written notice.

b) In the event of an Event of Default, BRPL may, without prejudice to any other right granted to it by law, or the Contract, take any or all of the following actions;

i) present for payment to the relevant bank the Performance Bond;

ii) purchase the same or similar Commodities from any third party; and/or

iii) recover any losses and/or additional expenses BRPL may incur as a result of Supplier's default.

22.0 Penalty for Delay

22.01 If supply of items / equipments is delayed beyond the supply schedule as stipulated in purchase order then the Supplier shall be liable to pay to the Purchaser as penalty for delay, a sum of 1% (one percent) of the contract price for every week delay or part thereof for undelivered quantities.

22.02 The total amount of penalty for delay under the contract will be subject to a maximum of ten percent (10%) of the contract price for undelivered quantities.

22.03 The Purchaser may, without prejudice to any method of recovery, deduct the amount for such damages from any amount due or which may become due to the Supplier or from the Performance Bond or file a claim against the supplier.

23.0 Force Majeure

23.01 General

An "Event of Force Majeure" shall mean any event or circumstance not within the reasonable control directly or indirectly, of the Party affected, but only if and to the extent that:

i) Such event or circumstance materially and adversely affects the ability of the affected Party to perform its obligations under this Contract, and the affected Party has taken all reasonable precautions, due care and reasonable alternative measures in order to prevent or avoid the effect of such event on the affected party's ability to perform its obligations under this Contract and to mitigate the consequences thereof.

ii) For the avoidance of doubt, if such event or circumstance would not have materially and adversely affected the performance of the affected party had such affected party followed good industry practice, such event or circumstance shall not constitute force majeure.

iii) Such vent is not the direct or indirect result of the failure of such Party to perform any of its obligations under this Contract.

iv) Such Party has given the other Party prompt notice describing such events, the effect thereof and the actions being taken in order to comply with above clause.

23.02 Specific Events of Force Majeure subject to the provisions of above clause, Events of Force Majeure shall include only the following to the extent that they or their consequences satisfy the above requirements:

23.03 Mitigation of Events of Force Majeure Each Party shall:

i) Make all reasonable efforts to prevent and reduce to a minimum and mitigate the effect of any delay occasioned by an Event of Force Majeure including recourse to alternate methods of satisfying its obligations under the Contract;

ii) Use its best efforts to ensure resumption of normal performance after the termination of any Event of Force Majeure and shall perform its obligations to the maximum extent practicable as agreed between the Parties; and

iii) Keep the other Party informed at regular intervals of the circumstances concerning the event of Force Majeure, with best estimates as to its likely continuation and what measures or contingency planning it is taking to mitigate and or terminate the Event of Force Majeure.

23.04 Burden of Proof In the event that the Parties are unable in good faith to agree that a Force Majeure event has occurred to an affected party, the parties shall resolve their dispute in accordance with the provisions of this Agreement. The burden of proof as to whether or not a

force majeure event has occurred shall be upon the party claiming that the force majeure event has occurred and that it is the affected party.

23.05 Termination for Certain Events of Force Majeure. If any obligation of any Party under the Contract is or is reasonably expected to be delayed or prevented by a Force Majeure event for a continuous period of more than 3 months, the Parties shall promptly discuss in good faith how to proceed with a view to reaching a solution on mutually agreed basis. If a solution on mutually agreed basis cannot be arrived at within a period of 30 days after the expiry of the period of three months, the Contract shall be terminated after the said period of 30 days and neither Party shall be liable to the other for any consequences arising on account of such termination.

23.06 Limitation of Force Majeure event. The Supplier shall not be relieved of any obligation under the Contract solely because cost of performance is increased, whether as a consequence of adverse economic consequences or otherwise.

23.07 Extension of Contract Period due to Force Majeure event The Contract period may be extended by mutual agreement of Parties by way of an adjustment on account of any period during which an obligation of either Party is suspended due to a Force Majeure event.

23.08 Effect of Events of Force Majeure. Except as otherwise provided herein or may further be agreed between the Parties, either Party shall be excused from performance and neither Party shall be construed to be in default in respect of any obligations hereunder, for so long as failure to perform such obligations shall be due to and event of Force Majeure."

24.0 Transfer And Sub-Letting

24.01 The Supplier shall not sublet, transfer, assign or otherwise part with the Contract or any part thereof, either directly or indirectly, without prior written permission of the Purchaser.

25.0 Recoveries

25.01 Whenever under this contract any money is recoverable from and payable by the bidder, the purchaser shall be entitled to recover such sum by appropriating in part or in whole by detecting any sum due to which any time thereafter may become due from the supplier in this or any other contract. Should the sum be not sufficient to cover the full amount recoverable the bidder shall pay to the purchaser on demand the remaining balance.

26.0 Waiver

26.01 Failure to enforce any condition herein contained shall not operate as a waiver of the condition itself or any subsequent breach thereof.

27.0 Indemnification

27.01 Notwithstanding contrary to anything contained in this RFQ, Supplier shall at his costs and risks make good any loss or damage to the property of the Purchaser and/or the other Supplier engaged by the Purchaser and/or the employees of the Purchaser and/or employees of the other Supplier engaged by the Purchaser whatsoever arising out of the negligence of the Supplier while performing the obligations under this contract.

SECTION – IV: QUANTITY AND DELIVERY REQUIREMENT

Sl. No.	Item Description	Specification	Requirement	Delivery Schedule	Location
BRPL,DELHI					
1	Supply of Various ratings of Package Substation	SECTION V	22 nos	2 months from the date of drawing approval	Stores BRPL Delhi
TOTAL					

Annexure –I

BID FORM

Supply of Various Ratings of Package Substation

To
Head of the Department Contracts & Materials BSES Rajdhani Power Ltd BSES Bhawan, Nehru Place New Delhi– 110019
Sir,

We understand that BRPL is desirous of procuring "Various Ratings of Package Substation" in its licensed distribution network area in Delhi. Having examined the Bidding Documents for the above named works, we the undersigned, offer to deliver the goods in full conformity with the Drawings, Conditions of Contract and specifications for the sum of AS PER PRICE BID ENCLOSED or such other sums as may be determined in accordance with the terms and conditions of the contract .The above amounts are in accordance with the Price Schedules attached herewith and are made part of this bid.

If our Bid is accepted, we undertake to deliver the entire goods as per delivery schedule given by you from the date of award of purchase order/letter of intent.

If our Bid is accepted, we will furnish a performance bank guarantee for an amount of 10% (Ten) percent of the total contract value for due performance of the Contract in accordance with the General Conditions of Contract.

We agree to abide by this Bid for a period of 120 days from the date fixed for bid opening under clause 9.0 of GCC, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

We declare that we have studied the provision of Indian Income Tax Law and other Indian Laws for supply of equipments/materials and the prices have been quoted accordingly.

Unless and until Letter of Intent is issued, this Bid, together with your written acceptance thereof, shall constitute a binding contract between us.

We understand that you are not bound to accept the lowest, or any bid you may receive.

There is provision for Resolution of Disputes under this Contract, in accordance with the Laws and Jurisdiction of Contract, Clause 19 of GCC .

Dated this.....day of.....20.....
Signature..... In the capacity of……
.....duly authorized to sign for and on behalf of (IN BLOCK CAPITALS)……

Annexure -II

FORMAT FOR EMD BANK GUARANTEE

(To be issued in a Non Judicial Stamp Paper of Rs.50/-purchased in the name of the bank)

Whereas [name of the Bidder] (hereinafter called the "Bidder") has submitted its bid dated [date of submission of bid] for the supply of [name and/or description of the goods] (hereafter called ''the Bid"). KNOW ALL PEOPLE by these presents that WE [name of bank]at[Branch Name and address],having our registered office at[address of the registered office of the bank](herein after called —"the Bank"),are bound unto BSES Rajdhani Power Ltd., with its Corporate Office at BSES Bhawan Nehru Place, New Delhi -110019, (herein after called —the "Purchaser") in the sum of_____ for which payment well and truly to be made to the said Purchaser, the Bank binds itself, its successors, and assigns by these presents. Sealed with the Common Seal of the said Bank this____ day of__ 20__.

THE CONDITIONS of this obligation are:

If the Bidder withdraws its Bid during the period of bid validity specified by the Bidder on the Bid Form; or

If the Bidder, having been notified of the acceptance of its Bid by the Purchaser during the period of bid validity:

fails or refuses to execute the Contract Form ,if required; or
fails or refuses to furnish the performance security, In accordance with the Instructions to Bidders/GENERAL CONDITIONS.;

We undertake to pay to the Purchaser up to the above amount upon receipt of its first written demand, without the Purchaser having to substantiate its demand, provided that is its demand the purchaser will note that amount claimed by it is due to it, owing to the occurrence of one or both of the two conditions, specifying the occurred condition or conditions.

This guarantee will remain in force up to and including thirty (30) days after the period of bid validity, and any demand in respect thereof should reach the Bank not later than the above date.

(Signature of the bank)

Signature of the witness

Annexure-III

PRICE FORMAT

ENQUIRY NO & DATE: NIT: CMC/BR/23-24/RB/PR/RJ/1144

PRICE SCHEDULE

ITEM DESCRIPTION	QTY AS PER RFQ	UOM	EX-WORKS RATE/ UNIT	CGST (%)	CGST AMOUNT	SGST (%)	SGST AMOUNT	IGST (%)	IGST AMOUNT	FREIGHT	LANDED RATE/ UNIT	TOTAL LANDED COST (INR)
250 kVA Package Substation	12	Nos										
400 kVA Package Substation	5	Nos										
630 kVA Package Substation	5	Nos										

Note: 1.Prices shall be Firm
2.The prices received without break up of ex works, Freight, GST are liable for rejection
3. Pls. Indicate the exact percentage of taxes in figures and words.
4. If there is a discrepancy between the unit price and the total price THE UNIT PRICE shall prevail.
5. Bidders are requested to attach the covering letter head alongwith the price bid indicating reference no and date.

Bidders seal & signature

Annexure – IV

Enquiry No. : CMC/BR/23-24/RB/PR/RJ/1144

COMMERCIAL TERMS AND CONDITIONS

S/NO	ITEM DESCIPTION	AS PER BRPL	CONFIRMATION OF BIDDER
1	Validity of prices	120 days from date of offer	
2	Price basis	Price Variation, FOR Delhi store basis, Prices shall be inclusive of all taxes & duties, freight upto Delhi stores. Unloading at stores be in vendor's scope Transit insurance in BRPL scope	
3	Payment Terms	100% payment within 45 days after receipt of material at stores	
4	Delivery schedule	2 months from the date of drawing approval	
5	Defect Liability Period	The bidder to Guarantee the materials / items supplied against any defect of failure, which arise due to faulty materials, workmanship or design for the entire defects liability period. The Defect liability period shall be 60 months from the date of commissioning or 66 months from the date of delivery whichever is earlier. If during the defects liability period any materials / items are found to be defective, these shall be replaced or rectified by the bidder at his own cost within 30 days from the date of receipt of intimation.	
6	Penalty for delay	1% per week of delay of undelivered units or part thereof subject to maximum of 10% of total PO value of undelivered units	
7	Performance Bank Guarantee	10% of total PO value for 24 months after commissioning or 30 months from date of supply, whichever is earlier plus 3 months towards claim period	

ANNEXURE - V

ENQUIRY NO: CMC/BR/23-24/RB/PR/RJ/1144

NO DEVIATION SHEET

SL NO	SL NO OF TECHNICAL SPECIFICATION	DEVIATION, IF ANY

SIGNATURE & SEAL OF BIDDER

NAME OF BIDDER

BSES
RAJDHANI POWER LIMITED

CHECK LIST

Sl No	Item Description	YES/NO
1	INDEX	YES/NO
2	COVERING LETTER	YES/NO
3	BID FORM (UNPRICED) DULY SIGNED	YES/NO
4	BILL OF MATERIAL (UNPRICED)	YES/NO
5	TECHNICAL BID	YES/NO
6	ACCEPTANCE TO COMMERCILAL TERMS & CONDITIONS	YES/NO
7	FINANCIAL BIDS (IN SEALED ENVELOPE)	YES/NO
8	EMD IN PRESCRIBED FORMAT	YES/NO
9	DEMANT DRAFT OF RS 1180/- DRAWN IN FAVOUR OF	BSES RAJDHANI POWER LTD
10	POWER OF ATTORNEY/ AUTHORISATION LETTER FOR SIGNING THE BID	YES/NO

Annexure III

FORM FOR PARTICIPATION IN REVERSE AUCTION EVENT

(To be signed & stamped by the bidder along-with bid)

BSES Rajdhani Power Ltd (BRPL) intends to use reverse auction through SAP-SRM tool as an integral part of entire tendering process. All bidders who are techno-commercially qualified on the basis of tender requirements shall participate in the reverse auction.

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

1. In case of bidding through Internet medium, bidders are advised to ensure availability of all associated infrastructure as required to participate in the reverse auction event. Inability to bid due to telephone glitch, internet response issues, software & hardware hangs/failures, power failures or any other reason shall not be the responsibility of BRPL.

2. In case bidder fails to participate in the reverse auction event due to any reason whatsoever, it shall be presumed that the bidder has no further discounts to offer and the initial bid submitted by them as a part of tender shall be considered as bidder's Final .No Regret offer.Any off-line price bids received from a bidder in lieu of non-participation in the reverse auction event shall be rejected by BRPL.

3. The bidder is advised to understand the auto bid process t safeguard themselves against any possibility of non-participation in the reverse auction event.

4. The bidder shall be prepared with competitive price quotes during the day of reverse auction event.

5. The prices quoted by bidder in reverse auction event shall be on FOR Landed cost BRPL Store/site basis inclusive of all relevant taxes, duties, levies, transportation charges etc.

6. The prices submitted by the bidder during reverse auction event shall be binding on the bidder.

7. The bidder agrees to non-disclosure of trade information regarding bid details e.g.purchase, identity, bid process/technology, bid documentation etc.

8. BRPL will make every effort to make the bid process transparent. However award decision of BRPL will be final and binding on the bidder.

9. The prices submitted during reverse auction event shall be binding on the bidder.

10. No request for Time extension of the reverse auction event shall be considered by BRPL.

SECTION – V

TECHNICAL SPECIFICATIONS (TS)

VARIOUS RATINGS OF PACKAGE SUBSTATION IN BRPL

CMC/BR/23-24/RB/PR/RJ/1144

The detailed technical specifications of Package Substation

250 KVA PSS --- Specification No--BSES-TS-21-CPSSR0
400 KVA PSS---Specification no--BSES-TS-122-SPSS-RO -- Type 17
630 KVA PSS--Specification no--BSES-TS-122-SPSS-RO -- Type 13

BSES

Technical Specification for

11 KV Dry type Conventional Packaged Substation

Specification no – BSES-TS-21-CPSS-R0

Rev:		0
Pages		75
Date:		04 April 2022
Prepared by	Abhishek Harsh	
	Rohit Patil	
Reviewed by	Srinivas Gopu	
	Amit Tomar	04/04/2022
Approved by	Gaurav Sharma	
	K. Sheshadri	04/04/22

Index

1.0 Scope

i. Design, manufacture, testing at manufacturer works before dispatch, packing, and delivery of Packaged Substation (PSS) as per this specification and supply of commissioning spares.

ii. Supply of all installation/commissioning accessories for PSS.

iii. Submission of documentation of PSS.

iv. Supervision of testing & commissioning of PSS at site.

2.0 Codes & standards

Materials, equipment and methods used in the manufacture of 11kV Packaged Substation shall conform to the latest edition of following –

Standard	Title
Indian Electricity Rules	With latest amendments
Indian electricity act	IE act 2003
	CBIP manual on transformers
IEC 60076	Power transformers
IEC:60616	Terminal and Tapping Markings for Power Transformers
IEC:60726	Dry-Type Power Transformers
IEC: 60529	Degrees of Protection Provided by Enclosures (IP Code).
IEC:60905	Loading Guide for Dry-Type Power Transformers
IEC 60694	Specification for high voltage switchgear
IEC 60439-1	Low voltage switchgear & control gear assemblies
IEC 60529	Degree of enclosures provided by enclosures
IEC 60664-1	Insulation coordination for low voltage systems
IEC 62262	Degree of protection provided by enclosure against mechanical shocks
IEC 62271-202	High voltage switchgear & control gear - prefabricated substation
IEC 60044	Instrument transformers - Current & voltage transformers
IEC 60225	Electrical relays
IEC 60625	High voltage switches
IEC 60502	Power cables
IEC 60947-2	Low-voltage switchgear and control gear : Circuit-breakers
IS 1180	Outdoor Type Oil Immersed Distribution Transformers Up to and Including 2500 kVA, 33kVSpecification
IS 2026	Power transformers
IS 11171	Dry type power transformers
IS 2026-part 1 /IEC 60076-11	Dry type transformers

IS 2026 part 12/IEC 60076-12	Loading guide for dry type Power Transformer
IS 6600	Loading of power transformers
IS 13947	Low voltage switchgear & control gear
IS 2099	Bushings for voltages above 1000v
IS 3156	Voltage transformers
IS 2705	Current transformers
IS 1554	PVC cables
IS 7098	XLPE cables
IS 2629	Recommended Practice for Hot-Dip Galvanizing of Iron and Steel
IS 4759	Hot-dip zinc coatings on structural steel and other allied products
IS 13585	Shunt capacitors
IS 13340	Shunt capacitors
IS 3043	Code of practice for Earthing
IS 335-2018	Insulating oils
IS 8130	Conductors for insulated cables
IS 5	Ready mixed paints
IS 9920 part 1,3 & 4	High voltage switches above rated voltage 1kv
IS 13118	General requirements of circuit breakers above rated voltage 1kv
IEC 60694	Specification for high voltage switchgear
IEC 60298	AC metal enclosed switchgear
IEC 60694	Specification for high voltage switchgear
IEC 60056	High voltage alternating current circuit breakers
IEC 60265 part 1	High voltage switches

In the event of direct conflict between various order documents, the precedence of authority of documents shall be as follows -

i. Guaranteed Technical Particulars (GTP)
ii. Specification including applicable codes & standards
iii. Approved Vendor Drawings
iv. Other documents

3.0 Electrical Distribution System Data

3.1.1	HT supply System	3 phase AC, 3 wire
3.1.2	Voltage	11000 volt ±10%
3.1.3	Frequency	50 Hz ± 5%
3.1.4	Fault level	350MVA – 18.5kA
3.1.5	System neutral	Earthed at upstream 11kV source
3.2.1	LT supply system	3 phase AC, 4 wire

3.2.2	Rated voltage	415V +/-10%
3.2.3	Rated frequency	50 Hz ± 5%
3.2.4	Fault level	35MVA – 50kA

4.0 PSS Configuration`

4.1	PSS Type	On the basis of transformer rating
4.1.1	PSS Type – I	With 1000kVA oil filled transformer / 1000KVA cast resin transformer
4.1.2	PSS Type – II	With 630kVA oil filled transformer / 630KVA cast resin transformer
4.1.3	PSS Type – III	With 400kVA oil filled transformer / 400KVA cast resin transformer
4.1.4	PSS Type – IV	With 250kVA oil filled transformer / 250KVA cast resin transformer
4.1.4	Transformer type	As per enquiry
4.2	Major Components	For all PSS Types
4.2.1	Enclosure	Metallic painted GI enclosure with steel base frame for overall package
4.2.2	11kV Ring main unit	
4.2.2.1	PSS Type – I	1. The 3 Way with 02 nos. load break switches (LBS) + 01 no. circuit breaker (CB). Or 2. The 4 Way with 02 nos. Load break switches (LBS) + 02 nos. Circuit breaker (CB). **As per tender requirement**
4.2.2.2	PSS Type – II , III & IV	The 3 Way with 02 nos. load break switches (LBS) + 01 no. circuit breaker (CB).
4.2.3	11kV XLPE Aluminium cable with termination kit along with cold applied boots	For CB feeder termination & transformer side termination.
4.2.4	Low voltage bus bar system	Insulated /sleeved with epoxy insulators
4.2.5	Low voltage system configuration for PSS type-I	1600A ACB incomer and 07 nos. 400A MCCB (utilization category- B) as outgoing.

4.2.6	Low voltage system configuration for PSS type-II	1600A ACB incomer and 05 nos. 400A MCCB (utilization category- B) as outgoing. Provisions shall also be made in LT panel to increase LT outgoing by 02 no's by adding MCCB's in future.
4.2.7	Low voltage system configuration for PSS type-III	1250A ACB incomer and 03 nos. 400A MCCB (utilization category- B) as outgoing. Provisions shall also be made in LT panel to increase LT outgoing by 02 no's by adding MCCB's in future.
4.2.8	Low voltage system configuration for PSS type-IV	400A ACB incomer and 02 nos. 250A MCCB (utilization category- B) as outgoing.
4.2.9	APFC system for PSS type-I	300kVAR APFC system with control relay & 630amp incomer MCCB (utilization category- B)
4.2.10	APFC system for PSS type-II	Not Required
4.2.11	APFC system for PSS type-III	Not Required
4.2.12	APFC system for PSS type-IV	Not Required
4.2.13	Energy meter box	To be provided on transformer LT side along with wiring.
4.2.14	Smoke detectors	Minimum 02 nos. in each LT, HT and Transformer compartment. These detectors shall be connected to local controller / alarm module.
4.2.15	Hooter with automatic timer reset	For operator alarm in case of PSS door open position
4.2.16	Fire Extinguisher	2Kg CO^2 Type shall be placed in HT Compartment
4.2.17	Other requirements	Substation internal cabling, lighting & earthing system along with required hardware, gaskets, gland plates etc.
4.2.18	Fire ball	3 nos. of fire ball require in each compartment of all types of PSS
4.2.19	Cable Sealing compound	Cable sealing compound (Roxtec or any other make) require in LT & HT compartment as per cable size

5.0 11 kV Ring Main Unit

5.1.0	**RMU Configuration**	
5.1.1	RMU Configuration	

5.1.1.1	PSS Type – I	1. Two Load break switches (LBS) + one transformer circuit breaker (TCB) or 2. Two Load break switches (LBS) + two transformer circuit breaker (TCB). Selection between the above configurations shall depend upon the purchaser's requirement.
5.1.1.2	PSS Type – II, III & IV	The 3 Way with 02 nos. load break switches (LBS) + 01 no. circuit breaker (CB).
5.1.2	Extensibility	Non extensible type
5.1.3	Load break switch, Circuit breaker & earth switch in RMU panel	All shall be non draw out type, fixed position
5.1.4	Insulation Medium	
5.1.4.1	For panel	SF6 gas or Dry air in sealed metallic tank
5.1.4.2	For Breakers	SF6 gas or Vacuum type (with disconnector & earth switch)
5.1.4.3	For load break switches	SF6 gas or Vacuum type (With Earth Switch)
5.1.5	Arc interruption chamber for breaker	Arc interruption chamber of breakers shall be separate from the main insulated tank. (Desirable feature)
5.1.6	Maximum dimensions of 3 Way (2LBS+1VCB) RMU and for 4 Way(2LBS+2VCB)	3 Way-1250 mm(W) X 800 mm (D) X 2000 mm (H) 4 Way- dimension of 3 way+ one VCB compartment shall be added
5.2.0	**RMU Panel Construction**	
5.2.1	Panel type	CRCA/ GI Metal enclosed, framed, Compartmentalized panel construction
5.2.2	Service Location	Indoor and outdoor, non air conditioned environment
5.2.3	Mounting	Free Standing
5.2.4	Overall Enclosure Protection	IP54X minimum, vermin proof
5.2.5	Doors	Front access with internal anti theft hinge arrangement with minimum opening angle of 120º, minimum three hinges (desirable)
5.2.6	Covers	Bolted for rear access, with handles. Support for handle shall be provided at suitable place on RMU body. All the accessible bolts / screws shall be vandal proof stainless steel (except termination bolt, washer and reducer which is brass). One set of required Special tools per RMU (if any) shall be in the scope of supply.
5.2.7	Construction	CRCA/GI Metal enclosed, framed, Compartmentalized

		panel construction. CRCA/GI thickness shall be 2 to 2.5 mm subject to type test report from CPRI/ERDA**. Sheet thickness below 2 mm in any part of RMU shall not be accepted**
5.2.8	Base frame	Base frame shall be made with 75mm ISMC/ISA channel. Proper Bolted fixing arrangement shall be provided. Also, base frame shall be painted with 2 coats of anti rust red oxide and 2 coats of bitumen paint shall be provided. Adjustable HDPE clits as cable supporting clamps for each power cable (to suit the cable size from 11kV, 3CX150 to 400 sq mm PILC / XLPE cable. Exact size shall be provided during drawing approval stage.), also cleat shall be adjustable vertically.
5.2.9	Lifting lugs	Four numbers
5.2.10	Cable Entry	Bottom 3mm metallic, removable type & split type in two parts, with 1no. 90 mm diameter knocks out punch/hole in the centre (For double cable boxes, Un-drilled gland plate to be supplied. Approval should be taken for the same during drawing submission)
5.2.11	Cable termination	
5.2.11.1	Cable type & size	11kV, 3C X 150 / 240 / 300/ 400 sq mm Aluminium conductor XLPE/ PILC with armor & PVC outer sheath
5.2.11.2	Terminals for 11kV cable termination	With right angled cold applied boots (3M,Raychem or K.D. Joshi make), set of required size of Brass Nut bolt – M 16 size, Bimetallic washers and reducer for different size of cable termination to be provided.
5.2.11.3	Termination type	Suitable for heat shrinkable type
5.2.11.4	Termination height	900mm minimum from gland plate to center of bushing
5.2.12	Bus bar	Copper/Tinned copper (Sizing Calculation to be submitted in support of its Guaranteed S.C. rating / Capability)
5.2.12.1	Bus bar continuous rated current	630amp
5.2.12.2	Bus bar short time withstand capacity	20 KA for 3 sec
5.2.12.3	Bus bar support insulator material	SMC / DMC resin
5.2.12.4	Maximum temperature rise above reference ambient	In line with Table 3 of IEC60694

5.2.13	Earth bus bar	Tinned Copper sized for rated fault duty for 3 sec
5.2.13.1	Earth bus internal connection to all noncurrent carrying metal parts	By 2.5 sq mm copper flexible green PVC wire, Earth connection point maximum 1 meter away from cable test facility
5.2.13.2	Earth bus external connection to owners earth	Studs on both sides with holes and with M10 bolt + hardware to readily receive purchaser earth connection
5.2.14	Cooling arrangement	By natural air without fan
5.2.15	Panel internal wiring	Multi strand flexible color coded PVC insulated Cu wire 1 sq mm (SCADA) / 2.5 sq mm (for CT's) 1100 volt grade (R phase - Red, Y phase – Yellow, B phase – Blue, AC- black, DC – grey, Earth – green) with ferrules at both ends. All the internal control / auxiliary wiring shall be routed through proper conduit.
5.2.16	Hardware (Nut, bolts & handle)	Stainless steel (Except termination nut-bolts-washers-reducer which are Brass / Tinned Copper)
5.2.17	Gasket	Neoprene rubber
5.2.18	Marshalling terminal blocks	1 Sq mm, Nylon 66 material, screw type + 20% spare in each row of TB.
5.2.19	Panel cover fixing bolts	Allen head 6mm with hexagonal slot
5.2.20	Padlock facility	Required for all earth switches & all handles
5.2.21	Internal Arc classification	
5.2.21.1	Explosion vents	To ensure operator's safety, design should ensure that gases / flames generated during flash over / blast in any of the compartment, must not come out from the front of RMU as well shall not go to adjacent cable compartment. Internal arc test report (for Cable compartment & other compartments) must be submitted to support above, along with RMU GA drawing indicating these vents. There shall not be any type of holes, gaps etc on the walls of cable termination compartment.
5.2.21.2	Internal Arc rating	20 kA for 1s
5.2.21.3	Internal arc classification	IAC AFLR
5.2.22	SF6 gas annual Loss	< 0.1% of total mass. Pressure of SF6 gas shall be above the operating limit throughout the life of the equipment.
5.3.0	**Load break switch / Isolator (LBS)**	

5.3.1	Type	Three poles operated simultaneously by a common shaft
5.3.2	Arc interruption in dielectric medium	SF6 or Vacuum
5.3.3	Operating mechanism for close / open	Manual as per enquiry.
5.3.4	Addition / removal of motor	Without overhaul of operating mechanism
5.3.5	RMU without motor	Complete with power & control wiring so that only motor can be added at later date
5.3.6	Motor rated voltage	NA
5.3.7	Battery type & size	a) NA
5.3.8	Continuous rating of LBS	630 Amp at design 40 deg C ambient
5.3.9	Short time withstand capacity	20 KA for 3 sec
5.3.10	Fault making capacity	50 kA peak
5.3.11	Minimum number of operations at rated current (as per IEC 62271-102)	Mechanical Endurance – Class M1(1000 operations) Electrical Endurance – Class E3 (100 operations)
5.3.12	Minimum number of operations at rated fault current (as per IEC IEC 62271-102)	Class E3 (Min 10 operations)
5.3.13	Fault passage indicator (FPI) (For both Earth fault and Over Current Protection) {}	To be provided on incommer side of one LBS for panel type 1CB + 2 LBS. For all other configuration of RMU, FPI to be provided on all LBS.
5.3.14	Earth Fault Indicator	CBCT – Split open type suitable for mounting without disconnection of cable.
5.3.15	Connection of CBCT with FPI	Cable connection of FPI with CBCT shall be of pre moulded type on the CBCT side. Cable shall be 2.5 sq.mm cu PVC insulated cable only
5.3.16	Fault Passage Indicator (For both Earth Fault and Over Current Protection)	Digital type and shall operate as the current exceeds the set value. Flash indication for identifying faults with red LED with one flash for every one sec. Test & rest button 1 NO + 1 NC potential free contact for remote indication FPI power supply unit shall use lithium battery with minimum life of 1000 blinking hours , so that FPI shall continue to function even after main feeder has tripped.
5.3.17	Data by Purchaser	
5.3.17.1	System Fault Level	2kA – 8.75kA
5.3.17.2	Type of Grounding	Solidly Grounded
5.3.17.3	Fault clearing time	100ms

5.3.17.4	Cable Type	PILC / XLPE , 11Kv, 3CX150 sq.mm to 400 sq.mm
5.3.18	Earth Fault Indicator	
5.3.18.1	Sensing Current	100 to 400A
5.3.18.2	Sensing Time	30 to 100 ms in steps of 10ms.
5.3.18.3	Reset Time	0.5 -1-2-3-4 hr
5.3.18.4	Resetting Facility	a) Self rest after reset time b) Self rest after restoration of voltage c) Manual d) Remote resetting
5.3.18.5	Contact Rating	1A at 230 V
5.3.18.6	Degree of Protection	IP 54
5.3.18.7	Mounting Arrangement	Surface or Flush Mounting
5.3.18.8	Ambient Temperature	-0 to 50 Deg C
5.4.0	**Circuit breaker**	
5.4.1	Type	Three pole, operated simultaneously by a common shaft
5.4.2	Transformer circuit breaker – TCB	For controlling transformer, manual operation only
5.4.3	Feeder circuit breaker - FCB	For controlling cable feeder, manual operation. Remote trip operation by SCADA possible
5.4.4	Arc interruption in dielectric medium	Vacuum Bottle
5.4.5	Operating mechanism - TCB	Manual spring charged stored energy type
5.4.6	Operating mechanism - FCB	Manual spring charged stored energy type, remote electrical close / open operation possible.
5.4.7	Emergency trip / open push button	On panel front with Protective flap to prevent any accidental tripping of breaker.
5.4.8	Continuous rating at design 40 deg C ambient	630amp
5.4.9	Short time withstand capacity	20 KA for 3 sec
5.4.10	Minimum number of operations at rated current (as per IEC 62271-100)	Mechanical Endurance – Class M1(2000 operations) Electrical Endurance – Class E2
5.4.11	Fault making capacity	50 KA peak
5.4.12	Fault breaking capacity	20 KA Minimum
5.4.13	Maximum number of operations at rated Fault	Electrical Endurance – Class E2 . To be guaranteed by manufacturer with authorized lab test reports

	current *(as per IEC 62271-100*)	
5.4.14	Breaker status auxiliary contact	2NO + 2NC wired to terminal block
5.4.15	Current transformer	a) 75-400 / 1 amp for TCB/ FCB. b) Considering three core cable terminations, mounting flexibility shall be provided for CT's (in horizontal & vertical direction both). Additionally, CAUTION marking (by sticker/ paint) shall be provided to avoid CT's installation above the screen of cable. (I.e. earth potential point.) c) Position of CTs inside compartment shall be adjustable in vertical and horizontal direction
5.4.16	CT accuracy class	5P10 minimum
5.4.17	Protection relay	Self powered, Microprocessor based Numerical relay (with LCD display), IDMT over current / earth fault protection with high set element, manual reset type Relay mounting flush to panel front. Relay shall be communicable for automation purposes
5.4.18	Relay auxiliary contacts for remote indication	Potential free contact 1NO + 1NC wired to terminal block
5.4.19	Shunt trip 230v AC (for WTI trip & door limit switch of Dry type transformer) & for remote trip from SCADA.	To be wired to terminal blocks (If the functional requirement is achieved by the Protection relay, then shunt trip is not required.
5.4.20	Breaking Timing	40 to 60 ms
5.5.0	**Earth switch**	
5.5.1	Type	Three Pole (ON, OFF and Earth), operated simultaneously by a common shaft, for each Circuit breaker & Load break switch.
5.5.2	Switching in dielectric medium	Dry Air in sealed medium or SF6 gas
5.5.3	Operating mechanism for close & open	Manual
5.5.4	Fault making capacity	50 kA (Desirable)
5.5.5	Auxiliary contacts	1NO+1NC wired to terminal block
5.5.6	Disconnect switch (if provided in series with	Desirable to be located on purchaser cable connection side of vacuum bottle

	vacuum bottle)	
5.5.7	Minimum number of operations at no load (as per IEC 62271-102)	Mechanical Endurance – Class M0(1000 operations)
5.5.8	Making capacity endurance of earth switch (as per IEC 62271-102)	Class E2 (Min 5 operations)
5.6.0	**Requirements of sealed housing live parts**	
5.6.1	Enclosure	Stainless steel enclosure suitable for IP67. Metal thickness shall be 3mm.
5.6.2	SF6 gas pressure low alarm	To be given
5.6.3	Provision for SF6 gas filling	To be given (For 'sealed for life' design of RMU, this is not applicable)
5.6.4	Provision for SF6 gas pressure indication	Digital/Analog Manometer with non return valve
5.6.5	Arc interruption method for SF6 breaker / Load break switch	Puffer type / rotating arc type
5.6.7	Potential free contacts for SF6 gas pressure low	1NO +1NC (Desirable)
5.7.0	**RMU operation interlocks**	
5.7.1	Interlock type	Mechanical
5.7.2	Load break switch & respective earth switch	Only one in 'close' condition at a time
5.7.3	Circuit breaker & respective earth switch	Only one in 'close' condition at a time
5.7.4	Prevent the removal of respective cable covers if load break switch or circuit breaker is 'ON'	Electrical / Mechanical
5.7.5	Prevent the closure of load break switch or circuit breaker if respective cable cover is open	Electrical / Mechanical
5.7.6	Cable test plug for LBS/CB accessible only if Earth switch connected to earth	Mechanical
5.8.0	**Indication & signals**	for SCADA / Local

5.8.1	Operation counter on front / Inside the RMU LT chamber	To be provided for each LBS & Circuit breaker, with minimum four digits & non resettable type
5.8.2	Cable charge status indication for all LBS & CB	Capacitor type voltage indicators with LED on all the phases (Shall be clearly visible in day light)
5.8.3	Spring charge status indication	On front for breaker
5.8.4	Earth switch closed indication (For Each LBS)	On front
5.8.5	Load break switch ON/OFF indication	Green for OFF / Red for ON
5.8.6	Circuit breaker On/OFF indication	Green for OFF / Red for ON
5.8.7	Circuit breaker protection relay operated on fault	Flag
5.8.8	Fault passage indication on LBS	Flag
5.8.9	Status signals to SCADA-to be wired to marshalling terminal block	2NO + 2NC
5.8.9.1	LBS close / open	potential free contacts
5.8.9.2	LBS & CB Earth Switch close /open	potential free contacts
5.8.9.3	CB close / open	potential free contacts
5.8.9.4	Protection relay operated	potential free contacts
5.8.9.5	FPI operated	potential free contacts
5.8.9.6	SF6 gas pressure low	Potential free contacts - to be provided.
5.9.0	**Mimic diagram, labels & finish**	a) Mimic diagram (Shall not be accepted with Stickers) b) On panel front with description of function & direction of operation of handles/buttons
5.9.1	Operating Instructions	Operating instruction chart and Do's & Don'ts in Hindi / local language to be displayed on left / front side of panel enclosure on anodized Al Sheet 16SWG, duly affixed on panel.
5.9.2	Name plate on panel front	Fixing by rivet only
5.9.2.1	Material	Anodized aluminum 16SWG / SS
5.9.2.2	Background	SATIN SILVER
5.9.2.3	Letters, diagram & border	Black

5.9.2.4	Process	Etching
5.9.2.5	Name plate details	Month & year of manufacture, equipment type, input & output rating, purchaser name & order number, guarantee period
5.9.3	Labels for meters & indications	Anodized aluminum with white character on black background OR 3 ply lamicoid
5.9.4	Danger plate on front & rear side	Anodized aluminum 16 SWG with white letters on red background
5.9.5	Painting surface preparation	Shot blasting or chemical 7 tank process
5.9.6	Painting external finish	Powder coated epoxy polyester base grade A, shade - RAL 7032, uniform thickness 60 micron minimum
5.9.7	Painting internal finish	Powder coated epoxy polyester base grade A, shade - white, uniform thickness 60 micron minimum Printed copy shall be fixed/mounted inside each and every compartment.
5.10.0	**Quality Assurance**	
5.10.1	Vendor quality plan	To be submitted for purchaser approval
5.10.2	Inspection points in quality plan	To be mutually identified & agreed
5.10.3	Quality – Process Audits	BSES shall carryout vendor process audits.
5.10.4	Field quality plan	Bidder to submit field quality plan along with the bid
5.10.5	Spare part list	Bidder to submit detailed spare part list along with the bid
5.10.6	Maintenance manual	Bidder to submit maintenance manual along with the bid
5.10.7	Self Powered O/C & E/F Relay	Ashida ADR241S-761
5.10.8	Boots	3M / Raychem/K.D.Joshi
5.11.0	**Inspection and Testing**	
	Type test	1. Equipment of type tested quality only, including internal arc test (AFLR) shall be accepted as specified in the specification on various compartments like cable chamber, SF6 gas tank etc.(refer IS/IEC mentioned in the clause no 2.) 2. All Type test certificate along with AFLR internal test report from CPRI/ERDA/Any other reputed independent international Lab equivalent or better than CPRI/ERDA to be submitted along with offer for scrutiny. Type test more than 5 years old will not be acceptable. In case type test is more than 5

		years old, bidder shall conduct type test from CPRI/ERDA/Any other reputed independent international Lab equivalent or better than CPRI/ERDA as per standard without any cost Implication to BSES. In this regards if BSES want to Witness the test, all the expenses of BSES inspector shall be borne by bidder.
	Routine test	As per relevant Indian standard (refer IS …)
	Acceptance test	To be performed in presence of purchaser at manufacturer works
		Physical inspection & BOM, wiring check
		Insulation resistance test (Before & after HV test)
		HV test for one minute,
		Operation & interlock check
		Measurement of resistance of main circuit
		Voltage Indication check
		Functional testing of Fault passage Indicator for Alarm
		Primary current injection test for each circuit breaker feeder with relay
		Breaker closing & opening time measurement
		PD Test and CRM phase wise
5.12.0	**Deviations**	
	a) Deviations from this specification shall be listed separately by bidder clause wise (format given below) along with optional offer and has to submit the list along with bid/quotation. BSES will review the deviations and if BSES is agreed with the deviation, seller has to take written confirmation from BSES on deviation during tender evaluation. b) In the absence of any separate list of deviations from the bidders with bid as well as written confirmation from BSES on deviations, it will be assumed by the Buyer that the Seller complies with the Specification fully. c) Any deviations mentioned in any other submitted bid documents (i.e.in filled GTP, Catalog, BSES old approval, buyer's/seller's standards etc) by seller without separate deviation sheets will not consider as a deviation from this tech spec at any stage of contract.	
5.13.0	**Special Technical Requirement**	
5.13.1	Self Powered Relay Protection setting (min 10%)	
5.13.2	NA".	

5.13.3	All the communicable accessories shall have Latch contact
5.13.4	NO/NC contact for manometer shall be provided
5.13.5	Each RMU shall be supplied with 2 sets of Operating Handle
5.13.6	1. Cable termination drawing, cable termination instruction, dia wise bolt tighten torque range chat shall be fixed by sticker inside the termination compartment of each and every RMU. 2. Operation instruction manual of RMU shall be given with each and every RMU by OEM.
5.13.7	In case of Motorized RMU required along with PSS in the place of Manual RMU (If requirement given by BSES),bidder may refer technical specification only for motorized RMU- GN101-03-SP-76-01 or latest version of the same.

5.14.0	**Make List of RMU's Accessories**	
Sl. No.	**Descriptions**	**Make**
1	Relay (Self Power+ AUX DC/AC Supply+ Communicable)	Ashida 241S-761
2	CT	Narayan Power Tech (NPT)/Gilbert Maxwell, 400/75-1/1, 5P10, 2.5 VA, Pragati, Nortex
3	FPI (Both for Earth Fault and Over Current Protection)	EMG/C&S/Schneider/SIEMENS
4	CBCT (Both for Earth fault and Over current protection)	EMG/C&S/Schneider/SIEMENS
5	Boot	3M/Raychem/K.D.Joshi
6	Wire	Polycab/Havells/Finolex/KEI
7	AC & DC MCB	SIEMENS/Havells/C&S/ Schneider
8	Disconnecting type fuses	Connectwell/Wago/Phoenix/Elmex
9	TB (disconnecting type)	Connectwell/Wago/Phoenix/Elmex
10	Vacuum Interrupter	CG/ ABB/Schneider/SIEMENS/other type tested

6.0 11KV XLPE Cable & termination kit

The 11kV XLPE cable connection from RMU to distribution transformer shall be conforming to IS 7098 and shall have all the following features -

6.1	Cable type & size	XLPE insulated armoured / un armoured cable 3C x 150 sqmm to 400 sqmm Aluminium conductor
6.2	Cable voltage grade	11KV

6.3	XLPE insulation thickness	3.14 mm minimum
6.4	Aluminium conductor no of strands	As per Table 2 of IS 8130
6.5	Insulation screen	With semi conducting extrusion, copper tape & water swellable tape
6.6	Type of armour	GI flat as per table 4 of 7098 part 2
6.7	11KV end termination at RMU	By 11kv grade end termination kit, heat shrink type
6.8	11KV end termination at Distribution transformer	By screened separable connector kit suitable for 630 A 'C'-interface epoxy cast bushings.
6.9	Cable support from RMU to transformer HT side cable box	GI cable tray 300mm wide

7.0 Oil Type Sealed Distribution Transformer

7.1.0	Major Design criteria	
7.1.1	Voltage variation on supply side	+ / - 10 %
7.1.2	Frequency variation on supply side	+/ - 5 %
7.1.3	Combined variation of voltage and frequency	- 20 % or + 10 %
7.1.4	Service Condition	Refer Annexure B
7.1.5	Insulation level	
	One minute power frequency withstand voltage	3KV for 415V system & 28KV for 11KV system
	Lightning impulse withstand voltage	75KV peak for 11KV system
7.1.6	Short Circuit withstand level	
	Three phase dead short circuit at secondary terminal with rated voltage maintained on the other side	For 3 sec
7.1.7	Overload capability	As per IS 6600
7.1.8	Noise level	Shall not exceed limits as per NEMA TR-1 with all accessories running measured as per IEC 551 / NEMA standard running measured as per IEC 551 / NEMA standard
7.1.9	Radio Influence Voltage	Maximum 250 microvolt

7.1.10	Harmonic currents	Transformer to be designed for suppression of 3rd, 5th, 7th harmonic voltages and high frequency disturbances.			
7.1.11	Partial Discharges	Transformer to be free from partial discharge up to 120% of rated voltage as the voltage is reduced from 150% of rated voltage i.e. there shall be no significant rise above background level.			
7.1.12	Parallel operation with existing transformer z= 5%	Shall be designed to operate in parallel			
7.2.0	Major Parameters				
7.2.1	Rating	1000KVA/ 630 KVA/ 400 KVA/250 KVA			
7.2.2	Voltage Ratio	11kv / 415 volts			
7.2.3	Vector Group	Dyn11			
7.2.4	Impedance at 75 deg C	4.5 % for 250 KVA 400KVA & 630KVA tolerance as per IS 5% for 1000KVA tolerance as per IS			
7.2.5	Losses at 75 deg C	With ONAN cooling			
7.2.5.1	Total Loss –Max in KW at 50% Load	1000KVA	630KVA	400KVA	250KVA
		2.79	1.86	1.225	0.98
7.2.5.2	Total Loss –Max in KW at 100% Load	1000KVA	630KVA	400KVA	KVA
		7.70	5.30	3.45	2.93
7.2.6	Temperature rise top oil – without enclosure	35 Deg C max over ambient 40 Deg C			
7.2.7	Temperature rise winding – without enclosure	40 Deg C max over ambient 40 Deg C			
7.2.8	Flux density	1.6 Tesla at 100% rated voltage 1.9 Tesla at 112.5% rated voltage			
7.2.9	Current density	3 amp / sqmm for HV & LV winding			
7.2.10	Tapping on HV winding	Off circuit + 5% to -10% in 2.5% step			
7.2.11	Design Clearances	Phase - phase	Phase – earth		
	11kv system	180mm	120mm		
	415v system	25mm	25mm		
7.3.0	Transformer construction				
7.3.1	Type	Double Copper wound, three phase, oil immersed, with ONAN cooling			
7.3.2	Tank	Type tested design			
7.3.2.1	Design	a) Completely sealed type with corrugated fins and without conservator b) Completely oil filled or N2 cushion at top filled with positive pressure. N2 shall be technical grade in			

		accordance with IS:1747 c) With bolted / welded cover
7.3.2.2	Plate / Corrugated fin / tank features	a) Adequate for meeting mechanical & electrical withstand requirements, as per applicable standard. b) The tank and its sealing (gaskets, o-rings, etc.) shall be of adequate strength to withstand positive and negative pressures built-up inside the tank while the transformer is in operation. The maximum pressure generated inside the tank should not exceed 40kPa, positive or negative. c) Corrugated fins shall be built up of CRCA sheets of minimum 1.2mm thick. d) The corrugated tank wall shall ensure sufficient cooling of the transformer and compensate for the changes in the oil volume during operation. e) The transformer shall be capable of giving continuous rated output, without exceeding the specified temperature rise. f) Internal clearance of tank shall be such that, it shall facilitate easy lifting of core with coils from the tank and HV & LV bushings mounted on Top cover. g) All joints of tank and fittings shall be oil tight. The tank design shall be such that the core and windings can be lifted freely with cover. The tank plate shall be of such strength that the complete transformers when filled with oil may be lifted bodily by means of lifting lugs. h) Tanks with corrugations & without conservator shall be tested for leakage at a pressure as per the applicable standard.
7.3.2.3	Material of Construction	Mild steel plate with low carbon
7.3.2.4	Plate Thickness	To meet the requirements of pressure and vacuum type tests as per CBIP manual
7.3.2.5	Welding features	a) All seams and joints shall be double welded b) All welding shall be stress relieved for sheet thickness greater than 35 mm c) All pipes, stiffeners, welded to the tank shall be welded externally d) All corrugated fins or expansion bellows provided shall be double welded.

7.3.2.6	Tank features	a) Bottom with stiffeners & adequate space for collection of sediments b) No external pocket in which water can lodge c) Tank bottom with welded skid base d) Strength to prevent permanent deformation during lifting, jacking, transportation with oil filled. e) Minimum disconnection of pipe work and accessories for cover lifting f) Tank to be designed for oil filling under vacuum g) Tank cover fitted with lifting lug
7.3.3	Inspection cover for bushing & Core / Wind	As per manufacturer standard
7.3.4	Fittings and accessories on main tank	As per clause 7.3.0
7.3.5	Core	
7.3.5.1	Material	High grade , non ageing, low loss, high permeability, grain oriented, cold rolled silicon steel lamination
7.3.5.2	Grade	Minimum M3 or better
7.3.5.3	Core Design Features	a) Magnetic circuit designed to avoid short circuit paths within core or to the earthed clamping structures. b) Magnetic circuit shall not produce flux components at right angles to the plane of lamination to avoid local heating. c) Least possible air gap and rigid clamping for minimum core loss and noise generation. d) Adequately braced to withstand bolted faults on secondary terminals without mechanical damage and damage/ displacement during transportation and positioning. e) Percentage harmonic potential with the maximum flux density under any condition limited to avoid capacitor overloading in the system. f) All steel sections used for supporting the core shall be thoroughly sand blasted after cutting, drilling, welding. g) Provision of lifting lugs for core coil assembly. h) Supporting framework designed not to obstruct complete drainage of oil from transformer i) Core shall be in the form of step and stack in three limb format . Note: No wound core shall be acceptable
7.3.6.0	Winding	

7.3.6.1	Material	Electrolytic Copper
7.3.6.2	Maximum Current Density allowed	Maximum 3 amp / sqmm
7.3.6.3	Winding Insulating material	Class A, non catalytic, inert to transformer oil, free from compounds liable to ooze out, shrink or collapse.
7.3.6.4	Winding Insulation	Uniform
7.3.6.5	Design features	a) Type of winding **:** LV: Spiral/Helical HV: Crossover/Disc Note: No foil winding shall be acceptable b) Stacks of winding to receive adequate shrinkage treatment. c) Connections braced to withstand shock during transport, switching, short circuit, or other transients. d) Minimum out of balance force in the winding at all voltage ratios. e) Conductor width on edge exceeding six times its thickness. f) Transposed at sufficient intervals. g) Coil assembly shall be suitably supported between adjacent sections by insulating spacers + barriers. h) Winding leads rigidly supported, using guide tubes if practicable. i) Winding structure & insulation not to obstruct free flow of oil through ducts. j) Delta connection shall be done using Flexible cable.
7.3.7.0	Transformer Oil	As per Annexure – C, Class 1 new mineral insulating oil, shall be certified not to contain PCBs. Naphthalene base with anti oxidant inhibitor subject to Purchaser's specification in Annexure - C
7.3.8.0	Bushings and Terminations	
7.3.8.1	Type of HV side bushing	Epoxy cast bushing, 630 Amp, interface type 'C' as per EN50180 and EN50181.
7.3.8.2	Type of LV side bushing	Indoor, Epoxy resin cast, 1kv voltage class and creepage 31mm/KV
7.3.8.2.1	Essential provision for LV side line bushing	It shall be complete with copper palm suitable for tinned copper bus bar of size 100x12 mm
7.3.8.2.2	Essential provision for LV side neutral bushing	In case of neutral bushing the stem and bus bar palm shall be integral without bolted, threaded, brazed joints. Bus bar size shall be 100x12 mm
7.3.8.3	Arcing Horns	Not required

7.3.8.4	Support insulators inside HV cable box if provided	Epoxy resin cast, 12KV rated voltage
7.3.8.5	Termination on HV side bushing	Cable connection by screened separable connector kit.
7.3.8.6	Termination of LV side bushing	Bus bar connection
7.3.8.7	Minimum creepage distance of all bushings and support insulators.	31mm/kv
7.3.8.8	Protected creepage distance	At least 50 % of total creepage distance
7.3.8.9	Continuous Current rating	Minimum 20 % higher than the current corresponding to the minimum tap of the transformer
7.3.8.10	Rated thermal short time current	26.3kA for 3 sec
7.3.8.11	Atmospheric protection for clamp and fitting of iron and steel	Hot dip galvanizing as per IS 2633
7.3.8.12	Bushing terminal lugs in oil and air	Tinned copper
7.3.8.13	Sealing washers /Gasket ring	Nitrile rubber/ Expanded TEFLON (PTFE) as applicable
7.3.9.0	HV cable box	N.A
7.3.9.1	Material of Construction	N.A
7.3.9.2	Cable entry	As per design
7.3.9.3	Cable size for HV	3C X150sqmm A2XWY 11KV
7.3.9.4	Connection on LV phase	Bus bar 100x12mm copper
7.3.9.5	Bus bar size for LV Neutral	Same as phase bus
7.3.9.6	Detachable Gland Plate material for HV cable box	N.A
7.3.9.7	Gland plate thickness for HV	N.A
7.3.9.8	Cable gland for HV	N.A
7.3.9.9	Cable lug for HV	Suitable for cable 3CX150 mm^2 11KV
7.3.9.10	Essential parts for HV cable box	N.A
		a) Flange type removable front cover with handles min two no's b) Tinned Cu Bus bar c) Earthing boss for the HV cable box. d) Earthing link for the gasketed joints at two point for each joint

		e) Earthing provision for cable Armour/ Screen f) Drain plug g) Danger / caution plate
7.3.9.11	Terminal Clearances HV phase – phase & phase - earth	180mm / 120mm
7.3.9.12	Termination height required for cable termination	750mm
7.3.10.0	Current Transformers	
7.3.10.1	Requirement	All three phases and neutral on LV side
7.3.10.2	Mounting	LV side bushings on all three phases and neutral with the help of fibre glass mounting plate affixed to main tank by nut bolt arrangement
7.3.10.3	Maintenance requirements	Replacement should be possible by removing fixing nut of mounting plate without disturbing LT bushing
7.3.10.4	Accuracy Class & ISF	0.5s / 10
7.3.10.5	Burden	5 VA
7.3.10.6	Type	Resin Cast Ring type suitable for outdoor use
7.3.10.7	CT ratio	a) 250 KVA-400/5 Amps b) 400/630KVA -1000/5 Amps c) 1000KVA -1500/5 Amp
7.3.11	Off Circuit tap Switch	On HV winding
7.3.11.1	Range /Step	+ 5 % to -10% in steps of 2.5 %
7.3.11.2	Type	Rotary type, 3 pole gang operated,
7.3.11.3	Operating Voltage	11kV
7.3.11.4	Rated Current for tap Switch	a) 100amp for 1000KVA /630KVA b) 60 amps for 400KVA /250KVA
7.3.11.5	Operating Handle	External at suitable height to be operated from ground level.
7.3.11.6	Tap position indicator	With direction changing facility, locking arrangement, caution plate metallic fixed by rivet.
7.3.12	Pressure Relief Device	Required
7.4.0	Hardware	
7.4.1	External	Stainless Steel
7.4.2	Internal	Cadmium plated except special hardware for frame parts and core assembly as per manufacturer's design
7.5.0	Gasket	
7.5.1	For Transformer, surfaces interfacing with oil like inspection cover etc.	Nitrile rubber based / cork
7.5.2	For Cable boxes,	Neoprene rubber

	Marshalling box, etc.	
7.6.0	Valves	
7.6.1	Material of construction	Brass / gun metal
7.6.2	Type	Both end flanged gate valve / butterfly valve depending on application
7.6.3	Size	As per manufacturer's standard
7.6.4	Essential provision	Position indicator, locking rod, padlocking facility, valve guard, cover plate.
7.7.0	Painting of transformer.	
7.7.1	Surface preparation	By shot blasting method
7.7.2	Finish on internal surfaces of the transformer	Bright Yellow heat resistant and oil resistant paint two coats. Paint shall neither react nor dissolve in hot transformer insulating oil.
7.7.3	Finish on outer surface of the transformer-frame parts	Battle ship Grey shade 632 Poly urethane paint two coats, minimum dry film thickness 80 microns
7.8.0	Fittings & accessories	
7.8.1	Rating and Diagram Plate	Required
7.8.1.1	Material	Anodized aluminium 16SWG
7.8.1.2	Background	SATIN SILVER
7.8.1.3	Letters, diagram & border	Black
7.8.1.4	Process	Etching
7.8.1.5	Rating and Diagram Plate details	

		a) Following details shall be provided on rating and diagram plate as a minimum. b) Type/kind of transformer with winding material. c) IS/ IEC standard to which it is manufactured. d) Manufacturer's name. e) Transformer serial number. f) Month and year of manufacture. g) Rated frequency in HZ. h) Rated voltages in KV. i) Number of phases. j) Rated power in KVA. k) Type of cooling (ONAN). l) Rated currents in Amp. m) Vector group connection symbol. n) 1.2/50µs wave impulse voltage withstands level in KV. o) Power frequency withstands voltage in KV. p) Impedance voltage at rated current and frequency in percentage at principal, minimum and maximum tap q) Load loss at rated current. r) No-load loss at rated voltage and frequency s) Continuous ambient temperature at which ratings apply in deg c t) Top oil and winding temperature rise at rated load in deg c; u) Winding connection diagram with taps and table of tapping voltage, current and power v) Transport weight of transformer w) Weight of core and windings x) Total weight y) Volume of oil z) Weight of oil aa) Name of the purchaser bb) PO no and date cc) Guarantee period
7.8.2	Terminal marking Plate for Bushing, anodized aluminium black lettering on satin silver background both inside cable boxes near termination and on cable box cover (all fixed by rivet)	Required

7.8.3	Company Monogram Plate fixed by rivet	Required
7.8.4	Lifting Lug to lift complete transformer with oil	Required
7.8.5	Lifting lug for top cover	Required
7.8.6	Lashing Lug	Required
7.8.7	Jacking Pad with Haulage hole to raise or lower complete transformer with oil	Required
7.8.8	Detachable Bidirectional flat roller Assembly	Required
7.8.9	Pockets for ordinary thermometer on tank cover with metallic identification plate fixed by rivet.	Required
7.8.10	Drain valve (gate valve) for the main tank with cork above ground by 150mm minimum with padlocking and valve guard with metallic identification plate fixed by rivet.	As per manufacturer design
7.8.11	Filter valve (gate valve) at top with padlocking and valve guard with metallic identification plate fixed by rivet.	As per manufacturer design
7.8.12	Air Release Plug on tank cover with metallic identification plate fixed by rivet.	As per manufacturer design
7.8.13	Oil level indicator with low level switch	As per manufacturer design
7.8.14	Earthing pad on tank for transformer earthing complete with non ferrous nut bolt, washers, spring washers etc. with metallic identification plate fixed by rivet	Required
7.8.15	Rain hood for vertical gasket joints	Desirable

7.8.16	Earthing bridge by copper strip jumpers on all gasket joints at at least two points for electrical continuity	Required
7.8.17	Skid base welded type with haulage hole	Required
7.8.18	Core , Frame to tank Earthing	Required
7.8.19	Danger plate made of Anodized aluminum with white letters on red background on Transformer, cable boxes (all fixed by rivet)	Required
7.8.20	Caution plate for Off Circuit tap changer fixed by rivet.	Required
7.8.21	Pressure Relief Device	Required
7.8.22	Gas-inlet valve of non-return type	Required (for transformers with nitrogen blanket above oil)
7.8.23	User manual for Hermetically Sealed Transformers must be provided for review as a part of the technical proposal. The manual must be provided with, but not limited to, maintenance schedule, frequency & method of oil-sampling, procedures for oil-filling & oil-filtration, etc.	Required

8.0 Dry Type Transformer (1000KVA/ 630KVA/ 400KVA/250 KVA)

8.1.0	Major Design criteria	
8.1.1	Voltage variation on supply side	+ / - 10 %
8.1.2	Frequency variation on supply side	+/ - 5 %
8.1.3	Transient condition	- 20 % or + 10 % combined variation of voltage and frequency

8.1.4	Service Condition	Refer Annexure B, the transformer enclosure in PSS is to be designed for outdoor location with service condition as specified, but its full rating shall be available if located indoor in poorly ventilated atmosphere
8.1.5	Insulation Level	
	One minute power frequency withstand voltage	28KV for 11KV system & 3KV for 415 V system
	Lightning impulse withstand voltage	75KV peak for 11KV system
8.1.6	Short Circuit withstand Capacity of the transformer	
8.1.6.1	Three phase dead short circuit at secondary terminal with rated voltage maintained on the other side	For 3 secs.
8.1.6.2	Single phase short circuit at secondary terminal with rated voltage maintained on other side voltage maintained on other side	For 3 secs.
8.1.7	Overload capability	As per IEC 60905
8.1.8	Noise level	Shall not exceed limits as per NEMA TR-1 with all accessories running measured as per IEC 551 / NEMA standard
8.1.9	Radio Influence Voltage	Maximum 250 Microvolt
8.1.10	Harmonic currents	Transformer to be designed for suppression of 3rd, 5th, 7th harmonic voltages and high frequency disturbances.
8.1.11	Partial Discharges	Transformer to be free from partial discharge upto 120 % of rated voltage as the voltage is reduced from 150 % of rated voltage i.e. there shall be no significant rise above background level
8.1.12	Parallel operation	Shall be designed to operate in parallel with existing transformer. Details of existing transformers shall be forwarded to the bidder on request
8.1.13	Fire Protection Class	Class F1 shall be required
8.1.14	Climate Class	Class C2 shall be required
8.1.15	Environment Class	Class E2 shall be required Transformer shall be E2C2F1 certified
8.2.0	Major Parameters	
8.2.1	Rating	1000KVA/ 630KVA/ 400KVA/250 KVA

8.2.2	Voltage Ratio	11kv / 415 volts			
8.2.3	Vector Group	Dyn11			
8.2.4	Impedance	5%, tolerance as per IS			
8.2.5	Losses at 130 deg C				
8.2.5.1	No load Loss –Max in KW	1000 KVA	630 KVA	400 KVA	250 KVA
		1.78	1.2	0.9	0.7
8.2.5.2	Load losses at principal tap- Max in KW	1000 KVA	630 KVA	400 KVA	250 KVA
		7.5	5.4	3.4	2.2
8.2.6	Temperature rise winding	Outside PSS without enclosure		Inside PSS max.	
		80°C		90°C	
8.2.7	Flux density	Maximum flux density at 10 % over excitation /overfluxing-1.73 Tesla maximum			
8.2.8	Tapping on HV winding	Off Circuit taps on HV winding , + / - 10 % in steps of 2.5 % , change of taps by link			
8.2.9	Design Clearances	Phase – phase		Phase – earth	
	11KV system	180mm		120mm	
	415V system	25mm		25mm	
	415V system	25mm		25mm	
8.3	Construction & Design				
8.3.1	Core				
8.3.1.1	Material	High grade , non ageing, low loss, high permeability, grain oriented, cold rolled silicon steel lamination			
8.3.1.2	Grade	Premium grade minimum M3 or better			
8.3.1.3	Lamination thickness	0.23mm (Max)			
8.3.1.4	Design Flux Density at rated conditions at principal tap	1.6 Tesla			
8.3.1.5	Maximum Flux Density at 10 % over excitation / over fluxing	1.73 Tesla maximum allowed			
8.3.1.6	Core Design Features	a. All steel sections used for supporting the core shall be thoroughly sand blasted after cutting, drilling, welding. b. Core shall be in the form of step and stack in three limb format Note: No wound core shall be acceptable c. Provision of lifting lugs for core coil assembly			
8.3.2	Winding				
8.3.2.1	Material	Electrolytic Aluminum			

8.3.2.2	Maximum Current Density allowed	Maximum allowed 1.5 A per sqmm
8.3.2.3	Winding Insulating material	Class F minimum, free from compounds liable to ooze out, shrink or collapse. Uniform insulation shall be applied to the windings and overall winding shall be epoxy cast resin
8.3.2.4	Tapping	Off Circuit taps on HV winding , + / - 5 % in steps of 2.5 % , change of taps by link
8.3.2.5	Essential provision for tap links	Shall be shrouded with cover made from insulating material. To prevent deposit of dust.
8.3.2.6	Design features	a) Stacks of winding to receive adequate shrinkage treatment b) Connections braced to withstand shock during transport, switching, short circuit, or other transients. c) Minimum out of balance force in the transformer winding at all voltage ratios. d) Conductor width on edge exceeding six times its thickness e) The termination bus-bar coming out from winding shall be tinned Copper f) Transposed at sufficient intervals. g) Threaded connection with locking facility. h) Winding leads rigidly supported, using guide tubes if practicable i) Provision of taps as indicated in the technical particulars
8.3.2.7	Essential provision of HV and LV winding leads	Phase marking required near termination on both HV and LV side. Phase colour coding required on insulating sleeves on both HV and LV side. Phase sequence 1U, 1V, 1W from left to right looking inside from the HV side door. Phase sequence 2n, 2u, 2v, 2w from right to left looking inside from LV side door Adequate HV termination clearance. Provision of check nut in all HV and LV winding lead connection.
8.3.3	Vibration Isolator	Vibration isolation pads shall be installed between core and coil assembly and enclosure base assembly to prevent the transmission of structure borne vibrations.
8.3.4	Bushings/Support Insulator/ terminations	
8.3.4.1	Type of HV and LV Bushings, support insulators	Epoxy Resin Cast

8.3.4.2	Minimum Creepage of bushings and support Insulators	31 mm / kV
8.3.4.3	Arcing horns	Not required
8.3.4.4	Termination on HV side	By cable within main enclosure by separable connector
8.3.4.5	HV side cable size	11 kV (E) grade , A2XCEWY 3C x 150 sqmm
8.3.4.6	Cable lugs	Long barrel medium duty Aluminium lug with knurling on inside surface. and suitable for cable size for 11 kV (E) grade , A2XCEWY 3C x 150 sqmm
8.3.4.7	HV side bushing	Epoxy cast bushing, 630 Amp, interface type 'C' as per EN50180 and EN50181.
8.3.4.7	Termination on LV side	Suitable bus bar as per PSS spec
8.3.5	Current Transformers	
8.3.5.1	Mounting	On LV side terminal busbars on all three phases and neutral with the help of fibre glass mounting plate
8.3.5.2	Maintenance requirements	Replacement should be possible without dismantling LV side support insulators
8.3.5.3	Accuracy Class	0.5s
8.3.5.4	Burden	5VA
8.3.5.5	Type	Resin Cast Ring type suitable for outdoor use
8.3.5.6	CT ratio	a) 250 KVA-400/5 Amps b) 400/630KVA -1000/5 Amps c) 1000KVA -1500/5 amp
8.3.6	Hardware	
8.3.6.1	External	Stainless Steel only
8.3.6.2	Internal	Cadmium plated except special hardware for frame parts and core assembly as per manufacturer's design
8.4	Gasket	Neoprene rubber based gasket across all doors & covers
8.5	Control cable specification (to be used by the vendor)	PVC insulated, extruded PVC inner sheathed, FRLS , armoured, extruded PVC outer sheathed 1100 V grade control cable as per latest edition of IS 1554 part 1 minimum 2.5 sqmm for signals and 4 sqmm for CT with multistrand copper conductor
8.6	Terminal Blocks to be used by the vendor	Nylon 66 material, minimum 4 sq mm, screw type for control wiring and potential circuit.
8.6.1	Essential provision for CT terminals	Sliding link type disconnecting terminal block screwdriver operated stud type with facility for CT terminal shorting material of housing melamine/ Nylon66
8.7	Painting of WTI box	
8.7.1	Surface preparation	By 7 tank pre-treatment process or shot blasting method
8.7.2	Finish on internal / external surfaces	Polyurethane based painting, min. Dry film thickness 80 microns

8.7.3	Insulating support material for base plate for mounting components	Bakelite shall not be used as a base plate for mounting any components, insulating material non hygroscopic insulating material like FRP shall be used.
8.8	Minimum Protective devices on Transformer	
8.8.1	Surge Arrestor	Required, Connected on Transformer Primary side on all three phases
8.8.1.1	Type	Metal oxide
8.8.1.2	Housing	Polymeric preferable
8.8.1.3	Rating	9 KV.
8.8.1.4	Continuous operating voltage , kV rms	6.35
8.8.1.5	Maximum Continuous operating voltage, kV rms	7.65
8.8.1.6	Nominal Discharge Current, kA peak	10
8.8.1.7	Energy Absorption Capability, kJ/kV	Greater than 2.5
8.8.1.8	Creepage factor	31 mm /kV
8.8.1.9	Reference std	IS 3070 part 3 and IEC 99-4
8.8.2	Winding Temperature scanner	Required
8.8.2.1	No of RTD inputs	Five (Three for windings, one for enclosure & one shall be spare) RTD for enclosure temperature monitoring shall be fixed at enclosure Top from inside to give max enclosure temp reading & shall be wired up to temp. scanner to indicate the reading
8.8.2.1.1	Location of winding RTD	At location of winding where maximum temperature is expected.
8.8.2.2	No of potential free trip contacts	Two
8.8.2.3	No of potential free Alarm contacts	Two
8.8.2.4	Auxiliary supply	240 V AC, 1 phase, 50 Hz. Tapped from LV side busbar through a MCB located inside box
8.8.2.5	Winding Temperature Scanner terminal Box	Required
8.8.2.5.1	Size	As per Manufacturer's Standard
8.8.2.5.2	Fixing of instrument within box	On base plate
8.8.2.5.3	Fixing of terminals within the box	On C channel available with the terminals
8.9	Fitting and accessories	

8.9.1	Rating & Diagram plate	Required
8.9.1.1	Material	Anodized aluminum 16SWG
8.9.1.2	Background	SATIN SILVER
8.9.1.3	Letters, diagram & border	Black
8.9.1.4	Process	Etching
8.9.1.5	Name plate details	Following details shall be provided on rating and diagram plate as a minimum a) Type of transformer i.e cast resin or VPI etc. With winding material b) IS / IEC standard to which it is manufactured c) Manufacturer's name; d) Transformer serial number; e) Month and year of manufacture f) Rated frequency in HZ g) Rated voltages in KV h) Number of phases i) Rated power in KVA j) Type of cooling k) Rated currents in a l) Vector group symbol m) 1.2/50µs wave impulse voltage withstand level in KV n) Power frequency withstand voltage in KV o) Impedance voltage at rated current and frequency in percentage at principal, minimum and maximum tap at highest temperature p) Load loss at rated current at highest temperature q) No-load loss at rated voltage and frequency r) Auxiliary loss s) Continuous ambient temperature at which ratings apply in c t) Winding connection diagram with taps and table of tapping voltage, current and power u) Transport weight of transformer v) Weight of core and windings w) Weight of enclosure and fittings x) Total weight y) Tapping details z) Phase ct details aa) Class of insulation bb) IP protection rating of the enclosure cc) Name of the purchaser dd) Po no and date ee) Guarantee period

8.9.2	Detachable Bi-directional flat Roller Assembly	Required
8.9.2.1	Roller center to center distance	Minimum 900 mm on the side of HV and LV termination Maximum 800 mm on the other side (perpendicular to HV, LV termination). and LV termination Maximum 800 mm on the other side (perpendicular to HV, LV termination).
8.9.2.2	Essential provision	Roller dia. 150 mm min., roller to be fixed in such a way so that the lowermost part of the skid is above ground by at least 100 mm when the transformer is installed on roller.
8.9.3	Earthing pad on enclosure for transformer earthing complete with Stainless Steel nut, bolt, washers, spring washers etc.	Required with identification plate on outside of enclosure.
8.9.4	Core, Frame to tank Earthing	Required
8.9.5	Off Circuit tapping link	Required
8.9.6	Tap link position plate	Required inside HV side door
8.9.7	Danger plate made of Anodized aluminium with white letters on red background on HV and LV side	Required
8.9.8	Skid with Haulage lugs	Required
8.9.9	Lifting lugs for complete transformer as well as enclosure	Required
8.9.9.1	Essential provision for lifting lugs	Lifting lugs for core coil assembly shall be provided in such a way that the weight shall not come on canopy while lifting Lifting lugs for canopy/ enclosure shall be provided in such a way that the weight shall not come on canopy while lifting , it shall be borne by supporting members.
8.9.10	Caution Plate for tap links	Required
8.9.11	Ventilation louvers with stainless steel wire mesh and rain water guard	Required as per Manufacturer's design, but it is to be provided minimum required preventing ingress of excessive dust.
8.9.12	Surge Arrestor & its Grounding bushing	Required

8.9.12.1	Essential provision	Surge arrestor shall be erected vertically in such a way that the surge arrestor can be removed at site without removing HV cable lug. Surge arrestor shall not be used for any kind of support. Surge arrestor grounding strip to be routed to the surge arrester grounding bushing near bottom of enclosure with proper support. Surge arrestor grounding bushing shall be identified by identification plate on outside of enclosure. Surge arrestor grounding bushing shall be supplied with all hardware to readily connect purchaser's ground lead.
8.9.13	LV additional neutral earthing bushing	Required
8.9.13.1	Essential provision	Busbar connecting the neutral to additional neutral bushing shall be properly supported and additional neutral bushing shall be identified by identification plate on outside of enclosure. Additional neutral bushing shall be supplied with all hardware to readily connect purchaser's ground lead.
8.9.14	Winding temperature scanner	Required
8.9.15	RTD in Winding and near top of enclosure.	Required
8.9.16	Space heater inside enclosure	Thermostatically controlled space heater inside enclosure required, supply of space heater from feeder pillar through MCB fixed properly inside enclosure.
8.9.1	Mounting of space heater	By suitable spacers so that heater does not come in contact with panel wall directly.
8.9.17	Copper earthing link	Across all gasketted joints in the enclosure body.

9.0 Low Voltage Bus bar system

9.1	LV bus bar	From transformer LV bushing to ACB and from ACB to MCCBs
9.2	Type of connection on transformer	By flexible copper link rated 1600Amp
9.3	Bus bar size for phase & neutral	a) 100x12 mm tinned copper / Eqvt Size Aluminum. b) Connection to each MCCB by 40x6 tinned copper bar.
9.4	Bus bar support insulators	1 KV voltage class, SMC epoxy
9.5	Insulator creepage distance	31mm / KV
9.6	Bus bar sleeve insulation	Color coded, for 1kv
9.7	Bus bar rated current	Type I & II:1600 Amp Type III:1250 Amp

		Type IV : 500 Amp
9.8	Bus bar short circuit withstand	27.7kA for 1 sec
9.9	Maximum temperature rise	20º C

10.0 Low voltage switchgear, ACB, MCCB & Fuses

10.1.0	Air Circuit Breaker (ACB)	Fixed type 4 pole
10.1.1	ACB - On & OFF operation	Manual as well as electrical by spring charged mechanism
10.1.2	ACB operating mechanism	Trip free, anti pumping type
10.1.3	Spring charging method	Manual as well as electric motor
10.1.4	Spring charging motor supply	1 ph 240V tapped from LV bus bar
10.1.5	Close & trip coil supply	1 ph 240V tapped from LV bus bar
10.1.6	ACB Neutral connection	Fully isolable link sized for 1600 / 1250 / 400 amp
10.1.7	ACB rated voltage	415v +/- 10% at 50Hz
10.1.8	ACB rated current	1600 / 1250 / 400 amp continuous
10.1.9	ACB rated 3 phase short circuit breaking capacity Ics = Icu	50kA minimum at 415v and 50Hz
10.1.10	ACB rated 3 phase short circuit withstand capacity, Icw	50kA for 1sec
10.1.11	ACB SC making current capacity	100kA peak
10.1.12	ACB rated insulation level	1000volt
10.1.13	ACB mechanical & electrical endurance	As per IS 13947 / IEC
10.1.14	ACB utilization category as per IS	B
10.1.15	ACB indications	ON, OFF & TRIP
10.1.16	ACB operation - manual	ON, OFF by push buttons
10.1.17	ACB operation - electrical	ON, OFF by TNC switch
10.1.18	ACB overload, short circuit & earth fault protection	By micro processor based releases
10.1.19	Operation counter	4 digit minimum , Non reversible

10.1.20	Multifunction meter	Digital CTR & PTR programmable
10.1.21	Display & Event log	Display type LT ACB required with Min. 10 nos previous fault event log
10.2.0	MCCB	For outgoing feeders – 400A 07 no for Type I PSS, 05+02* no's for type II PSS& 03+02* no's for Type III PSS 02 nos for type IV PSS APFC system – 1 no. 630 Amp *Spare Outgoings - Provisions shall also be made in LT panel to increase LT outgoing by 02 no's by adding MCCB's in future.
10.2.1	MCCB type	3 pole, one break per pole, Utilization category B
10.2.2	MCCB - On & OFF operation	Manual by handle
10.2.2(i)	MCCB design ambient temperature	50deg C
10.2.2(ii)	MCCB Housing	Thermoplastic material resistant to fire & abnormal heat , non hygroscopic
10.2.2(iii)	MCCB Terminal	Silver coated copper with phase barriers, spreader terminals & shrouds
10.2.2(iv)	MCCB Spreader size & material	Minimum-50(W)X50(L)X10(D)mm- Cu suitable for bimetallic joint i.e. for aluminium bus/cable lug
10.2.2(v)	De-rating at 50Deg ambient temperature	No derarting (0%)
10.2.3	MCCB rated 3 phase short circuit breaking capacity Ics = Icu	36kA minimum at 415v and 50Hz
10.2.4	MCCB rated 3 phase short circuit withstand capacity, Icw	8kA for 1sec
10.2.5	MCCB SC making current capacity	75kA peak
10.2.6	MCCB rated insulation level	1000V
10.2.7	MCCB mechanical & electrical endurance	As per IS 13947 / IEC
10.2.8	MCCB utilization category	B as per IS / IEC 947
10.2.9	MCCB indications	ON, OFF & TRIP
10.2.10	MCCB protection	Microprocessor based release + earth fault
10.2.10(i)	Tripping characteristic required	
a	Overload setting	Range 60-100%In (Set on 95%)

b	Short Circuit setting	Range 200-1200%In (Set on 300%)
c	Earth fault setting	To be provided
10.2.11	MCCB Clearances in air	As per table XIII of IS 13947-1
10.2.12	MCCB temperature rise limits	As per table 2 & 3 of IS 13947-1
10.2.13	MCCB Ingress Protection	IP2X Minimum (pollution degree minimum 2)
10.2.13(i)	MCCB additional features	Sealing/padlocking of operating knob in OFF position Sealing/padlocking of operating knob in OFF position isolation suitable with positive contact
10.2.14	Connection to ACB main bus	By Cu bar with double PVC insulation For 400 amp MCCB / fuse – 40x6 mm For 630 amp MCCB – 50x10 mm
10.2.15	Connection to outgoing cables	By terminals suitable for 2X4CX300sqmm , A2XFY 1100 volt grade cable

11.0 Automatic Power Factor Correction system

The APFC equipment shall be located in LV compartment of package enclosure either as a separate panel or integrated along with LV Switchgear and shall have all the following features –

11.1	APFC Output	Type I :300 KVAR @ 400 V However APFC should be rated at 440 V. Manufcatuerer needs to spcify rated output @ 440V.
11.2	APFC mounting	All components mounted in shelf type arrangement on package substation enclosure LV compartment wall or RMU compartment wall or Part of LT Panel
11.3	APFC relay & data logger	Mounted on base plate supported on compartment wall by three hinges
11.4	APFC system bus bar power connection to transformer LT side	By 4CX300sqmm AYFY 1100v grade cable to or Bus Bars
11.5	APFC system bus bar size	50x10mm tinned copper mounted on SMC insulators 1100V grade
11.6	APFC system CT input signal	From CT on transformer LV side by 7CX2.5sqmm YY 1100V grade cable
11.7	APFC capacitor modules	Type I:12x25KVAR three phase compensation Type II & III:8x25KVAR three phase compensation
11.8	Capacitor duty contactor for each capacitor module	Utilization category 6b as per IS
11.9	MCCB for each capacitor module	100amp, Three Pole, Ics=Icu=35kA

11.10	Connection to each MCCB from APFC system bus	By 35sqmm copper wire double insulated with tinned copper lugs
11.11	APFC control supply	Through 415/240v transformer, 2amp / 6amp SP MCB
11.12	APFC relay	Microprocessor based relay for automatic control of minimum 12 capacitors in sequential or cyclic switching fashion with settable time delay 0 -180 sec
11.13	APFC relay LCD display with self monitoring feature	To show no. of capacitors energized, actual PF & target PF, voltage & current
11.14	Target power factor setting range	0.8 lag to 0.9 lead in steps of 0.1
11.15	APFC relay sensing	3 phase CT input 5 amp to sense max load current
11.16	No volt protection in relay	To switch OFF all capacitors
11.17	Capacitor unit 25KVAR type	Double layer All Poly Propylene (APP) or Mixed Poly Propylene (MPP)
11.18	Capacitor unit construction	1.5mm thick sheet metal welded tank or Al cylindrical construction
11.19	Capacitor unit impregnant	Dry type filler or non PCB liquid
11.20	Capacitor unit conducting layer	Al foil or metalized film
11.21	Capacitor sealing	Hermetic sealing after vacuum process
11.22	Capacitor unit safety	Pressure sensitive dis-connector or internal fuse for each element
11.23	Discharge resistor	Between all three phases of capacitor unit, to reduce the voltage across the capacitor to 50V or less in one minute
11.24	Terminal bushings	For rated voltage class 1 KV Suitable wires / terminals brought out from capacitor unit is also acceptable.
11.25	Earth connection for individual capacitor container	To be done & connected to main earth bus bar of the panel
11.26	APFC Operational features	
11.26.1	Automatic power factor correction	To achieve target lagging power factor without hunting
11.26.2	Operation for rated output	At continuous rated voltage (440 V) & frequency (50 Hz)
11.26.3	Operation with over voltage	115% of rated voltage for 12 hours in a day
11.26.4	Operation with harmonic distortion	THD voltage – 5% & THD current 3%

11.26.5	Maximum permissible over current	1.3 times rated current, continuous
11.26.6	Dielectric loss	0.2 watt per KVAR maximum
11.26.7	Temperature Category & Maximum temperature rise	- 5 / 60 deg C Not exceeding 10 deg C over 60 deg C.
11.26.8	Residual voltage after disconnection from mains	50 volts maximum after 60 seconds
11.26.9	Design life of capacitor unit	Minimum 10 years
11.27.0	Data Logger	(approved by requisite authority / Electrical inspector)
11.27.1	General	Accuracy class 0.5, microprocessor based with LCD display, with 3 CTs for measurement of cumulative KWH, power factor, voltage & current of transformer secondary, THD of voltage.
11.27.2	Data logging and Software	Data logging of KWH value at every 30 minutes to give cumulative reading of KWH for 45 days minimum, data downloadable in ASCII-II or MS Excel format. Software for downloading the data from data logger to be provided by data logger vendor.
11.27.3	Display and communication	Display of DATE, TIME, station ID -Display & log power parameters phase wise & total (load current, kVA, kW & PF). -Display & log kVAr phase wise & total. -Display TDH V or current. -The logger shall be with built in communication facility of RS485 / RS232 to down load all parameters on demand.

12.0 Energy Meter Box

12.1	Energy meter	In the scope of purchaser
12.2	Location	To be provided mounted on enclosure wall in LV compartment.
12.3	Energy meter box Size	650 mm height x 450 mm width x 275 mm depth.
12.4	Box door design	With antitheft hinge, padlock facility, door fixed by stainless steel Allen screw M6 size.
12.5	Fixing of energy meter within box	On slotted horizontal channel 40 x 12 mm size, channel shall be movable on vertical slotted angle 40 x 40 mm size at two ends.
12.6	Meter reading window	Front door shall be with acrylic sheet for viewing the energy meter.
12.7	Sealing arrangement	02 no's sealing arrangement shall be provided on meter box's door.

12.8	Data downloading port	Slot shall be provided on door of meter box for fixing 9 pin DB connector (RS232 serial port)
12.9	Test Terminal Block	No Test terminal block shall be provided.
12.10	Cables and wires	PVC insulated, extruded PVC inner sheathed, armored, extruded PVC outer sheathed 1100 V grade control cable as per latest edition of IS 1554 part 1 minimum 2.5 sq mm for PT and 4 sq mm for CT with multi strand copper conductor.
12.11	Cable Glands	Nickel plated brass double compression weatherproof cable gland.
12.12	Wiring diagram	To be fixed on the back of door along with CT spec. etched on Anodised Aluminium plate fixed by rivet.
12.13	CT / PT Secondary wires	All CT and PT's Secondary wires shall be routed through metallic conduit. All secondary wires shall be bunched and kept for termination without any terminal/ TTB in between.

13.0 Enclosure for packaged substation

13.1	Service conditions	For outdoor use
13.2	Material for enclosure	Galvanised Sheet steel 2mm thick with outer finish painting
13.3	Enclosure construction	Frame supported construction with all doors, covers welded with steel channel ribs at every 1000mm minimum
13.4	Lifting lugs for site handling / lifting by crane	Four numbers on top to enable lifting of total package unit without any problem
13.5	Doors for RMU compartment & LV compartment	With internal anti theft hinge with minimum opening angle of 120º , minimum 3 nos., with lockable handle & with padlocking facility
13.6	Two side covers for transformer compartment	Bolted with Allen head type bolts to main frame
13.7	Top & other side walls of package substation enclosure	Welded sheet metal to main frame
13.8	Removable canopy above top cover	2mm thick sheet metal with 10º slope
13.9	Enclosure integral steel base frame	'I' section of suitable size to support total static and dynamic load
13.10	Base frame bottom support pads for fixing by bolt to foundation	Minimum six numbers to rest on foundation

13.11	Enclosure compartments	Separate compartments for RMU, transformer & LV switchgear/APFC
13.12	Separation between RMU & transformer compartment	By sheet steel 2mm thick
13.13	Separation between transformer compartment & LV compartment	By sheet steel 2mm thick
13.14	Degree of ingress protection against solids & water as per IS12063	• IP53 for RMU compartment • IP 34 for transformer compartment • IP54 for LV compartment
13.15	Louvers on side covers of transformer compartment & side walls of LV compartment	To be provided with steel wire mesh welded from inside so as to meet IP requirement as above
13.16	Louver area on cover / side wall	1500mm height x 1500mm desirable
13.17	Louver position from bottom level	Minimum 200mm above bottom
13.18	Exhaust Fans	Mounted in LV compartment to discharge air in transformer compartment & Controlled by SPMCB & thermostat to operate above 35 deg C, 2x150CFM, 1 ph 230v 50Hz
13.19	Gland plate for RMU compartment	3 mm thick MS plate suitable for 3x3c300/400 sqmm AYFY 11kv cable
13.20	Gland plate for LV compartment	3 mm thick MS plate suitable for 10x 4c400sqmm cable + 10x7c2.5sqmm cable
13.21	Door Opening Provision	Type I, II & III : With 3 side door opening
13.22	Class of enclosure as per IEC 62271-202	10K
13.23	Internal Arc classification	IAC AB 20 KA, 1s
13.24	Limiting dimensions of package enclosure	
13.25 a	Type I (1000KVA Transformer):	3400(L) x 2900(W) x 2800(H)
13.25.b	Type II & III (400KVA /630KVA Transformer)	3400(L) x 2600(W) x 2600(H)
13.26	Type IV (250 kVA Transformer)	2000(L) x 2000(W) x 2000(H)

14.0 Other Provisions: Earthing, Illumination, Hooter & Smoke Detector

14.1.1	Earth bus connection brought out of package substation enclosure to earth pad for connection to earth pit	a) Two earth pads for RMU, transformer & LV compartment each. b) Two earth pads for transformer neutral

14.1.2	Earth bus size	50 x6 GI flat
14.1.3	Earth bus fault current capacity	26.3kA for 1 sec
14.1.4	Earth connection of all covers, doors & structural parts to GI bus	By metallic jumper connection
14.1.5	Earth connection of RMU, ACB & transformer body parts to GI bus	By two numbers of 50x6mm GI flat per equipment
14.1.6	Earth bus identification	Shown by letter 'E'
14.2.1	RMU, transformer & LV compartment illumination	By 36w CFL fixture controlled through SPMCB & door limit switch
14.2.2	RMU, transformer & LV compartment power socket	5/15amp 3 pin socket through 15 amp SPMCB
14.24	Smoke Detector in each compartment	Minimum 02 no's Smoke Detectors in each LT, HT and Transformer compartment with potential free auxiliary contact for tripping the RMU, Alarm and SCADA. All detectors shall be wired upto controller cum alarm unit suitable.
14.25	Hooter	Required with timer reset for operator alarm on opening of PSS door

15.0 Labels & painting

15.1	Name plate on package enclosure	Fixing by rivet only
15.1.1	Material	Anodized aluminum 16SWG / Stainless Steel (SS)
15.1.2	Background	SATIN SILVER
15.1.3	Letters, diagram & border	Black
15.1.4	Process	Etching
15.2	Name plate details	Month & year of manufacture, transformer rating, purchaser name & order number, guarantee period, Ref. IS / IES No. Shall be provided inside enclosure as well as outside enclosure.
15.3	Labels for meters & indications	Anodized aluminium with white character on black background OR 3 ply Lamicoid
15.4	Danger plate on doors of RMU compartment & LV compartment	Etched on 16 swg anodised aluminium / SS plate with white letters on red background
15.5	BSES Insignia	a) 02 no's b) HV and LV side of PSS enclosure. c) Shall be etched on anodized aluminium 16SWG / SS plate.

		d) Details shall be finalized during drawing approval.
15.6	Enclosure painting surface preparation	Shot blasting or 7 tank chemical process
15.7	Enclosure painting external finish Powder coated epoxy polyester base	Hot dip galvanizing – 80 micron thick grade A, shade - RAL 7032, uniform thickness 60 micron minimum .
15.8	Enclosure painting internal finish	Powder coated epoxy polyester base grade A, shade -white, uniform thickness 80 micron minimum

16.0 Approved makes

16.1.0	RMU	For RMU accessories please refer RMU Specification part
16.2.0	Oil type transformer	Toshiba/Danish/ Schneider// or any other make approved by BSES.
16.3.0	Dry type transformer	ABB/ Raychem / TMC/ or any other make approved by BSES.
	Transformer core	Nippon/JFE/Posco
	Aluminium	Hindalco, Nalco, Sterlite, Birla Copper
	Copper	Birla Copper/Sterlite
	CT	Pragati/ECS/Kappa
	Resin	Huntsmen
16.4.0	Pressure relief valve	Sukrut / VIAL
16.5.0	Bushings make	Baroda bushing / CJI / Jaipur Glass
16.6.0	Winding Temperature Indicator	Precimeasure/ Pecon
16.7.0	ACB	L&T / Schneider-MG / AREVA / GE / Siemens / ABB / C&S
16.8.0	MCCB	GE / Merlin Gerin / ABB / L&T/Siemens
16.09.0	APFC	
16.10.1	Switch	ABB / Siemens / L&T (Salzer)
16.5.2	HRC Fuse Links	Alstom / Siemens / L&T / GE
16.5.3	Load manager	L&T / Enercon / AE / DUCATI / Phasetrac M-40 / TAS POWERTECH
16.5.4	APFC relay	Beluk / ABB / Fraco / Ducati/ TAS / POWERTECH
16.5.5	AC Contactors	ABB / Schneider
16.5.6	Push buttons / Actuator	L&T / Teknic / Siemens
16.5.7	MCB	ABB / L&T / Siemens/Schneider –MG
16.5.8	Capacitors	FRACO / DUCATI/ABB
16.5.9	Fans	EBM Nadi
16.6.0	Terminals	Connectwell / Elmex
16.7.0	Transformer Bushings (HV side)	Euromold (Nexan)/ Elmek/ H.J. International/

		Pfisterer any other vendor approved by BSES
16.8.0	Termination kits for RMU	3m/ Raychem/ Denson
16.9.0	Termination kits for Transformer	3M/ Raychem/ Denson / any other make approved by BSES
16.9.1	Cold applied cable boots	3M/ Raychem

17.0 Quality assurance

17.1	Vendor quality plan	To be submitted for purchaser approval for all components listed in clause 4.0 For transformer, RMU & APFC panel sub vendor quality plan to be submitted.
17.2	Inspection points in quality plan	To be mutually identified & agreed
17.3	Quality – Process Audits	BSES shall carryout vendor process audits.
17.4	Field quality plan	Bidder to submit field quality plan along with the bid
17.5	Spare part list	Bidder to submit detailed spare part list along with the bid
17.6	Maintenance manual	Bidder to submit maintenance manual along with the bid

18.0 Inspection & testing

18.1	Type test as per IS / IEC	a) Only type tested quality equipment(s) shall be offered. b) Type test certificates mentioned in this clause shall be submitted along with offer for scrutiny c) The test report should not be more than 5years old. d) Type test and special tests for Transformer (from CPRI/ERDA) shall include the following **:** i) Impulse withstand test on all three HV limbs of the transformers for chopped wave as per IS 2026 ii) Temperature rise test as per IS 2026 iii) Air pressure test for sealed transformers asper IS 1180 iv) Pressure and Vacuum test on tank v) Dynamic & Thermal (3 sec) Short Circuit Test as per IS. vi) Measure of zero seq. impedance (Cl. 16.10 IS 2026 Part I). vii) Measurement of acoustic noise level (Cl. 16.12

		of IS 2026 Part I). viii)Measurement of harmonic level on no load current. ix) Partial discharge test x) High voltage withstand test shall be performed on the auxiliary equipment and wiring after complete assembly. e) If identical rating type test reports for transformers are not available vendor to carryout Short circuit withstand test (Dynamic and thermal (for 3 secs)), Lightning impulse test & temperature rise test without any additional cost.
18.1.1	Package substation assembly	As per IEC 62271-202
18.1.2	11kv RMU, transformer, ACB, MCCB, APFC system and capacitor units	As per relevant IS/ IEC, For RMU type test criteria refer RMU specification part
18.2	Routing tests	
18.2.1	Routine tests of PSS	As per IEC 62271-202
18.2.2	Routine tests of transformer, RMU, LT panel & APFC	As per relevant IS/ IEC , For RMU refer RMU specification part
18.3	Inspection and acceptance testing	a) Purchaser reserves the right to inspect /witness all tests on the meters at manufacture's works at any time, prior to dispatch, to verify compliance with the specification/ standards. b) Manufacturer should have all the facilities/ equipments to conduct all the acceptance tests during inspection. All the testing equipment should be calibrated. c) Stage and / or final inspection call intimation shall be given at least 15 days in advance to the purchaser. d) For RMU refer RMU specification part
18.3.1	Stage inspection of transformer	Purchaser shall inspect transformers at the core and coil assembly stage at the manufacturer's premises.
18.3.2	Final inspection of transformers	The sequence of testing shall be as follows a) Visual and dimension check for completely assembled transformer. b) Measurements of voltage ratio. c) Measurements of winding resistance at principal tap and two extreme taps. d) Vector Group and polarity test. e) *Measurements of insulation resistance and polarization index. f) Separate sources voltage withstand test.

		g) Measurement of iron losses and exciting current at rated frequency and 90%, 100% and 110% rated voltage. h) Induced voltage withstand test. i) Load losses measurement. j) Impedance measurement of principal tap (HV and LV) of the transformer. k) Measurement of Iron loss (to be repeated if type test are conducted). l) Measurement of capacitance and Tan Delta for HV and LV bushings and Tan Delta for transformer oil (for all transformers). m) Oil leakage test on assembled transformer n) Magnetic balance test. o) Power frequency voltage withstand test on all auxiliary circuits p) Measure of zero seq. impedance (Cl. 16.10 IS 2026 Part I). q) Measurement of acoustic noise level (Cl. 16.12 of IS 2026 Part I). r) Measurement of harmonic level on no load current. s) Partial discharge test *Insulation resistance measurement shall be carried out at 5kV for HV and 1kV for LV. Value of IR should not be less than 2000 Mohms**.** Polarization Index (PI = IR10min/IR1min) should not be less than 1.5 (If one minute IR value is above 5000 Mohms and it is not be possible to obtain an accurate 10 minutes reading, in such cases polarization index can be disregarded as a measure of winding condition.)
18.3.3	Final Inspection of package substation after complete assembly	As per IEC 62271-202 and relevant IS/ IEC of equipment. a) Visual check b) Dimensional and sheet thickness check c) Verification of Wiring & BOM d) Paint thickness inside and outside of PSS enclosure. e) Functional test i. Operation of switchgear and control gear. ii. Mechanical operation and alignments of PSS doors. iii. Fixing of insulating barriers. iv. Voltage indication check v. Checking of temperature and liquid level of the transformer.

		vi. Fitting of earthing devices. vii. Cable testing viii. Replacement of LTCT ix. Operation of transformer tap changer x. Operation of illumination system xi. Trip function of HV switchgear. f) IR test g) HV test on power circuit h) HV test on auxiliary circuits i) Operational and interlocks check
18.3.4	Acceptance Test of LT Panel / APFC Panel	a) Visual, dimension, wiring & BOM check. b) Operational check. c) IR Test. d) HV Test
18.4	Special acceptance tests	
18.4.1	Transformer	Temperature rise test shall be carried out on 01 no transformer of each rating randomly selected from the offered lot.
18.4.2	PSS	Temperature rise test of PSS along with transformer as per IEC 62271-202.
18.5	Right to waive off tests	Reserved by Purchaser

19.0 Shipping, Handling and Site support

19.1	Packing Protection	Against corrosion, dampness, heavy rains, breakage and vibration
19.2	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection & identification Label
19.3	Packing Identification Label (Anodized Aluminum Plate)	On each packing case, following details are required:
		a) Individual serial number
		b) Purchaser's name
		c) PO number (along with SAP item code, if any) & date
		d) Equipment Tag no. (if any)
		e) Destination
		f) Manufacturer / Supplier's name
		g) Address of Manufacturer / Supplier / it's agent
		h) Description of PSS.
		i) Country of origin
		j) Month & year of Manufacturing
		k) Case measurements
		l) Gross and net weights in kilograms
		m) All necessary slinging and stacking instructions

19.4	Shipping	The seller shall be responsible for all transit damage due to improper packing.
19.5	Handling and Storage	a) Manufacturer instruction shall be followed. b) Detail handling & storage instruction sheet / manual to be furnished before commencement of supply.

20.0 Deviations

20.1	Deviations from this Specification shall be stated in writing with the tender by reference to the Specification clause/GTP/Drawing and a description of the alternative offer. In absence of such a statement, it will be assumed that the bidder complies fully with this specification.

21.0 Drawings Submission

21.1.0	To be submitted along with bid	The seller has to submit following:
21.1.1	GA drawing (Complete assembly, RMU, transformer, LT panel + other items)	
21.1.2	BOM of Packaged substation	
21.1.3	Calculation for sizing of Transformer	
21.1.4	Sizing Calculation of busbar in support of its Guaranteed S.C. rating / Capability	
21.1.5	Guaranteed technical particulars (GTP) of Packaged substation in the format as per annexure 'C'	
21.1.6	Clause wise deviation sheet as per clause no. 20.0	
21.1.7	Catalogues & manuals for Package substation + RMU + Transformer + LT switchgear items + APFC	
21.1.8	User manual for Hermetically Sealed Transformers. The manual must be provided with, but not limited to, maintenance schedule, frequency & method of oil-sampling, procedures for oil-filling & oil-filtration, etc.	
21.1.9	Quality plan for Packaged substation.	
21.1.10	Type test reports as per clause 18.1 of this specification.	
21.1.11	Recommended spare parts and consumable items for five years of operation and spare parts catalogue with price list	
21.2.0	After award of contract, Seller has to submit following drawings for buyer's Approval (A) / Reference (R)	
21.3.1	Program for production and testing (A)	
21.3.2	GTP of Packaged substation as per annexure 'C' of this specification.	
21.3.3	Deviation sheet, in case of any deviations finalized in technical bid evaluation.	
21.3.4	Design calculations for transformer	
21.3.5	Detailed GA drawing(s) (Complete assembly, RMU, transformer, LT panel + meter box + other items)	
21.3.6	Wiring/ schematic drawings (Complete assembly, RMU, transformer, LT panel + APFC + meter box + other items)	
21.3.7	Drawing details of Name plates, danger plates, BSES insignia, instruction sheets etc.	

21.3.8	Drawings of cable cleats/ clamps.	
21.3.9	Foundation drawing(s).	
21.3.10	BOM of Packaged substation	
21.3.11	Quality plan Packaged substation, RMU, Transformer, LT panel, APFC (panel and units etc.	
21.3.12	Installation, commissioning manual for all items in Packaged substation. (for information)	
21.3.13	Operation & maintenance manual for all items in Packaged substation. (for information)	
21.3.14	Transport / Shipping dimensions with weights, wheel base details, un tanking height	
21.4	Submittals required prior to dispatch	
21.4.1	As built Drawings	
21.4.2	Inspection and test reports, carried out in manufacturer's works	
21.4.3	Test certificates of all bought out items	
21.4.4	Operation and maintenance Instruction as well as trouble shooting charts/ manuals	
21.5	Drawing and document sizes	Standard size paper A3, A4
21.6	Number of Documents required at different stages	4 hard copies + 2 soft copies in CD Format at each stage
Note :	Duly signed & stamped copies of the drawings / documentation are required to be submitted to BSES for approval.	

Annexure A Service Conditions

The package substation shall be designed & tested to operate satisfactorily under following conditions -

Sr No	Description	Data by purchaser
1.	Location	Delhi
2.	Reference design ambient temperature	40°C for Delhi
3.	Maximum ambient temperature	50°C for Delhi
4.	Relative humidity	85% for Delhi
5.	Seismic zone	Zone IV for Delhi

Annexure B Technical Specification for transformer oil

Transformer oil shall be new and conform to the following requirements:

1.0 Codes & standards

Latest revision of following codes & standards with all amendments –

	Standard no	Title
1.1	IS 335	New insulating oils
1.2	IS 1783	Drums for oils

1.1 Properties

The insulating oil shall have following features:

S. No.	Item description	Specification requirement
2.1	Appearance of oil	Clear, free from sediment and suspended matter
2.2	Viscosity Max.	15 mm2 /s at 40°C 1800 mm2 /s at 0°C
2.3	Pour Point, Max	-10°C
2.4	Water content, Max	30 mg/Kg
2.5	Breakdown voltage	
i)	New unfiltered oil. Min.	30 kV
ii)	After filtration Min.	70 kV
2.6	Density Max.	0.895 g/ml at 20°C
2.7	Dielectric dissipation factor Max	0.005 at 90 °C,
2.8	Particle Content	Value to be provided by the vendor
2.9	Acidity Max	0.01 mg KOH/g
2.10	Interfacial tension at 27°C Min	40 mN/m
2.11	Total sulphur content	Value to be provided by the vendor
2.12	Corrosive sulfur	Not-corrosive
2.13	Potentially Corrosive sulfur	Not-corrosive
2.14	DBDS	Not detectable (<5 mg/kg)

2.15	Inhibitor	Not detectable (<0.01%)
2.16	Metal Passivator	Not detectable (<5 mg/kg)
2.17	Other addivites	Type and concentration of additives to be provided by the vendor
2.18	2-furfural and related Compounds content	Not detectable (<0.05 mg/kg) for each individual compound
2.19	Oxidation stability	
a)	Total acidity, Max	1.2 mg KOH/g
b)	Sludge Max	0.8%
c)	DDF at 90 °C, Max	0.5
2.20	Gassing Tendency	Value to be provided by the vendor
2.21	ECT	Value to be provided by the vendor
2.22	Flash point Min.	135°C,
2.23	PCA content Max	3%
2.24	PCB content	Not detectable (<2 mg/Kg)
2.25	Test	As per IS 335-2018

Annexure C Guaranteed Technical Particulars (Data by Supplier)

i. Bidder shall furnish the GTP format with all details against each clause.

ii. Bidder shall not change the format of GTP or clause description.

iii. Bidder to submit duly filled GTP in hard copy format with company seal.

Sr. No.	Description	Data to be filled by Manufacturer
1	Manufacturer Name	
2	Manufacturer Address	
2.1	Telephone no	
3	Manufacturer contact person	
4	Manufacturer brand name (Give catalogue reference)	
	Conformance to specification	Yes/No
	If NO for above, Submission of clause wise deviation sheet	Yes/No
5	**11kV RMU**	

1	11kV RMU, 630A	
2	Equipment make	
	Equipment type / brand name	
3	Conformance to design standards as per specification clause no 2.0 –	Yes/No
4	Conformance to specification clause no 3.0 to 17.0 –	Yes/No
5	If NO for pt 3 or pt 4 above, Submission of deviation sheet for each specification clause no –	Yes/No
6	Panel overall dimensions in mm	
	Width (measured from front)	
	Depth	
	Height	
7	Panel weight in kg	
8	Panel extensible on both sides – Yes / No	
9	Panel enclosure protection offered	
10	Panel tested for internal arc (Cable & other compartments) –Yes / No	
11	Heat generated by the panel in Kw	
12	Insulation level for complete panel	
12.1	Impulse withstand (Kv peak) -70kvp min	
12.2	Power frequency withstand (Kv rms) – 28kv min	
13	Bus bar	
13.1	Material & grade	
13.2	Bus bar cross section area in sq mm	
13.3	Bus bar rated current in amp at designed 50 deg.C ambient at 50 deg.C ambient	
13.4	Max temperature rise above reference ambient of 40 deg C	
13.5	Short time current withstand capacity for 3 seconds (in KA)	
13.6	Bus bar clearances in mm P-P / P-E	
13.7	Bus bar with insulation sleeve / barriers	
13.8	Bus bar support insulator type	
13.9	Bus bar support insulator voltage class	
13.10	Bus bar support insulator minimum creepage distance / mm	
13.11	Earth bus bar material	
13.12	Earth bus bar size	
14	**Circuit breaker type – SF6 or VCB**	

14.1	Rated voltage & frequency	
14.2	Rated current in amp	
14.3	Rated breaking current – KA rms symmetrical	
14.4	Short time withstand capacity in KA for 3 sec	
14.5	Rated making current - KA peak	
14.6	Breaker total opening time at rated breaking capacity (in milliseconds)	
14.7	Number of breaks per pole	
14.8	Total length of contact travel in mm	
14.9	No of circuit breaker operation cycles (close & open) guaranteed at rated current, Electrical endurance class	25% rated current -
		50% rated current -
		75% rated current -
		100% rated current -
14.10	No of breaker opening operations guaranteed at rated fault current, Electrical Endurance Class	
14.11	No of breaker mechanical operation cycles (close & open) guaranteed at zero current , Mechanical endurance class	
14.12	Contact material	
14.13	Operating mechanism – trip free	
	Manual Spring charge type	
14.14	Feeder circuit breaker (FCB) –VCB	
14.14.3	Closing coil wattage & rated DC voltage	
14.14.4	Trip coil wattage & rated DC voltage	
14.15	Transformer CT class, ratio & Vk	
15	**Load break switch type – SF6 or VCB**	
15.1	Rated voltage & frequency	
15.2	Rated current in amp	
15.3	Load break switch total opening time at rated current (in milliseconds)	
15.4	Number of breaks per pole	
15.5	Total length of contact travel in mm	
15.7	No of LBS close & open operation cycles guaranteed at	25% rated current -
		50% rated current -

		75% rated current - 100% rated current -
15.8	No of LBS making operations guaranteed at rated fault current, Electrical endurance class	
15.9	No of LBS close & open operations guaranteed at zero current, Mechanical endurance class	
15.10	Contact material	
15.11	Operating mechanism type	
15.13	Minimum permissible SF6 gas pressure (For SF6 type RMU only)	
15.14	Capacitor type cable voltage indication provided?	Yes / No
15.15	Operation counter provided	Yes/ No
16.1	Disconnect switch continuous rating (Amp)	
16.2	Disconnect switch Short time withstand rating -20kA for 3 sec minimum	Yes / No
16.3	One LBS open operation possible in the event of loss of SF6 gas	Yes/No
17.1	Cable termination – Height of power terminal from gland plate	Mm
17.2	Torque required for tightening terminal lug	
18	Mimic diagram, labels & finish as per cl. no 12	Yes / No
19	Submission of RMU / component catalogue	Yes/No
20	Unit price for Conversion kit offered separately for converting the RMU from single cable termination design to double cable termination design	Yes / No
21	Earth Switch	
21.1	Minimum number of operations at no load- Mechanical Endurance class	
21.2	Making capacity endurance of earth switch – Electrical endurance class	
22	Self Powered Relay – Make / Model	As per make list (Relay shall be communicable with SCADA)
22.1	CT Input	

22.2	IDMT Setting Range 4 element – Over Current & Earth fault & steps	Overcurrent- Earth Fault- Instantaneous O/C- Instantaneous E/F-
22.3	Operating Time	Over Current – Curves Instantaneous
22.4	Pick up Current	
22.5	Resetting Current	
22.6	Relay Burden	
22.7	Time Accuracy	
22.8	Tripping Coil O/P – type & duration	
22.9	Fault Current Display	
22.10	No of Fault Current Latching with time stamping	
22.11	Display Facility / Type	
22.12	Operational Indicators	
22.13	Potential Free Output Contacts	
22.14	Thermal Withstand Capacity of Relay	
23	Fault Passage Indicator	Over Current and Earth Fault
23.1	CBCT	
a	Type	
b	Mounting Arrangement	
c	CT to indicator connection	
d	ID of sensor	
23.2	Earth Fault Indicator	
a	Sensing Current	
b	Sensing Time	
c	Indication	
d	Reset Time	
e	Resetting Facility	
f	Output Contact	
g	Contact Rating	
h	Aux Power Supply	
i	Degree of Protection	
j	Mounting Arrangement	
k	Ambient Temperature	
24	Current Transformer- Make	
24.1	Ratio	
24.2	Burden	
24.3	Accuracy Class	
25	Voltage Presence Indicator	
	Make	

	Rating		
	Model No		
26.8	Terminal Blocks, Disconnecting type fuses make		
6.0.0	**11kv cable**		from RMU to transformer
6.1.0	Cable size 3CX150 sqmm AYFY		Yes/No
6.2.0	Cable rated voltage - 11000v		Yes/No
6.3.0	Cable short circuit current capacity for 1 sec		kA
6.4.0	Type of insulation - XLPE		Yes/No
6.5.0	Outer insulation sheath – PVC with armor		Yes/No
6.6.0	Cable termination type & make		
7.0.0	**250 KVA/400KVA /630KVA/1000KVA hermetically sealed type transformer**		
7.1.0	Make		
7.2.0	Type - Oil immersed, core type, step down		Yes/No
7.3.0	Transformer continuous rating when placed in package substation enclosure	HV winding	LV winding
		KVA	KVA
7.4.0	Rated voltage (kV)	HV winding	LV winding
		11 KV	0.415 KV
7.5.0	Rated current	HV winding	LV winding
		Amps	Amps
7.6.0	Transformer vector group – Dyn11		Yes / No
7.7.0	Impedance at principal tap rated current and frequency, ohm @75 °C	250KVA/400KVA & 630KVA - 4.5.0 % & 1000KVA-5% with IS tolerance	
7.7.1	Impedance at lowest tap		Ω
7.7.2	Impedance at highest tap		Ω
7.8.0	Resistance of the winding at 75°C in ohm	HV winding	LV winding
		Ω	Ω
7.9.0	Zero sequence impedance in ohm	HV winding	LV winding
		Ω	Ω
7.10.0	Guaranteed maximum losses at principal tap full load and 75°C without any positive tolerance, kW		
7.10.1	No load losses (max.)		KW
7.10.2	Load losses (max.)		KW
7.10.3	Total losses (max.) at 50% and 100% load		KW
7.10.4	No load loss at maximum permissible voltage and frequency (approx.),		KW

7.11.0	Temperature rise over reference ambient	
7.11.1	Top oil by thermometer °C	35 0C
7.11.2	Winding by resistance °C	40 0C
7.12.0	Efficiency	at 75°C and unity power factor
7.12.1	at 100% load	
7.12.2	at 50% load	
7.12.3	at 25% load	
7.13.0	Efficiency	at 75°C and 0.8 power factor lag
7.13.1	at 100% load	
7.13.2	at 50% load	
7.13.3	at 25% load	
7.14.0	Load and power factor at which Maximum efficiency occurs	
7.15.0	Regulation at full load at 75°C	
7.15.1	at unity power factor	
7.15.2	at 0.8 power factor lagging	
7.16.0	Regulation at 110% load at 75°C	
7.16.1	at unity power factor	
7.16.2	at 0.8 power factor lagging	
7.17.0	Tapping	Off circuit
7.17.1	Capacity	Full capacity
7.17.2	Range-steps x % variation	
7.17.3	Taps provided on HV winding	Yes / No
7.17.4	Rated current of rotary switch 100Amp	Yes / No
7.18.0	Transformer Tank	Corrugated plate tank
7.18.1	Cooling	ONAN
7.18.2	Tank material	Robust mild steel plate without pitting and low carbon content
7.18.3	Thickness of sides mm	
7.18.4	Thickness of bottom mm	
7.18.5	Thickness of cover mm	
7.18.6	Tank designed and tested for Vacuum, Pressure (Ref: CBIP Manual)	Yes/ No
7.18.7	Vacuum mm of Hg. / (KN/m^2)	
7.18.8	Pressure mm of Hg.	Twice the normal head of oil / normal pressure + $35kN/m^2$ whichever is lower, As per CBIP
7.18.9	Is the tank lid sloped?	Yes / No
7.18.10	Inspection cover provided	Yes / No
7.18.11	Location of inspection cover	Yes / No
7.19.0	Core	
7.19.1	Core material grade	Premium grade minimum M3 or

		better
7.19.2	Core lamination thickness	mm
7.19.3	Insulation of lamination	With insulation coating on both sides
7.19.4	Design flux density at rated condition at principal tap, Tesla	
7.19.5	Maximum flux density at 12.5 % over excitation / over fluxing,	1.9 Tesla
7.19.6	Equivalent cross section area	mm^2
7.20.0	Guaranteed No Load current at 100% rated voltage.	
7.20.1	HV	Amps
7.20.2	LV	Amps
7.21.0	Guaranteed No Load current At 110% rated voltage.	
7.21.1	HV	Amps
7.21.2	LV	Amps
7.22.0	Winding	
7.22.1	Type of Winding	
7.22.1	HV	
7.22.2	LV	
7.22.2	Conductor material	Electrolytic Copper
7.22.3	Current density (HV/LV)	Maximum allowed 3.0 A per mm^2.
7.22.4	Gauge/area of cross section of conductor	
	HV	mm^2
	LV	mm^2
7.22.5	Insulating material	type & thickness in mm
	HV Turn	mm
	LV Turn	mm
	LV Core	mm
	HV - LV	mm
7.23.0	Transformer insulation Polarization Index value (Min 1.5	
7.24.0	Transformer insulation IR value for HV winding (Min 2000Mega Ohm)	
7.25.0	Minimum design clearance, mm	
7.25.1	HV to earth in Air	
7.25.2	HV to earth in oil	
7.25.3	LV to earth in Air	
7.25.4	LV to earth in oil	
7.25.5	Between HV & LV in Air	
7.25.6	Between HV & LV in oil	
7.25.7	Top winding and yoke	

7.25.8	Bottom winding and yoke	
7.26.0	Transformer Insulating oil	
7.26.1	Quantity of oil	Ltrs
7.26.2	In the Transformer tank	
7.26.3	In each radiator	
7.26.4	Total quantity	
7.26.5	10% excess oil furnished?	Yes / No
7.26.6	Type of Oil	
7.27.0	Bushing / Support Insulator	
7.27.1	Make	
7.27.2	Type	
7.27.3	HV side	
7.27.4	LV side	
7.27.5	Reference Standard	
7.27.6	Voltage class, kV	
	HV side Bushing/ Support Insulator	12 kV
	LV side line and neutral bushing/ Support insulator	1.1 kV
7.27.7	Creepage factor for all bushing / Support Insulator mm/KV	31 mm / kV
7.27.8	Rated thermal short time current	
	HV bushing	KA
	LV line and neutral bushing	KA
7.27.9	Weight, Kg	
	HV bushing	KG
	LV line and neutral bushing	KG
7.27.10	Free space required for bushing removal	Mm
	HV bushing	
	LV line and neutral bushing	
7.28.0	HV Termination arrangement	To 3CX150 mm^2 AYFY 11KV By screened separable connector kit
7.28.1	Phase to phase clearance ,	mm
7.28.2	Phase to earth ,	mm
7.29.0	L.V termination arrangement	To 100x12 mm for phase & neutral
7.29.1	Phase to phase clearance,	25 mm minimum
7.29.2	Phase to earth clearance ,	25 mm minimum
7.30.0	Current Transformer on LV phases	
7.30.1	Type	
7.30.2	Make	
7.30.3	Reference Standard	
7.30.4	CT Ratio	
7.30.5	Burden, VA	

7.30.6	Class of Accuracy / ISF		
7.30.7	CT terminal box size		
7.31.0	Pressure release device on tank - make		
7.31.2	Minimum pressure the device is set to rupture		
7.32.0	Fittings Accessories Each Transformer furnished as per Clause 7.3.0		Yes/No
7.33.0	Painting: as per clause for the transformer, cable boxes, Marshalling box		Yes/No
7.34.0	Over all transformer dimensions		
7.34.1	Length		mm
7.34.2	Breadth		mm
7.34.2	Height		Mm
7.35.0	Weight data		
7.35.1	Core		KG
7.35.2	Winding		KG
7.35.3	Frame		KG
7.35.4	Tank		KG
7.35.5	Weight of oil in Tank		KG
7.35.6	Total Transport weight of the transformer		KG
7.36.0	Transformer total oil volume		liters
8.0.0	**250/400/630/1000KVA Cast Resin Transformer**		
8.1.0	Make		
8.2.0	Type- Cast Resin Dry Type		Yes / No
8.3.0	Transformer continuous rating when placed in package substation enclosure	HV winding	LV winding
		KVA	KVA
8.4.0	Rated voltage (kV)	HV winding	LV winding
		11 KV	0.415 KV
8.5.0	Rated current	HV winding	LV winding
		Amps	Amps
8.6.0	Transformer vector group – Dyn11		Yes / No
8.7.0	Impedance at principal tap rated current and frequency, ohm @130°C		5.0 % with IS tolerance
8.7.1	Impedance at lowest tap		Ω
8.7.2	Impedance at highest tap		Ω
8.8.0	Resistance of the winding at 130°C in ohm	HV winding	LV winding
		Ω	Ω

8.9.0	Zero sequence impedance in ohm	HV winding	LV winding
		Ω	Ω
8.10.0	Guaranteed maximum losses at principal tap full load and 130°C without any positive tolerance, kW		
8.10.1	No load losses (max.)		KW
8.10.2	Load losses (max.)		KW
8.10.2	Total losses (max.),		KW
8.10.4	No load loss at maximum permissible voltage and frequency (approx.),		KW
8.10.5	Total stray loses @ 130° C		
8.11.0	Temperature rise over reference ambient		
8.11.1	Winding by resistance: Outside the PSS enclosure / inside the PSS enclosure 0 C		80°C/ 90°C
8.11.2	Maximum hot spot temperature, Deg. C		°C
8.12.0	Efficiency		at 130°C and unity power factor
8.12.1	at 110% load		%
8.12.2	at 100% load		%
8.12.2	at 80% load		%
8.12.3	at 60% load		%
8.12.4	at 40% load		%
8.12.5	at 20% load		
8.13.0	Maximum hot spot temperature, Deg. C		at 130°C and 0.8 power factor lag
8.13.1	Efficiency		%
8.13.2	at 110% load		%
8.13.3	at 100% load		%
8.13.4	at 80% load		%
8.13.5	at 60% load		%
8.13.6	at 40% load		%
8.14.0	Maximum efficiency at 130°C		%
8.14.1	% Load and power factor at which it occurs		
8.15.0	Regulation at full load at 130°C		
8.15.1	at unity power factor		
8.15.2	at 0.8 power factor lagging		
8.16.0	Regulation at 110% load at 1300 C		
8.16.1	at unity power factor		
8.16.2	at 0.8 power factor lagging		
8.17.0	Core		

8.17.1	Core material grade	Premium grade minimum M3 or better	
8.17.2	Thickness of lamination mm		mm
8.17.3	Insulation of lamination		
8.17.4	Design Flux Density at rated condition at principal tap, Tesla- 1.6 Tesla (Max)		
8.17.5	Maximum flux density at 10 % over excitation /overfluxing, Tesla -1.73Tesla (Max)		
8.17.6	Equivalent cross section area		
8.18.0	Guaranteed No Load current At 100% rated voltage , Amps		
8.18.1	HV		
8.18.2	LV		
8.19.0	Guaranteed No Load current At 110% rated voltage, Amps		
8.19.1	HV		
8.19.2	LV		
8.20.0	Type of Winding		
8.20.1	HV		
8.20.2	LV		
8.20.3	Conductor material		
8.20.4	Current density Amps/sqmm		
	HV winding		
	LV winding		
8.20.5	Gauge/area of cross section of conductor, sqmm		
	HV		
	LV		
8.21.0	Tapping - Off Ckt		Yes / No
8.21.1	Capacity		Full Capacity
8.21.2	Range- steps X % variation		
8.21.3	Taps provided on HV winding		Yes / No
8.21.4	Tap link Current rating , A		
8.22.0	Insulating material and thickness	Material	Thickness
8.22.1	HV Turn		mm
8.22.2	LV Turn		mm
8.22.3	LV to Core		mm
8.22.4	HV to LV		mm
8.23.0	Minimum design clearance, mm		
8.23.1	HV to earth in Air		mm
8.23.2	LV to earth in Air		mm

8.23.3	Between HV & LV in Air	mm
8.23.4	Top winding and yoke	mm
8.23.5	Bottom winding and yoke	mm
8.24.0	Bushing / Support Insulator	
8.24.1	Make	
8.24.2	Type	
8.24.3	Reference Standard	
8.24.4	Voltage class, kV	
8.24.5	HV side Bushing / Support insulator	
8.24.6	LV side line and neutral bushing / Support insulator	
8.24.7	Creepage factor for all bushing	mm / KV
8.24.8	Weight	KG
8.24.9	HV bushing / Support insulator	
8.24.10	LV line and neutral bushing / Support insulator	
8.24.11	Free space required for bushing / Support insulator removal, mm	
8.24.12	HV bushing / Support insulator	
8.24.13	LV line and neutral bushing / Support insulator	
8.25.0	HV Termination arrangement	Suitable for 3CX150 mm^2 AYFY 11KV
8.25.1	Phase to phase clearance	mm
8.25.2	Phase to earth clearance	mm
8.25.3	HV side bus bar size	
8.25.4	HV Termination height	Mm
8.26.0	L.V termination arrangement	Suitable to 100x12 mm for phase & neutral
8.26.1	Phase to phase clearance,	25 mm minimum
8.26.2	Phase to earth clearance ,	25 mm minimum
8.26.3	LV side bus bar size	
8.26.4	LV Termination Height	Mm
8.27.0	Current Transformer on LV phases	
8.27.1	Type	
8.27.2	Make	
8.27.3	Reference Standard	
8.27.4	CT Ratio	
8.27.5	Burden, VA	
8.27.6	Class of Accuracy	
8.28.0	WT scanner terminal box size	
8.29.0	Alarm and Trip contact ratings of protective devices	

8.29.1	Rated / making/ breaking currents , Amp @ Voltage for	
8.29.2	Winding temperature scanner	
8.30.0	Fittings and Accessories as per Cl. 7.19 provided	(YES / NO)
8.31.0	Over all transformer dimensions	
8.31.1	Length	mm
8.31.2	Width	mm
8.31.3	Height	mm
8.32.0	Weight data	
8.32.1	Core	KG
8.32.2	Frame parts, kG	KG
8.32.3	Core and frame, kG	KG
8.32.4	Total Winding, kG	KG
8.32.5	Core , Frame, Winding, kG	KG
8.32.6	Enclosure, kG	KG
8.32.7	Total Transport weight of the transformer, kG	KG
8.32.8	Total weight of the transformer with all accessories	KG
8.33.0	Shipping Data	
8.33.0	Weight of heaviest package, kG	KG
8.33.0	Dimensions of the largest package (L x B x H)	mm
8.34.0	Surge Arrestor requirement	
8.34.1	Type	
8.34.2	System Voltage , kV rms	
8.34.3	Rated Voltage of Arrestor, kV rms	
8.34.4	Continuous operating voltage , kV rms	
8.34.5	Maximum Continuous operating voltage, kV rms	
8.34.6	Nominal Discharge Current, kA peak	
8.34.7	Energy Absorption Capability, kJ/kV	
8.34.8	Creepage factor	
8.34.9	Reference std	
8.35.0	WTI Scanner Details	
8.35.1	Make	
8.35.2	Model no.	
8.35.3	No of Channel / Input	
8.35.4	Manual submitted	
9.0.0	Low voltage bus bar system	To connect transformer LV side to ACB & to MCCB
9.1.0	Bus bar material tinned copper	Yes / No

9.2.0	Bus bar size	sqmm
9.3.0	Bus bar continuous current rating	Amp
9.4.0	Bus bar insulator voltage class	kV
9.5.0	Bus bar droppers size from ACB to MCCB (40x6 tinned copper)	
9.6.0	Maximum bus bar temperature rise	
10.0.0	ACB, MCCB	As per IS 13947
10.1.0	ACB make	
10.1.1	ACB rated voltage 415v +/- 10%	
10.1.2	ACB 4 pole	Yes / No
10.1.3	ACB continuous current capacity at 415v 50Hz, at 50 deg C	amp
10.1.4	ACB short circuit breaking capacity Ics =Icu = 50kA minimum	kA
10.1.5	ACB SC making current capacity 100kAp	kA peak
10.1.6	ACB short time current withstand capacity for 1 sec (Icw= 50kA)	kA
10.1.7	ACB rated impulse withstand voltage for main & aux circuit in kv	
10.1.8	ACB closing time in ms	
10.1.9	ACB opening time in ms	
10.1.10	Guaranteed number of close & open operations at no load	
10.1.11	Guaranteed number of close & open operations at rated load	
10.1.12	ACB dimensions	
10.1.13	ACB operating mechanism -Trip free, anti pumping type, manual as well as motor	Yes / No
10.1.14	Spring charging motor supply	volt
10.1.15	Close & trip coil supply	volt
10.1.16	ACB utilization category -B as per IS	
10.1.17	ACB indications - ON, OFF & TRIP	
10.1.18	ACB operation - manual - ON, OFF by push buttons	
10.1.19	ACB operation – electrical - ON, OFF by TNC switch	
10.1.20	ACB overload, short circuit & earth fault protection - By static or micro processor based releases	
10.1.21	Inbuilt CT burden, ration & class	
10.1.22	Overload release setting range	
10.1.23	Short circuit release setting range	
10.1.24	Earth fault release setting range	

10.1.25	Display & Event Log	Display Require , Min last 10 nos fault event log req
10.2.0	MCCB make	
10.2.1	MCCB type -3 pole, one break / pole	Yes / No
10.2.2	MCCB - On & OFF by Manual handle	Yes / No
10.2.3	MCCB Neutral connection - Fully isolable link sized for rated current	
10.2.4	MCCB rated voltage 415v +/- 10% at 50Hz	
10.2.5	MCCB rated continuous current at 50deg C(after derating)(400 amp & 630A MCCB as per enquiry)	400/630 amp
10.2.5(i)	De rating of MCCB(0% at 50 deg C)	Yes / No
10.2.6	MCCB 3 ph short circuit breaking capacity Ics = Icu =36kA	
10.2.7	MCCB 3 ph short circuit withstand capacity, Icw =8kA for 1 sec	
10.2.8	MCCB SC making current capacity	
10.2.9	MCCB rated insulation level	
10.2.10	MCCB mechanical & electrical endurance as per IS 13947 / IEC	
10.2.11	MCCB category of duty - B as per IS / IEC 947	Yes / No
10.2.12	MCCB indications -ON, OFF & TR	
10.2.13	MCCB protection – Microprocessor release + earth fault	
10.2.14	Tripping characteristic required	
a	Overload setting- Range 60-100%In (Set on 95%)	
b	Short Circuit setting- Range 200-1200%In (Set on 300%)	
c	Earth fault setting To be provided	
10.2.15]	MCCB Housing- Thermoplastic material resistant to fire & abnormal heat , non hygroscopic	
10.2.16]	MCCB Terminal- Silver coated copper with phase barriers, spreader terminals & shrouds	
10.2.16]	MCCB Spreader size & material-	
	Minimum-50(W)X50(L)X10(D)mm- Cu suitable for bimetallic joint i.e. for aluminium bus/cable lug	

10.2.17	MCCB Clearances in air- As per table XIII of IS 13947-1	
10.2.18	MCCB temperature rise limits - As per table 2 & 3 of IS 13947-1	
10.2.19	MCCB Ingress Protection- IP2X Minimum (pollution degree minimum 2)	
10.2.20	MCCB additional features	Sealing/padlocking of operating knob in OFF position Sealing/padlocking of operating knob in OFF position isolation suitable with positive contact
10.3.0	Connection to ACB main bus by Cu bar with double PVC insulation	Yes / No
10.3.1	For 400 amp MCCB	
10.3.2	For 630 amp MCCB	
10.4.0	Connection to outgoing cables by bus bar terminals suitable for 2x4CX300sqmm AYFY 1100 volt grade cable	
10.4.1	MCCB– 7 nos. for Type–I , 5 nos. for Type–II & 3 for Type-III & 630 Amp three phase + neutral link	(YES/ NO)
10.4.2	Only for Type II & III- Provisions in LT panel to increase LT outgoing by 02 no's by adding MCCB's in future.	(YES/ NO)
11.0.0	APFC system	
11.1.0	Rating of APFC system	KVAR
11.2.0	Rated voltage & frequency	Volts at 50Hz
11.3.0	Rated line current of APFC system	Amp
11.4.0	Rated capacitance	micro Farad
11.5.0	Capacitor steps – Type I: 12x25KVAR? Type II: 8 X 25 KVAR?	Yes / No
11.6.0	Rated current of each 25KVAR unit	Yes / No
11.7.0	Rated capacitance – 25KVAR unit	micro Farad
11.8.0	Three phase connection – star / delta	
11.9.0	Capacitor dielectric type –	APP / MPP
11.10.0	No of series group / capacitor unit	
11.11.0	No. of parallel elements / series group	
11.12.0	Thickness of PP film in micron	
11.13.0	Thickness of Al foil in micron	
11.14.0	No. of PP film layers	
11.15.0	Maximum voltage stress per each PP film layer	
11.16.0	Discharge device material	

11.17.0	Capacitor tank steel thickness	mm
11.18.0	Capacitor unit dimension (L x D x H)	
11.19.0	APFC dimensions in mm (L x D x H)	
11.20.0	APFC system weight in kg	
11.21.0	Heat generated by APFC in Kw with all capacitor steps ON	
11.22.0	Operation with over voltage 115% of rated voltage for 12 hours in a day	
11.23.0	Operation with harmonic distortion THD 5% voltage & current	
11.24.0	Maximum permissible over current of	
11.25.0	1.3 times rated current continuous	
11.26.0	Dielectric loss less than 0.2w / KVAR	
11.27.0	Guaranteed minimum capacitor switching operations (ON/OFF) per year	
11.28.0	Maximum temperature rise above ambient of 45 Deg C	Deg C
11.29.0	Residual voltage after de-energiszation & at 60 seconds	
11.30.0	Design life of capacitor unit	
11.31.0	APFC panel insulation level	
11.32.0	1 minute power frequency withstand	KV
11.33.0	Impulse withstand voltage	KVp
11.34.0	Main bus bar material / size (sqmm)	
11.35.0	Main bus bar rated current	
11.36.0	Main bus bar short time withstand	
11.37.0	CT make & accuracy class	
11.38.0	CT ratio & burden (VA)	
11.39.0	APFC relay make / type	
11.40.0	APFC relay catalogue enclosed?	Yes / No
11.41.0	Data logger make / type	
11.42.0	Data logger catalogue enclosed?	Yes / No
11.43.0	AC contactor make	
11.44.0	AC contactor rating	Amp
11.45.0	AC contactor utilization category as per IS	
11.46.0	100amp MCCB make	
11.47.0	100amp MCCB current breaking capacity Ics=Icu=35kA	
11.48.0	Copper wire size from MCCB to contactor & capacitor – 35sqmm Cu	
12.0.0	Energy meter box as per specification provided?	Yes / No
13.0	Enclosure for package substation	

13.1	Service conditions for outdoor use	Yes / No
13.2	Material for enclosure – Galvanised Sheet steel 2.5mm thick CRCA for all side doors, covers with painting	Yes / No
13.3	Enclosure construction -Frame supported construction with all doors, covers welded with steel channel ribs at every 1000mm minimum	Yes / No
13.4	Lifting lugs for site handling / lifting by crane - qnty	
13.5	Doors for RMU compartment & LV compartment with anti theft hinge minimum 3 nos., with lockable handle & with padlocking facility	Yes / No
13.6	Two side covers for transformer	Yes / No
	compartment bolted with Allen head type bolts to main frame	
13.7	Top & other side walls of enclosure welded sheet metal	
13.8	Removable canopy above top cover -2.5mm thick sheet metal with 10º slope	Yes / No
13.9	Enclosure integral steel base frame 'I' section size	
13.10	Base frame bottom support pads for fixing by bolt to foundation - minimum six numbers to rest on foundation	Yes / No
13.11	Enclosure compartments -separate compartments for RMU, transformer & LV switchgear/APFC	Yes / No
13.12	Separation between RMU & transformer compartment by sheet steel 2.5mm thick	Yes / No
13.13	Separation between transformer compartment & LV compartment by sheet steel 2.5mm thick	Yes / No
13.14	Degree of ingress protection against solids & water as per IS12063	
a	IP53 for RMU compartment	
b	IP34 for transformer compartment	
c	IP33 for LV compartment	
13.15	Louvers on side covers of transformer compartment & side walls of LV compartment with steel wire mesh welded from inside so as to meet IP requirement as above	Yes / No

13.16	Louver area on cover / side wall -1500mm height x 1500mm minimum	
13.17	Exhaust fans mounted for APFC system to discharge air in transformer compartment - Controlled by SPMCB & thermostat to operate above 35 deg C, 2x150CFM, 1 ph 230v 50Hz	
13.18	Gland plate for RMU compartment - 2.5mm thick MS plate suitable for 3x3c300sqmm AYFY 11kv cable	
13.19	Gland plate for LV compartment -2.5mm thick MS plate suitable for 10x4c400sqmm cable + 10x7c2.5sqmm cable	
13.20	Class of enclosure as per IEC 62271-202 = 10K	Yes / No
13.21	Overall dimensions of package substation (LxWxH)	In mm
13.22	Overall weight of package substation	Kg
14.0	Enclosure earthing & illumination	
14.1	Two earth bus connection brought out of package substation enclosure to earth pad for connection to earth pit -Two earth pads for RMU, transformer & LV compartment each -One earth pads for transformer neutral	
14.2	Earth bus size 50X 6 mm GI flat	
14.3	Earth bus fault current capacity 26.3kA for 1 sec	
14.4	Earth connection of all covers, doors & structural parts to GI bus by metallic jumper connection	Yes / No
14.5	Earth connection of RMU, ACB & transformer body parts to GI bus by two numbers of 50x6mm GI flat per equipment	
14.6	Earth bus identification shown by letter ‘E’	Yes / No
14.7	RMU, transformer & LV Compartment illumination by 36w CFL fixture controlled through SPMCB & door limit switch	
14.8	RMU, transformer & LV compartment power socket - 5/15amp 3 pin socket controlled through 15 amp SPMCB	
14.9	Paint shade external for enclosure	
14.10	Paint shade internal for enclosure	
14.11	Paint material & thickness	

14.12	Name plate & labels as per specification provided?	Yes / No
14.13	Smoke Detector	Yes / No
14.13.1	Make	
14.13.2	No Of Aux Contacts	
14.14	Hooter	Yes / No
15.0	Type test report submitted with GTP for RMU, transformer, ACB, MCCB, APFC system?	Yes / No
15.1	GA drawing of package substation submitted with GTP?	Yes / No
15.2	Bill of material submitted with GTP?	Yes / No
15.3	Clause wise deviation to technical specification submitted?	Yes / No

Bidder / Vendor seal / signature ----------

Name of the bidder	
Address of bidder	
Name of contact person	
Telephone no & email id	

Annexure D - CRGO & Testing Points

In addition to the BSES specification following points to be verified during manufacturing/inspection.	
1	Transformer core shall be low loss, non-ageing, high permeability PRIME GRADE CRGO with M3 Grade or better with max thickness of 0.23mm and with max core loss of 1 W/Kg, perfectly insulated and clamped to minimize noise and vibrations.
2	Following stage inspections will be carried out by purchaser or by third party engineers appointed by BSES :
2.1	Verification & inspection of the mother coil at port & putting stamp & seal may be inspected by BSES.
2.2	Reconciliation of mother coil by checking stamp & seal at factory before slitting. One sample of CRGO to be sealed for testing at ERDA/CPRI. Following Tests shall be conducted on the sample: 1) Specific core loss measurement 2) Magnetic polarization 3) Magnetic permeability 4) Specific core loss measurement after accelerated ageing test 5) Surface insulation resistivity

	6) Electrical resistivity measurement 7) Stacking factor 8) Ductility(Bend test) 9) Lamination thickness 10) Magnetization characteristics (B-H curve)
2.3	Bidder should have in house core cutting facility for proper monitoring & control on quality. In case it is done outside cutting shall be done in presence of BSES.
2.4	Following documents to be submitted during the stage inspection :
2.4.1	Invoice of supplier
2.4.2	Mills test certificates
2.4.3	Packing list
2.4.4	Bill of lading
2.4.5	Bill of entry certificates by customs
2.5	BSES may appoint recognized testing authority like CPRI /ERDA with their instruments & engineer's team and measure no load loss, load loss and percentage impedance of the transformer at supplier's works at our own cost. Bidder shall agree and give them full cooperation during their stay & testing at shop floor. The losses & impedance values so obtained will be considered as final.
2.8	Bidder should have in-house NABL accredited testing facility. In case of unavailability of same, one Transformer of each rating shall be randomly selected and sealed by BSES representative for complete acceptance test as per IS 2026-Part 11 (including temperature test) at third party NABL Lab. Tests shall be conducted once per Rate contract.

Annexure E Recommended spares (Data by supplier)

List of recommended spares as following

Sr. No	Description of spare part	Unit	Quantity
1		No	
2		No	
3			
4			
5			
6			
7			

Annexure F: BOM for 250 kVA PSS

Bill of Material for 11kV, 250 kVA PSS with (2 X 2 X 2 mtr)		
A	3 Way RMU (2 LBS + 1 VCB)	1 No.
B	250 kVA Dry/Oil DT	1 No.
C	LT Switchgear	
	Incomer 400 A 4P LT ACB	1 No.
	Outgoing 250A 3P MCCB	2 No.
D	Outdoor Enclosure	
	Outdoor type enclosure having modular construction of CRCA sheet metal in corrugated type wall design for better heat dissipation and providing robust construction. The enclosure shall have IP54 degree of protection for HT & LT switchgear compartment & IP34 degree of protection for Transformer compartment. The enclosure exterior shall be painted with epoxy based powder paint (colour RAL 7032). Each compartment will be provided with the door and pad locking arrangement. Doors of transformer compartment are fitted with Arc reflectors from the inside for providing better safety. The Compartment illumination lamp with door operated switch shall be provided for each compartment.	1 Set
E	Height of all equipment (RMU,LT panel & DT) from FGL	300 mm above from FGL
F	No foundation requirement , base frame / Pad mounted	Req.
G	Smoke detector with flag type auxiliary relay	Req.
H	Other material like (MFM, Fire Ball, Cable sealing compound, Space for DT meter Installation, etc.)	As per Spec

BSES

Specification of
11 kV Dry type Smart Package Substation

Specification no – BSES-TS-122-SPSS-R0

Rev		0
Date:		23/06/2022
Pages		77
Prepared by	Jeena Borana	
	Rohit Patil	
Reviewed by	Srinivas Gopu	
	Amit Tomar	
Approved by	Gaurav Sharma	
	Gopal Nariya	

Index

Record of Revision

Revision No	Item / clause no.	Nature of Change	Approved By

1.0 Scope

1.1 Design, manufacture, testing at manufacturer works before dispatch, packing, and delivery of Packaged Substation (PSS) as per this specification and supply of commissioning spares.

1.2 Supply of all installation/commissioning accessories for PSS.

1.3 Submission of documentation of PSS with operating manuals of each equipment.

1.4 Installation testing & commissioning of PSS at site along with interconnection of all components DI/DO/AI signals, status monitoring signals and wireless sensors signals to FRTU. Integration of FRTU with SCADA.

1.5 FRTU Licensed software for programming, configuration, troubleshooting and diagnosis of FRTU shall be provided.

1.6 Supplier scope includes training of BSES team – 4 batches (each batch with 4-5 engineers) for minimum 3 days at factory for erection, commissioning, maintenance trouble shooting of complete PSS including Transformer, RMU, FRTU, Modem, LT Panel, APFC.

1.7 If any item not specifically mentioned in scope but necessary for successful operation of substation shall be deemed to be included in bidder's scope.

2.0 Codes & standards

Materials, equipment and methods used in the manufacture of 11kV Packaged Substation shall conform to the latest edition of following –

S.no	Standard	Title
2.1	Indian Electricity Rules	With latest amendments
2.2	Indian electricity act	IE act 2003
2.3		CBIP manual on transformers
2.4	IEC 60076	Power transformers
2.5	IEC:60616	Terminal and Tapping Markings for Power Transformers
2.6	IEC: 60529	Degrees of Protection Provided by Enclosures (IP Code).
2.7	IEC 60694	Specification for high voltage switchgear
2.8	IEC 60439-1	Low voltage switchgear & control gear assemblies
2.9	IEC 60529	Degree of enclosures provided by enclosures
2.10	IEC 60664-1	Insulation coordination for low voltage systems
2.11	IEC 62262	Degree of protection provided by enclosure against mechanical shocks
2.12	IEC 62271-202	High voltage switchgear & control gear - prefabricated substation
2.13	IEC 60044	Instrument transformers - Current & voltage transformers
2.14	IEC 60225	Electrical relays
2.15	IEC 60625	High voltage switches
2.16	IEC 60502	Power cables

2.17	IEC 60947-2	Low-voltage switchgear and control gear :Circuit breakers
2.18	IS 2026 part 11	Power transformers-Dry type Transformer
2.19	IS 11171	Dry type transformers
2.20	IS 2026	Loading of power transformers
2.21	IS 13947	Low voltage switchgear & control gear
2.22	IS 2099	Bushings for voltages above 1000V
2.23	IS 3156	Voltage transformers
2.24	IS 2705	Current transformers
2.25	IS 1554	PVC cables
2.26	IS 7098	XLPE cables
2.27	IS 2629	Recommended Practice for Hot-Dip Galvanizing of Iron and Steel
2.28	IS 4759	Hot-dip zinc coatings on structural steel and other allied products
2.29	IS 13585	Shunt capacitors
2.30	IS 13340	Shunt capacitors
2.31	IS 3043	Code of practice for Earthing
2.32	IS 8130	Conductors for insulated cables
2.33	IS 5	Ready mixed paints

In the event of direct conflict between various order documents, the precedence of authority of documents shall be as follows -

i. Guaranteed Technical Particulars (GTP)

ii. Specification including applicable codes & standards

iii. Approved Vendor Drawings

iv. Other documents

3.0 Electrical Distribution System Data

3.1.1	HT supply System	3 phase AC, 3 wire
3.1.2	Voltage	11000 volt ±10%
3.1.3	Frequency	50 Hz ± 5%
3.1.4	Fault level	350MVA – 18.5kA
3.1.5	System neutral	Earthed at upstream 11kV source
3.2.1	LT supply system	3 phase AC, 4 wire
3.2.2	Rated voltage	415V +/-10%
3.2.3	Rated frequency	50 Hz ± 5%
3.2.4	Fault level	35MVA – 50kA

4.0 PSS Configuration

4.1 Types of PSS- General

S.no	PSS type	DT rating, kVA	RMU	LT Panel						APFC rating, kVAr @400V
				Incomer, ACB		Buscoupler, ACB		Outgoing, MCCB		
				Rating, Amps	Qty, no's	Rating, Amps	Qty, no's	Rating, Amps	Qty, no's	
4.1.1	Type 1	2000	3Way	3200	1	NA	NA	630	12	600
4.1.2	Type 2	2000	4Way	3200	1	NA	NA	630	12	600
4.1.3	Type 3	2000	3Way	3200	1	3200	1	630	10	600
4.1.4	Type 4	2000	4Way	3200	1	3200	1	630	10	600
4.1.5	Type 5	1600	3Way	3200	1	NA	NA	630	10	500
4.1.6	Type 6	1600	4Way	3200	1	NA	NA	630	10	500
4.1.7	Type 7	1600	3Way	3200	1	3200	1	630	8	500
4.1.8	Type 8	1600	4Way	3200	1	3200	1	630	8	500
4.1.9	Type 9	1000	3Way	2000	1	NA	NA	630	7	300
4.1.10	Type 10	1000	4Way	2000	1	NA	NA	630	7	300
4.1.11	Type 11	1000	3Way	2000	1	2000	1	630	5	300
4.1.12	Type 12	1000	4Way	2000	1	2000	1	630	5	300
4.1.13	Type 13	630	3Way	1250	1	NA	NA	630	5	200
4.1.14	Type 14	630	4Way	1250	1	NA	NA	630	5	200
4.1.15	Type 15	630	3Way	1250	1	1250	1	630	5	200
4.1.16	Type 16	630	4Way	1250	1	1250	1	630	5	200
4.1.17	Type 17	400	3Way	800	1	NA	NA	630	3	200
4.1.18	Type 18	400	4Way	800	1	NA	NA	630	3	200
4.1.19	Type 19	400	3Way	800	1	800	1	630	3	200
4.1.20	Type 20	400	4Way	800	1	800	1	630	3	200

4.2 Type of PSS- Multistoried building

S.no	PSS type	DT rating, kVA	RMU	LT Panel								APFC rating, kVAr @400V
				Incomer, ACB		Buscoupler, ACB		Outgoing				
								ACB		MCCB		
				Rating, Amps	Qty, no's	Rating, Amps	Qty, no's	Rating, Amps	Qty, no's	Rating, Amps	Qty, no's	
4.2.1	Type 21	2000	3Way	3200	1	NA	NA	2000	2	630	2	600
4.2.2	Type 22	2000	4Way	3200	1	NA	NA	2000	2	630	2	600
4.2.3	Type 23	1600	3Way	3200	1	3200	1	2000	2	630	2	500
4.2.4	Type 24	1600	4Way	3200	1	3200	1	2000	2	630	2	500

5.0 PSS Enclosure

5.1	Service conditions	For outdoor use
5.2	Material for enclosure	Galvanised Sheet steel 2mm thick with painting
5.3	Enclosure construction	Frame supported construction with all doors, covers welded with steel channel ribs at every 1000mm minimum
5.4	Lifting lugs for site handling / lifting by crane	Four numbers on top to enable lifting of total package unit without any problem
5.5	PSS enclosure door	a) Doors to be provided for all LT, HT and Transformer compartment. b) The door arrangement should be folded type design, the width of each folding section door is limited to 600mm. c) The doors should be internal anti theft hinge with minimum opening angle of 120º, minimum 3 nos. with lockable handle & with padlocking facility d) The door limits switch to be provided for status of door.
5.6	Top & other side walls of package substation enclosure	Welded sheet metal to main frame
5.7	Removable canopy above top cover	2mm thick sheet metal with 10º slope
5.8	Enclosure integral steel base frame	'I' section of suitable size to support total static and dynamic load

5.9	Base frame bottom support pads for fixing by bolt to foundation	Minimum six numbers to rest on foundation
5.10	Enclosure compartments	Separate compartments for RMU, transformer & LV switchgear/APFC
5.11	Separation between RMU & transformer compartment	By sheet steel 2mm thick
5.12	Separation between transformer compartment & LV compartment	By sheet steel 2mm thick
5.13	Degree of ingress protection against solids & water as per IS12063	IP53 for RMU compartment IP23 for transformer compartment IP33 for LV compartment
5.14	Louvers on side covers of transformer compartment & side walls of LV compartment	To be provided with steel wire mesh welded from inside so as to meet IP requirement
5.15	Louver area on cover / side wall	1500mm height x 1500mm desirable
5.16	Exhaust Fans	Mounted in LV compartment to discharge air in transformer compartment & Controlled by SPMCB & thermostat to operate above 35 deg C, 2x150CFM, 220V DC. Rectifier to be provided for exhaust fan supply.
5.17	Gland plate for RMU compartment	3 mm thick MS plate suitable for 3x3c300sqmm AYFY 11kv cable
5.18	Gland plate for LV compartment	3 mm thick MS plate suitable for rated LT outgoing as per the PSS type. Each LT outgoing is suitable for 2X4CX300 sq mm cable.
5.19	Class of enclosure as per IEC 62271-202	10K
5.20	Internal Arc classification	IAC AB 20 KA, 1s
5.21	Limiting dimensions of package enclosure	
5.21.1	Type 1 to Type 8 and Type 21 to 24 configuration	4200(L) x 3000(W) x 3200(H)
5.21.2	Type 9 to Type 20 configuration	3400(L) x 2600(W) x 2600(H)

6.0 11KV Ring Main Unit

6.1.1	RMU Configuration	As per the PSS type
6.1.1.1	3 Way RMU, all are VCB modules.	
6.1.1.1.1	Cable feeder 1	Motorized VCB with manual operation facility. FPI and CBCT to be provided.
6.1.1.1.2	Cable feeder 2	Motorized VCB with manual operation facility. FPI and CBCT to be provided.

6.1.1.1.3	Transformer feeder	Motorized VCB with manual operation facility. Self power relay with protection CTs to be provided.
6.1.1.2	4 Way RMU, all are VCB modules.	
6.1.1.2.1	Cable feeder 1	Motorized VCB with manual operation facility. FPI and CBCT to be provided.
6.1.1.2.2	Cable feeder 2	Motorized VCB with manual operation facility. FPI and CBCT to be provided.
6.1.1.2.3	Transformer feeder 1	Motorized VCB with manual operation facility. Self power relay with protection CTs to be provided.
6.1.1.2.4	Transformer feeder 2	Motorized VCB with manual operation facility. Self power relay with protection CTs to be provided.
6.1.2	Extensibility	Non extensible type
6.1.3	Insulation Medium	
6.1.3.1	For panel	SF6 gas in sealed metallic tank
6.1.3.2	Breakers	Vacuum type (with disconnector & earth switch)
6.1.4	Arc interruption chamber for breaker	Arc interruption chamber of breakers shall be separate from the main insulated tank.
6.1.5	Maximum dimensions of RMU	1250 mm(W) X 800 mm (D) X 2000 mm (H)
6.2.0	RMU Panel Construction	
6.2.1	Panel type	Metal enclosed, framed, Compartmentalized panel construction
6.2.2	Service Location	Indoor, non air conditioned environment
6.2.3	Mounting	Free Standing
6.2.4	Overall Enclosure Protection	IP4X minimum, vermin proof
6.2.5	Doors	Front access with internal anti theft hinge arrangement with minimum opening angle of 120º, minimum three hinges (desirable)
6.2.6	Covers	Bolted for rear access, with handles. Support for handle shall be provided at suitable place on RMU body. All the accessible bolts / screws shall be vandal proof. One set of required Special tools per RMU (if any) shall be in the scope of supply.
6.2.7	Construction	Sheet metal 2.5mm thick CRCA
6.2.8	Base frame	a) Made of CRCA steel b) Base frame height should be 300 mm
6.2.9	Power Cable Clamping Arrangement	Shall be provided for each power cable alongwith HDPE cable clamps (to suit the cable size from 150 to 400 sq mm PILC / XLPE cable. Exact size shall be provided during drawing approval stage.)
6.2.10	Lifting lugs	Four numbers

6.2.11	Cable Entry	Bottom
6.2.12	Gland plate	Separate for control cable & power cable 3mm metallic, removable type & split type in two parts, with 1 no ,90mm diameter knockout punch/ hole in the centre.
6.2.13	Cable termination	
6.2.13.1	Cable type & size	3C X 150 / 240 / 300 /400 sq mm Aluminium conductor XLPE/ PILC with armour & PVC outer sheath
6.2.13.2	Terminals for 11kV cable termination	.
6.2.13.2.1	Terminals	M16 size Set of required size of stud suitable for M 16 size Ring type lug & bimetallic washers.
6.2.13.2.2	Bimetallic washers	Required
6.2.13.2.3	Right angled boots	Minimum 20mm spacing between boots preferred. Type test reports, maintenance replacement plan shall be submitted.
6.2.13.2.4	Cable Test Plug	Preferred with cable test plug facility, without opening of cable compartment
6.2.13.3	Termination type	Suitable for heat shrinkable type
6.2.13.4	Termination height	700mm minimum, from gland plate
6.2.14	Bus bar	Tinned copper with sleeve (Sizing Calculation to be submitted in support of its Guaranteed S.C. rating / Capability)
6.2.14.1	Bus bar continuous rated current	630amp
6.2.14.2	Bus bar short time withstand capacity	20 KA for 3 sec
6.2.14.3	Bus bar support insulator material	SMC / DMC resin
6.2.14.4	Maximum temperature rise above reference ambient	In line with Table 3 of IEC60694
6.2.15	Earth bus bar	Aluminum / Copper sized for rated fault duty for 1 sec
6.2.15.1	Earth bus internal connection to all noncurrent carrying metal parts	By 2.5 sq mm copper flexible wire, Earth connection point maximum 1 meter away from cable test facility
6.2.15.2	Earth bus external connection to owners earth	Studs on both sides with holes for M10 bolt + hardware to readily receive purchaser earth connection
6.2.16	Cooling arrangement	By natural air without fan
6.2.17	Panel internal wiring	a) Multi strand flexible color coded PVC insulated Cu wire 1 sq mm (SCADA) b) 1.1KV , PVC insulated 2.5 sq mm cu cable for CT connection. c) Colour of wire (R phase - Red, Y phase –

		Yellow, B phase – Blue, AC- black, DC – grey, Earth – green) with ferrules at both ends. All the internal control / auxiliary wiring shall be routed through proper conduit.
6.2.18	Hardware (Nut, bolts & handle)	Stainless steel (Except termination nut-bolts which are Brass / Tinned Copper)
6.2.19	Gasket	Neoprene rubber
6.2.20	Marshalling terminal blocks	Terminal block size should be suitable for 2.5 Sq mm, Nylon 66 material, screw type + 20% spare in each row of TB.
6.2.21	Panel cover fixing bolts	Allen head 6mm with hexagonal slot
6.2.22	Padlock facility	Required for all earth switches & all handles
6.2.23	Internal Arc classification	
6.2.23.1	Explosion vents	To ensure operator's safety, design should ensure that gases / flames generated during flash over / blast in any of the compartment, must not come out from the front of RMU as well shall not go to adjacent cable compartment. Internal arc test report (for Cable compartment & other compartments) must be submitted to support above, along with RMU GA drawing indicating these vents. There shall not be any type of holes, gaps etc on the walls of cable termination compartment.
6.2.23.2	Internal Arc rating	20 kA for 1s
6.2.23.3	Internal arc classification	Shall comply to the requirements of IEC 62271-200, Accessibility type AFLR. Operators of equipment shall be protected against the effects of an arcing fault in any of the MV compartment at all times , including while carrying out the maintenance works on other compartments
6.2.23.3	SF6 Gas Annual Loss	< 0.1% of total mass. Pressure of SF6 gas shall be above the operating limit throughout the life of the equipment.
6.3.0	Circuit breaker	
6.3.1	Type	Three pole, operated simultaneously by a common shaft
6.3.2	Arc interruption medium	Vacuum Bottle
6.3.3	Operating mechanism	Motorized spring charged stored energy type with facility for manual charging
6.3.4	Motor rated voltage	24V DC
6.3.5	Emergency trip / open push button	On panel front with Protective flap to prevent any accidental tripping of breaker.

6.3.6	Continuous rating	630amp
6.3.7	Short time withstand capacity	20 KA for 3 sec
6.3.8	Minimum number of operations at rated current (as per IEC 62271-100)	Mechanical Endurance – Class M1(2000 operations) Electrical Endurance – Class E2
6.3.9	Fault making capacity	50 KA peak
6.3.10	Fault breaking capacity	20 KA Minimum
6.3.11	Maximum number of operations at rated Fault current (as per IEC 62271-100)	Electrical Endurance – Class E2. To be guaranteed by manufacturer with authorized lab test reports
6.3.12	Breaker status auxiliary contact	2NO + 2NC wired to terminal block
6.4	Earth switch	
6.4.1	Type	Three Pole, operated simultaneously by a common shaft for each Circuit breaker.
6.4.2	Dielectric medium	SF6 gas
6.4.3	Operating mechanism for close & open	Manual
6.4.4	Fault making capacity	50 kA (Desirable)
6.4.5	Auxiliary contacts	1NO+1NC wired to terminal block
6.4.6	Disconnect switch (if provided in series with vacuum bottle)	Desirable to be located on purchaser cable connection side of vacuum bottle
6.4.7	Minimum number of operations at no load (as per IEC 62271-102)	Mechanical Endurance – Class M0(1000 operations)
6.4.8	Making capacity endurance of earth switch (as per IEC IEC 62271-102)	Class E2 (Min 10 operations)
6.5	For Cable Feeder circuit breaker module (Module 1& Module 2)	
6.5.1	Self powered relay	Not required
6.5.2		
6.5.3	Fault passage indicator (FPI)	To be provided cable feeders
6.5.4	Fault passage indicator (FPI) (Earth fault and over current protection type)	a) To be provided on each and every cable feeder for RMU. FPI shall be earth fault and over current protection type and shall be suitable for remote load monitoring at SCADA for cable feeders. b) CBCT – Split open type suitable for mounting without disconnection of cable for EF.

		c) Phase sensor – 3 Nos. split open type for short ckt. purpose with mounting arrangement
6.5.5	Connection of CBCT with FPI	Cable connection of FPI with CBCT shall be of pre moulded type on the CBCT side. Cable shall be 2.5 sq.mm cu cable or fiber cable.
6.5.6	Fault Passage Indicator	a) Digital type and shall operate as the current exceeds the set value. Flash indication for identifying faults with red LED with one flash for every one sec. Test & reset button 1 NO + 1 NC potential free contact for remote indication FPI power supply unit shall use lithium battery with minimum life of 1000 blinking hours , so that FPI shall continue to function even after main feeder has tripped. FPI shall be powered with 24V DC in all motorized RMU. b) FPI shall be suitable for remote load monitoring at SCADA for Cable feeder. FPI shall be provided with Remote communication capability with SCADA on Modbus Protocol. The Load current as measured by FPI shall be communicated to SCADA.
6.5.6.1	**Earth Fault Indicator**	
6.5.6.1.1	Sensing Current	50 to 400A
6.5.6.1.2	Sensing Time	30 to 100 ms in steps of 10ms.
6.5.6.1.3	Reset Time	0.5 -1-2-3-4 hr
6.5.6.1.4	Resetting Facility	a) Self rest after reset time b) Self rest after restoration of voltage c) Manual d) Remote resetting
6.5.6.1.5	Contact Rating	1A at 230 V
6.5.6.1.6	Degree of Protection	IP 54
6.5.6.1.7	Mounting Arrangement	Surface or Flush Mounting
6.5.6.1.8	Ambient Temperature	-20 to 55 Deg C
6.5.6.2	**Short Ckt indicator**	
6.5.6.2.1	Sensing Current	200 to 1200 A
6.5.6.2.2	Sensing Time	30 to 100 ms in steps of 10 ms
6.5.6.2.3	Reset time	0.5-1-2-3-4 hr
6.5.7	Data by Purchaser	
6.5.7.1	System Fault Level	2kA – 8.75kA

6.5.7.2	Type of Grounding	Solidly Grounded
6.5.7.3	Fault clearing time	100ms
6.5.7.4	Cable Type	XLPE , 70 sq.mm to 400 sq.mm
6.6	For Transformer circuit breaker module (Module 3)	
6.6.1	Current transformer	a) 75-150-400 / 1 amp b) Resin Cast Ring type c) Considering three core cable terminations, mounting flexibility shall be provided for CT's (in horizontal & vertical direction both). Additionally, CAUTION marking (by sticker/ paint) shall be provided to avoid CT's installation above the screen of cable. (i.e. earth potential point.) d) Disconnecting type terminal block shall be provided for CT Circuit. e) Change in CT ratio shall be possible from the disconnecting type TB. Any change in CT ratio from CT secondary will not be acceptable.
6.6.2	CT accuracy class	5P10 minimum
6.6.3	CT burden	CT burden should be 20% higher than the connected relay burden.
6.6.4	Protection relay	a) Self powered, Microprocessor based Numerical relay (with backlit LCD display), IDMT over current / earth fault protection with high set element, manual reset type, flush mounted on panel front b) Relay Setting 10 % to 250% In insteps of 1% c) The relay should record atleast 10 fault events on FIFO basis d) Relay should have event recorder e) Relay auxiliary supply shall be 24V DC for all motorized RMU. For non Motorized RMU relay shall be with 240V AC auxiliary for remote tripping f) RS-485 Port to be provided on the Relay for remote communication of the parameters to the SCADA through FRTU over IEC103 Protocol. Necessary internal wiring also shall be done between Relay and FRTU. g) Licensed software shall be provided for Relay communication with Laptop along with necessary cables for interconnection between Laptop and Relay (Based on requirement). h) Appropriate wiring to be done to connect all the relays to the FRTU.
6.6.5	Relay auxiliary contacts for remote indication	Potential free contact 1NO + 1NC wired to terminal block

6.6.6	Shunt trip 24V DC (for WTI trip & door limit switch & for remote trip from SCADA.)	To be wired to terminal blocks
6.7	FRTU and Associated equipment battery, BHMU and battery charger	
6.7.1	Battery	
6.7.1.1	Battery type	SMF lead acid battery
6.7.1.2	Rating	24V DC, 26AH (min). It shall be rated for 10 close & 10 open operations of RMU CBs motor as well as 3 hrs back up for all equipment install inside FRTU cabinet (mini FRTU load shall be consider 50 W). However the actual battery and battery charger sizing shall be finalize by owner during detail engineering and bidder has to supply the finalized size of battery and battery charger without any price implication.
6.7.1.3	Location	Battery shall be kept in shielded compartment in FRTU panel and fixed with rivet and nut bolt. Individual battery terminal shall be wired upto terminal blocks mounted in FRTU cabinet.
6.7.2	Battery Health Monitoring Unit (BHMU)	1. BHMU will have Auto / Manual test facility. In Auto Mode it ensures battery automatic discharge at preset set period with 100W discharge resistor along with suitable algorithm to check the healthiness based on rate of discharge. 2. In manual Mode PB provided for battery testing. 3. Provision for Bypass mode of BHMU shall also be provided. 4. Output contacts :230V/24V DC -5A a. Battery Fail: 1 CO b. Test In process 5. Indications: a. BHMU healthy. b. Battery Fail c. Battery Low d. Test On.
6.7.3	Battery charger	2 no's chargers with auto change over using 10A diodes.
6.7.3.1	MCBs at charger input & output supply	Required 2nos DP MCB for AC Incoming supply All the MCBs shall be easily accessible for operation, with proper labeling. All AC MCB shall be 2 poles. MCB location shall be preferably away from Battery charger location.
6.7.3.2	Charger temperature rise at heat sink at full load for 2 hours	Maximum 55 deg C above ambient of 40 deg C

6.7.3.3	Battery charger cooling method	Natural without any fans
6.7.3.4	Individual CBs DC control	Required with MCB
6.7.4	FRTU	FRTU shall be provided and integrated with RMU and LV compartment with completely wired along with Modem suitable for communicating over GSM network and also have facility to communicate with fibre network. Bidder shall demonstrate the data communication of FRTU modem with MCC/BCC for the proposed modem for approval of owner in the Pre Order technical evaluation stage. For detailed specification of FRTU, I/O requirements , refer standard specification of Annexure F
6.7.5	Modem	Modem should be dual sim 4G and shall also have compatibility of 3G/2G network. For detailed technical specification of modem, please refer Annexure E
6.7.6	Transducer	DC voltage transducer (4-20mA) for monitoring of DC battery bus voltage.
6.8	Requirements of sealed housing live parts (RMU SF6 gas chamber)	
6.8.1	Enclosure	Stainless steel enclosure suitable for IP67
6.8.2	SF6 gas pressure low alarm	To be given
6.8.3	Provision for SF6 gas filling	To be given (For ‘sealed for life’ design of RMU, this is not applicable)
6.8.4	Provision for SF6 gas pressure indication	Manometer with non return valve
6.8.5	Arc interruption method for SF6 breaker / Load break switch	Puffer type / rotating arc type
6.8.6	Potential free contacts for SF6 gas pressure low	1NO +1NC (Desirable)
6.9	RMU operation interlocks	
6.9.1	Circuit breaker & respective earth switch	Only one in ‘close’ condition at a time
6.9.2	Prevent the removal of respective cable covers if circuit breaker is ‘ON’	Electrical / Mechanical
6.9.3	Prevent the closure circuit breaker if respective cable cover is open	Electrical / Mechanical
6.9.4	Cable test plug for CB accessible only if Earth switch connected to earth	Mechanical
6.9.5	Prevent motorized operation of CB during manual operation	Electrical / Mechanical Electrical signal shall cut-off completely during manual operation. If CB fail to operate, the supply to motor shall be disconnected after certain time period

		to prevent burning of motor due to continuous supply.
6.9.6	Prevent motorized operation of more than one CB at a time	Necessary feature (Electrical)
6.10.1	Indication & signals	Local
6.10.1.1	Operation counter on front / Inside the RMU LT chamber	To be provided for each Circuit breaker, with minimum four digits & non resettable type
6.10.1.2	Cable charge status indication for all CB	Capacitor type voltage indicators with LED on all the phases (Shall be clearly visible in day light)
6.10.1.3	Spring charge status indication	On front for breaker
6.10.1.4	Circuit breaker On/OFF indication	Green for OFF / Red for ON
6.10.1.5	Earth switch closed indication (For Each CB)	On front
6.10.1.6	Circuit breaker protection relay operated on fault	Flag
6.10.1.7	Fault passage indication on CB	Flag
6.10.2	Status signals to SCADA-to be wired to marshalling terminal block	2NO + 2NC
6.10.2.1	CB close / open	potential free contacts
6.10.2.2	CB Earth Switch close /open	potential free contacts
6.10.2.3	Battery charger Fail	potential free contacts
6.10.2.4	CB close / open	potential free contacts
6.10.2.5	Protection relay operated	potential free contacts
6.10.2.6	FPI operated	potential free contacts
6.10.2.7	SF6 gas pressure low	potential free contacts
6.10.2.8	Ready to close signal to control centre to indicate all interlocks are OK	Potential free contacts. Signal to indicate Ready for remote operation from Scada required for entire closing and entire tripping ckt. with all interlocks accounted for (Make : Gogate with P Card / Eqvt after approvals)
6.10.2.9	Local / Remote Switch	a) A manual Local / Remote selector switch shall be provided for each FRTU to disable all control outputs by breaking the power supply connection to the control outputs. b) When in the “Local” position, the Local/ remote switch shall allow testing of all the control outputs of FRTU without activating the control outputs to field devices. A status input indication shall be

		provided for the Local/ Remote switch to allow the SCADA system to monitor the position of the switch. c) The status of Local/ Remote switch should be wired and configured in FRTU.
6.10.2.7	Commands from SCADA- to be wired to marshalling terminal block	Cable feeder close / open
		Cable feeder close / open
		FPI Reset
		Transformer feeder Trip
6.11.0	Mimic diagram, labels & finish	a) Mimic diagram (Shall not be accepted with Stickers) b) On panel front with description of function & direction of operation of handles/buttons
6.11.1	Operating Instructions	Operating instruction chart and Do's & Don'ts in Hindi / local language to be displayed on left / front side of panel enclosure on anodized Al Sheet 16SWG, duly affixed on panel.
6.11.2	Name plate on panel front	Fixing by rivet only
6.11.2.1	Material	Anodized aluminum 16SWG / SS
6.11.2.2	Background	SATIN SILVER
6.11.2.3	Letters, diagram & border	Black
6.11.2.4	Process	Etching
6.11.2.5	Name plate details	Month & year of manufacture, equipment type, input & output rating, purchaser name & order number, guarantee period
6.11.3	Labels for meters & indications	Anodized aluminum with white character on black background OR 3 ply lamicoid
6.11.4	Danger plate on front & rear side	Anodized aluminum 16 SWG with white letters on red background
6.11.5	Painting surface preparation	Shot blasting or chemical 7 tank process
6.11.6	Painting external finish	Powder coated epoxy polyester base grade A, shade -RAL 7032, uniform thickness 60 micron minimum
6.11.7	Painting internal finish	Powder coated epoxy polyester base grade A, shade -white, uniform thickness 60 micron minimum

7.0 11KV XLPE Cable & termination kit

The 11kV XLPE cable connection from RMU to distribution transformer shall be conforming to IS 7098 and shall have all the following features –

7.1	Cable type & size	XLPE insulated armoured / un armoured cable 3C x 150 sqmm Aluminium conductor
7.2	Cable voltage grade	11KV
7.3	XLPE insulation thickness	3.14 mm minimum
7.4	Aluminium conductor no of strands	As per Table 2 of IS 8130
7.5	Insulation screen	With semi conducting extrusion, copper tape & water swellable tape
7.6	Type of armour	GI flat as per table 4 of 7098 part 2
7.7	11KV end termination at RMU	By 11kv grade end termination kit, heat shrink type
7.8	11KV end termination at Distribution transformer	By 11kv grade end termination kit, heat shrink type
7.9	Cable support from RMU to transformer HT side cable box	GI cable tray 300mm wide

8.0 Dry Type Transformer

8.1.0	Major Design criteria	
8.1.1	Voltage variation on supply side	+ / - 10 %
8.1.2	Frequency variation on supply side	+/ - 5 %
8.1.3	Transient condition	- 20 % or + 10 % combined variation of voltage and frequency
8.1.4	Service Condition	Refer Annexure B, the transformer enclosure in PSS is to be designed for outdoor location with service condition as specified, but its full rating shall be available if located indoor in poorly ventilated atmosphere
8.1.5	Insulation Level	
8.1.5.1	One minute power frequency withstand voltage	28KV for 11KV system & 3KV for 415 V system
8.1.5.2	Lightning impulse withstand voltage	75KV peak for 11KV system
8.1.6	Short Circuit withstand Capacity of the transformer	
8.1.6.1	Three phase dead short circuit at secondary terminal with rated voltage maintained on the other side	For 3 secs.

8.1.6.2	Single phase short circuit at secondary terminal with rated voltage maintained on other side voltage maintained on other side	For 3 secs.				
8.1.7	Overload capability	As per IEC 60905				
8.1.8	Noise level	Shall not exceed limits as per NEMA TR-1 with all accessories running measured as per IEC 551 / NEMA standard				
8.1.9	Radio Influence Voltage	Maximum 250 Microvolt				
8.1.10	Harmonic currents	Transformer to be designed for suppression of 3rd, 5th, 7th harmonic voltages and high frequency disturbances.				
8.1.11	Partial Discharges	Transformer to be free from partial discharge upto 120 % of rated voltage as the voltage is reduced from 150 % of rated voltage i.e. there shall be no significant rise above background level				
8.1.12	Parallel operation	Shall be designed to operate in parallel with existing transformer. Details of existing transformers shall be forwarded to the bidder on request				
8.1.13	Fire Protection class	Class F1 shall be required				
8.1.14	Climate class	Class C2 shall be required				
8.1.15	Environment class	Class E2 shall be required				
8.2.0	Major Parameters					
8.2.1	Rating	2000kVA/1600kVA/1000KVA/ 630KVA/ 400KVA				
8.2.2	Voltage Ratio	11kV / 433 volts				
8.2.3	Vector Group	Dyn11				
8.2.4	Impedance	a) 5% for 400kVA/630kVA &1000kVA, tolerance as per IS b) 6% for 400kVA/630kVA &1000kVA, tolerance as per IS				
8.2.5	Losses at 130 deg C					
8.2.5.1	No load Loss –Max in KW	2000 KVA	1600 KVA	1000 KVA	630 KVA	400 KVA
		3.56	3.2	1.78	1.2	0.9
8.2.5.2	Load losses at principal tap- Max in KW	2000 KVA	1600 KVA	1000 KVA	630 KVA	400 KVA
		15.25	12	7.5	5.4	3.4
8.2.6	Temperature rise winding	Outside PSS without enclosure		Inside PSS max.		
		80°C		90°C		

8.2.7	Flux density	Maximum flux density at 10 % over excitation /overfluxing-1.9 Tesla maximum	
8.2.8	Tapping on HV winding	Off Circuit taps on HV winding , + / - 10 % in steps of 2.5 % , change of taps by link	
8.2.9	Design Clearances	Phase – phase	Phase - earth
8.2.9.1	11KV system	180mm	120mm
8.2.9.2	415V system	25mm	25mm
8.2.9.3	415V system	25mm	25mm
8.3	Construction & Design		
8.3.1	Core		
8.3.1.1	Material	High grade , non ageing, low loss, high permeability, grain oriented, cold rolled silicon steel lamination	
8.3.1.2	Grade	Premium grade minimum M3 or better	
8.3.1.3	Lamination thickness	0.23mm (Max)	
8.3.1.4	Design Flux Density at rated conditions at principal tap	1.7 Tesla	
8.3.1.5	Maximum Flux Density at 10 % over excitation / over fluxing	1.9 Tesla maximum allowed	
8.3.1.6	Core Design Features	a. All steel sections used for supporting the core shall be thoroughly sand blasted after cutting , drilling, welding. b. Provision of lifting lugs for core coil assembly	
8.3.2	Winding		
8.3.2.1	Material	Electrolytic Aluminum	
8.3.2.2	Maximum Current Density allowed	Maximum allowed 1.5 A per sqmm	
8.3.2.3	Winding Insulating material	Class F minimum, free from compounds liable to ooze out, shrink or collapse. Uniform insulation shall be applied to the windings and overall winding shall be epoxy cast resin	
8.3.2.4	Tapping	Off Circuit taps on HV winding , + / - 5 % in steps of 2.5 % , change of taps by link	
8.3.2.5	Essential provision for tap links	Shall be shrouded with cover made from insulating material. To prevent deposit of dust.	
8.3.2.6	Design features	a) Stacks of winding to receive adequate shrinkage treatment b) Connections braced to withstand shock during transport, switching, short circuit, or other transients. c) Minimum out of balance force in the transformer winding at all voltage ratios. d) Conductor width on edge exceeding six times its thickness	

		e) The termination bus-bar coming out from winding shall be tinned Copper f) Transposed at sufficient intervals. g) Threaded connection with locking facility. h) Winding leads rigidly supported, using guide tubes if practicable i) Provision of taps as indicated in the technical particulars
8.3.2.7	Essential provision of HV and LV winding leads	Phase marking required near termination on both HV and LV side. Phase colour coding required on insulating sleeves on both HV and LV side. Phase sequence 1U, 1V, 1W from left to right looking inside from the HV side door. Phase sequence 2n, 2u, 2v, 2w from right to left looking inside from LV side door Adequate HV termination clearance. Provision of check nut in all HV and LV winding lead connection.
8.3.3	Vibration Isolator	Vibration isolation pads shall be installed between core and coil assembly and enclosure base assembly to prevent the transmission of structure borne vibrations.
8.3.4	Bushings/Support Insulator/ terminations	
8.3.4.1	Type of HV and LV Bushings, support insulators	Epoxy Resin Cast
8.3.4.2	Minimum Creepage of bushings and support Insulators	31 mm / kV
8.3.4.3	Arcing horns	Not required
8.3.4.4	Termination on HV side	By cable within main enclosure by separable connector
8.3.4.5	HV side cable size	11 kV (E) grade , A2XCEWY 3C x 150 sqmm
8.3.4.6	Cable lugs	Long barrel medium duty Aluminium lug with knurling on inside surface. and suitable for cable size for 11 kV (E) grade , A2XCEWY 3C x 150 sqmm
8.3.4.7	HV side bushing	Indoor, Epoxy resin cast, 12kV voltage class and creepage 31mm/KV
8.3.4.7	Termination on LV side	Suitable bus bar as per PSS spec
8.3.5	Current Transformers	
8.3.5.1	Mounting	On LV side terminal busbars on all three phases and neutral with the help of fibre glass mounting plate
8.3.5.2	Maintenance requirements	Replacement should be possible without dismantling LV side support insulators
8.3.5.3	Accuracy Class	0.5s
8.3.5.4	Burden	5VA
8.3.5.5	Type	Resin Cast Ring type suitable for outdoor use
8.3.5.6	CT ratio	a) 400/630kVA -1000/5 Amps b) 1000kVA -1500/5 amp

		c) 1500kVA- 2500/5 amp d) 2000kVA-3000/5 amp
8.3.6	Hardware	
8.3.6.1	External	Stainless Steel up 10mm size and Hot dip galvanized for 12mm and above size bolts.
8.3.6.2	Internal	Cadmium plated except special hardware for frame parts and core assembly as per manufacturer's design
8.4	Gasket	Neoprene rubber based gasket across all doors & covers
8.5	Control cable specification (to be used by the vendor)	PVC insulated, extruded PVC inner sheathed, FRLS , armoured, extruded PVC outer sheathed 1100 V grade control cable as per latest edition of IS 1554 part 1 minimum 2.5 sqmm for signals and 4 sqmm for CT with multistrand copper conductor
8.6	Terminal Blocks to be used by the vendor	Nylon 66 material, minimum 4 sq mm, screw type for control wiring and potential circuit.
8.6.1	Essential provision for CT terminals	Sliding link type disconnecting terminal block screwdriver operated stud type with facility for CT terminal shorting material of housing melamine/ Nylon66
8.7	Painting of WTI box	
8.7.1	Surface preparation	By 7 tank pre-treatment process CRCA sheet or Powder coating for GI sheet.
8.7.2	Finish on internal / external surfaces	Polyurethane based painting, min. Dry film thickness 80 microns
8.7.3	Insulating support material for base plate for mounting components	Bakelite shall not be used as a base plate for mounting any components, insulating material non hygroscopic insulating material like FRP shall be used.
8.8	Minimum Protective devices on Transformer	
8.8.1	Surge Arrestor	Required, Connected on Transformer Primary side on all three phases
8.8.1.1	Type	Metal oxide
8.8.1.2	Housing	Polymeric preferable
8.8.1.3	Rating	9 KV
8.8.1.4	Continuous operating voltage , kV rms	6.35
8.8.1.5	Maximum Continuous operating voltage, kV rms	7.65
8.8.1.6	Nominal Discharge Current, kA peak	5
8.8.1.7	Energy Absorption Capability, kJ/kV	Greater than 2.5
8.8.1.8	Creepage factor	31 mm /kV
8.8.1.9	Reference std	IS 3070 part 3 and IEC 99-4

8.8.2	Winding Temperature scanner	Required
8.8.2.1	No of RTD inputs	Five (Three for windings, one for enclosure & one shall be spare) RTD for enclosure temperature monitoring shall be fixed at enclosure Top from inside to give max enclosure temp reading & shall be wired up to temp. scanner to indicate the reading
8.8.2.1.1	Location of winding RTD	At location of winding where maximum temperature is expected.
8.8.2.2	No of potential free trip contacts	Two
8.8.2.3	No of potential free Alarm contacts	Two
8.8.2.4	Auxiliary supply	240 V AC, 1 phase, 50 Hz. Tapped from LV side busbar through a MCB located inside box
8.8.2.5	Communication	RS 485 Port for communication on Modbus protocol for remote SCADA indication
8.8.2.6	Winding Temperature Scanner terminal Box	Required
8.8.2.6.1	Size	As per Manufacturer's Standard
8.8.2.6.2	Fixing of instrument within box	On base plate
8.8.2.6.3	Fixing of terminals within the box	On C channel available with the terminals
8.9	Fitting and accessories	
8.9.1	Rating & Diagram plate	Required
8.9.1.1	Material	Anodized aluminum 16SWG
8.9.1.2	Background	SATIN SILVER
8.9.1.3	Letters, diagram & border	Black
8.9.1.4	Process	Etching
8.9.1.5	Name plate details	Following details shall be provided on rating and diagram plate as a minimum a) Type of transformer i.e cast resin or VPI etc. With winding material b) IS / IEC standard to which it is manufactured c) Manufacturer's name; d) Transformer serial number; e) Month and year of manufacture f) Rated frequency in HZ g) Rated voltages in KV h) Number of phases i) Rated power in KVA j) Type of cooling k) Rated currents in a l) Vector group symbol m) 1.2/50µs wave impulse voltage withstand level in

		KV n) Power frequency withstand voltage in KV o) Impedance voltage at rated current and frequency in percentage at principal, minimum and maximum tap at highest temperature p) Load loss at rated current at highest temperature q) No-load loss at rated voltage and frequency r) Auxiliary loss s) Continuous ambient temperature at which ratings apply in c t) Winding connection diagram with taps and table of tapping voltage, current and power u) Transport weight of transformer v) Weight of core and windings w) Weight of enclosure and fittings x) Total weight y) Tapping details z) Phase ct details aa) Class of insulation bb) IP protection rating of the enclosure cc) Name of the purchaser dd) Po no and date ee) Guarantee period
8.9.2	Detachable Bi-directional flat Roller Assembly	Required
8.9.2.1	Roller center to center distance	Minimum 900 mm on the side of HV and LV termination Maximum 800 mm on the other side (perpendicular to HV, LV termination). and LV termination Maximum 800 mm on the other side (perpendicular to HV, LV termination).
8.9.2.2	Essential provision	Roller dia. 150 mm min., roller to be fixed in such a way so that the lowermost part of the skid is above ground by at least 100 mm when the transformer is installed on roller.
8.9.3	Earthing pad on enclosure for transformer earthing complete with Stainless Steel nut, bolt, washers, spring washers etc.	Required with identification plate on outside of enclosure.
8.9.4	Core, Frame to tank Earthing	Required
8.9.5	Off Circuit tapping link	Required
8.9.6	Tap link position plate	Required inside HV side door
8.9.7	Danger plate made of Anodized aluminium with white letters on red background on HV and LV side	Required
8.9.8	Skid with Haulage lugs	Required

8.9.9	Lifting lugs for complete transformer as well as enclosure	Required
8.9.9.1	Essential provision for lifting lugs	Lifting lugs for core coil assembly shall be provided in such a way that the weight shall not come on canopy while lifting Lifting lugs for canopy/ enclosure shall be provided in such a way that the weight shall not come on canopy while lifting , it shall be borne by supporting members.
8.9.10	Caution Plate for tap links	Required
8.9.11	Ventilation louvers with stainless steel wire mesh and rain water guard	Required as per Manufacturer's design, but it is to be provided minimum required preventing ingress of excessive dust.
8.9.12	Surge Arrestor & its Grounding bushing	Required
8.9.12.1	Essential provision	Surge arrestor shall be erected vertically in such a way that the surge arrestor can be removed at site without removing HV cable lug. Surge arrestor shall not be used for any kind of support. Surge arrestor grounding strip to be routed to the surge arrester grounding bushing near bottom of enclosure with proper support. Surge arrestor grounding bushing shall be identified by identification plate on outside of enclosure. Surge arrestor grounding bushing shall be supplied with all hardware to readily connect purchaser's ground lead.
8.9.13	LV additional neutral earthing bushing	Required
8.9.13.1	Essential provision	Busbar connecting the neutral to additional neutral bushing shall be properly supported and additional neutral bushing shall be identified by identification plate on outside of enclosure. Additional neutral bushing shall be supplied with all hardware to readily connect purchaser's ground lead.
8.9.14	Winding temperature scanner with inbuilt RS 485 port for SCADA communication	Required
8.9.15	RTD in Winding and near top of enclosure.	Required
8.9.16	Space heater inside enclosure	Thermostatically controlled space heater inside enclosure required, supply of space heater from feeder pillar through MCB fixed properly inside enclosure.
8.9.1	Mounting of space heater	By suitable spacers so that heater does not come in contact with panel wall directly.
8.9.17	Copper earthing link	Across all gasketted joints in the enclosure body.

9.0 LV Switchgear Panel

9.1	LV busbar system	
9.1.1	Type of connection on transformer	By flexible copper link rated size as per the transformer size.
9.1.2	Busbar material	High conductivity electrolytic grade aluminium
9.1.3	Main Bus bar	a. Suitable for carrying rated continuous current depending upon the incomer ACB rating. Current density should be less than 1A per sqmm. Busbars shall be continuous throughout the panel. b. Size of neutral busbar should be same as phase busbar.
9.1.4	Vertical/Dropper Busbar	a. Bus bars rating should be same as the rating of respective ACB/MCCB. Current density should be less than 1A per sqmm. b. Size of neutral busbar should be same as phase busbar. c. Bus bars shall be colour coded with heat resistant colour tapes.
9.1.5	Busbar Joints	a. Shall be silver plated. Adequate contact pressure shall be ensured b. Bimetallic connectors shall be provided, as necessary c. Length of overlap shall be more than the width of Busbar
9.1.6	Temperature Rise	20 degrees over ambient (maximum)
9.1.7	Insulation	a. Bus bar shall be provided with colour coded PVC insulating heat shrinkable sleeves rated for maximum operating voltage b. Insulating shroud should be provided on all joints
9.1.8	Bus insulator	Non-hygroscopic, Flame retardant, Track resistant type with high creepage surface (31mm/kV), epoxy resin insulators
9.1.9	Phase barrier	All cable termination shall be provided with phase barriers.
9.1.10	Neutral link	Bolted disconnecting links shall be provided for all incoming and outgoing feeders for isolation of neutral, if necessary
9.2.0	Air Circuit Breaker	
9.2.1	General Features	
9.2.1.1	Rated Current at 40 deg C	Rating of ACB as per the configuration table. De-rating @50 deg C shall be mentioned separately.
9.2.1.2	Number of Poles	4 Pole ACB
9.2.1.3	ACB mounting	Fixed type
9.2.1.4	Line-Load Reversibility	Required
9.2.1.5	Terminals	Suitable for connection with aluminium busbars with phase barriers & shrouds

9.2.1.6	Operating mechanism	Electrical and manual spring charging, stored energy type
9.2.1.7	Operation counter	4 digit minimum, non reversible
9.2.1.8	Operating handle	Required
9.2.1.9	ACB indications	Separate ON / OFF / TRIP, L/R in remote & spring charge status
9.2.1.10	Closing coil	Closing coil shall operate correctly at all values of voltage between 85% & 110% of the rated voltage.
9.2.1.11	Tripping coil	Shunt trip shall operate correctly at all values of supply voltage between 70% & 110% of rated voltage.
9.2.1.12	ACB auxiliary contacts	6 NO + 6 NC minimum
9.2.1.13	ACB operating knob sealing	Possible in OFF condition
9.2.1.14	CT Requirement	All phase and neutral
9.2.1.15	Access to releases, coils & add on type replaceable parts to ACB	From front only
9.2.1.16	ACB indications	a. Separate ON / OFF / TRIP b. Spring charge status
9.2.1.17	ACB ingress protection (without enclosure)	IP2X minimum
9.2.1.18	Pollution degree as per IS	2 – non conductive pollution
9.2.1.19	ACB temperature rise limits	As per table 2 & 3 of IS 60947-1
9.2.2	Operation Features	
9.2.2.1	Number of phases	Three phase & neutral
9.2.2.2	Rated Operational Voltage(V)	415V
9.2.2.3	Rated Insulation Voltage (V)	1000V
9.2.2.4	Rated Impulse Voltage	8 kV for main circuit
9.2.2.5	Category of utilization	B
9.2.2.6	Rated Ultimate breaking capacity at rated voltage	a. Icu = 50kA minimum (up to 2000A rating ACB) b. Icu = 65kA minimum (above 2000A rating ACB)
9.2.2.7	Rated Service breaking capacity at rated voltage Ics	Ics =100% Icu
9.2.2.8	Rated short term withstand current for 1 sec at rated voltage - Icw	Icw = 100% Icu
9.2.2.9	Rated making current capacity -Icm	Icm = 220% Icu
9.2.2.10	Number of operating cycles at rated current (open + close) without changing arcing contact	5000
9.2.2.11	Number of mechanical operating cycles (open +	20000

	close)	
9.2.2.12	Product Information marking on ACB	As per clause 5 of IS 60947 Part-I. In addition name of purchaser shall be marked on front of device
9.2.3	Measurement and Protection Requirement	
9.2.3.1	Microprocessor release	a. Microprocessor based release with true RMS based sensing. b. Self powered, tapped from incoming side of supply, setting panel with locking arrangement
9.2.3.2	Protections Required	Overload, short-circuit & earth fault
9.2.3.3	Tripping characteristic	Inverse definite minimum time characteristics for Short circuit and earth fault protection
9.2.3.4	Overload setting	40% -100% In, steps of 10%.
9.2.3.5	Overload setting time delay	2.5 s to 40 s minimum three settings
9.2.3.6	Short Circuit Setting	100% - 800% of In, steps of 10%.
9.2.3.7	Short Circuit Setting time delay	50 ms - 400 ms in steps of 50ms
9.2.3.8	Instantaneous setting	200% - 1500% of In & OFF
9.2.3.9	Earth fault setting	10- 100 % of In, steps of 10%
9.2.3.10	Earth fault setting time delay	50ms - 400 ms in steps of 50ms
9.2.3.11	Neutral unbalance	Earth fault function should not operate during neutral unbalance. Same will be verified during inspection.
9.2.3.12	Measurements required in release	a. Phase wise current b. Phase wise voltage c. Power factor d. Maximum current with date and time e. Instantaneous Power: Active, Reactive and apparent power f. Power Demand g. Energy
9.2.3.13	Metering measurement accuracy	a. 1% for current and voltage b. 2% for Power and energy
9.2.3.14	Other release requirements	a. Release should have backlit display. b. Release should be plug-in type and easily replaceable in field. c. Separate fault indication shall be provided for each protection stage i.e overload, short circuit and earthfault d. Release should store 10 fault records on FIFO basis with date and time stamp. e. Release should have 2 Digital Inputs. CB On and Off status shall be wired to DIs through auxiliary switch. f. Release should have RS485 port for SCADA communication on open Modbus protocol. It should be able to transmit all measured,

		monitored and recorded data to SCADA including status of DIs. g. Remote time synchronization through SCADA should be possible
9.3.0	MCCB	
9.3.1	General Features	
9.3.1.1	Standard current rating at 40 deg C	As per the PSS configuration (De-rating @50 deg C shall be mentioned separately)
9.3.1.2	Construction	The MCCBs shall comprise of Four poles in a single construction. All the parts shall be enclosed in a moulded insulating material housing.
9.3.1.3	Type	The MCCBs shall be trip free type with quick make and break design.
9.3.1.4	Terminals	Suitable for connection with aluminium busbars with phase barriers & shrouds
9.3.1.5	CT Requirement	All phase and neutral
9.3.1.6	Access to releases, coils & add on type replaceable parts to MCCB	From front only
9.3.1.7	Indications	MCCBs shall be provided with mechanical position indicator with shrouded terminals. MCCB's shall have ON/OFF/trip positions.
9.3.1.8	MCCB ingress protection (without enclosure)	IP2X minimum
9.3.1.9	Pollution degree as per IS	2 – non conductive pollution
9.3.1.10	ACB temperature rise limits	As per table 2 & 3 of IS 60947-1
9.3.2.0	Operation Features	
9.3.2.1	Number of phases	Three phase & neutral
9.3.2.2	Rated Operational Voltage(V)	415V
9.3.2.3	Rated Insulation Voltage (V)	1000V
9.3.2.4	Rated Impulse Voltage	8 kV for main circuit
9.3.2.5	Category of utilization	A
9.3.2.6	Rated Ultimate breaking capacity at rated voltage	Icu = 50kA minimum
9.3.2.7	Rated Service breaking capacity at rated voltage Ics	Ics =100% Icu
9.3.2.8	Rated short term withstand current for 1 sec at rated voltage - Icw	Icw = 100% Icu
9.3.2.9	Rated making current capacity -Icm	Icm = 220% Icu
9.3.2.10	Number of operating cycles at rated current	5000

	(open + close) without changing arcing contact	
9.3.2.11	Number of mechanical operating cycles (open + close)	20000
9.3.2.12	Product Information marking on MCCB	As per clause 5 of IS: 13947 Part-I. In addition name of purchaser shall be marked on front of device
9.3.3	Measurement and Protection Requirement	
9.3.3.1	Microprocessor release	a. Microprocessor based release with true RMS based sensing. b. Self powered, tapped from incoming side of supply, setting panel with locking arrangement
9.3.3.2	Protection	Overload, short-circuit & earth fault
9.3.3.3	Tripping characteristic	Inverse definite minimum time characteristics for Short circuit and earth fault protection
9.3.3.4	Overload setting	40% -100% In, steps of 10%.
9.3.3.5	Overload setting time delay	2.5 s to 40 s minimum three settings
9.3.3.6	Short Circuit Setting	100% - 800% of In, steps of 10%.
9.3.3.7	Short Circuit Setting time delay	50 ms - 400 ms in steps of 50ms
9.3.3.8	Instantaneous setting	200% - 1500% of In & OFF
9.3.3.9	Earth fault setting	10- 100 % of In, steps of 10%
9.3.3.10	Earth fault setting time delay	50ms - 400 ms in steps of 50ms
9.3.3.11	Neutral unbalance	Earth fault function should not operate during neutral unbalance. Same will be verified during inspection.
9.3.3.12	Measurements required in release	a. Phase wise current b. Phase wise voltage c. Power factor d. Maximum current with date and time e. Instantaneous Power: Active, Reactive and apparent power f. Power Demand g. Energy
9.3.3.13	Metering measurement accuracy	a. 1% for current and voltage b. 2% for Power and energy
9.3.3.14	Other release requirements	a. Release should have backlit display. b. Release should be plug-in type and easily replaceable in field. c. Separate fault indication shall be provided for each protection stage i.e overload, short circuit and earthfault d. Release should store 10 fault records on FIFO basis with date and time stamp. e. Release should have 2DIs for MCCB On and Off status shall be wired to DIs through auxiliary switch.

		f. Release should have RS485 port for SCADA communication on open Modbus protocol. It should be able to transmit all measured, monitored and recorded data to SCADA including status of DIs. g. Remote time synchronization through SCADA should be possible
9.3.10	Common RS 485 port	a. Communication ports of all MCCBs and ACBs shall be looped and connected to a common RS485 port provided in the panel for interfacing with SCADA on open modbus protocol. b. If any additional communication device is required for looping/combining of ACB and MCCB data is to be provided.
9.3.11	Serial Port surge protection device	To be provided

10.0 Automatic Power Factor Correction system

The APFC equipment shall be located in LV compartment of package enclosure either as a separate panel or integrated along with LV Switchgear and shall have all the following features

10.1	APFC Output	As per the PSS configuaration clause 4.0 APFC should be rated at 440V. Manufacturer need to specify the rated output at 440V.
10.2	APFC mounting	All components mounted in shelf type arrangement on package substation enclosure LV compartment wall or RMU compartment wall or Part of LT Panel
10.3	APFC relay & data logger	Mounted on base plate supported on compartment wall by three hinges
10.4	APFC system bus bar power connection to transformer LT side	a) By 4CX300sqmm AYFY 1100V grade cable to or Bus Bars for 200kVAR/300kVAR APFC rating b) By 2X4CX300sqmm AYFY 1100V grade cable to or Bus Bars for 600kVAR/800kVAR APFC rating
10.5	APFC system bus bar size	a) 50x10mm tinned copper mounted on SMC insulators 1100V grade for 200kVAR/300kVAR APFC rating b) 100x10mm tinned copper mounted on SMC insulators 1100V grade for 200kVAR/300kVAR APFC rating
10.6	APFC system CT input signal	From CT on transformer LV side by 7CX2.5sqmm YY 1100V grade cable
10.7	APFC capacitor modules	As per the requirement
10.8	Capacitor duty contactor for each capacitor module	Utilization category 6b as per IS

10.9	MCCB for each capacitor module	100amp, Three Pole, Ics=Icu=35kA
10.10	Connection to each MCCB from APFC system bus	By 35sqmm copper wire double insulated with tinned copper lugs
10.11	APFC control supply	Through 415/240v transformer, 2amp / 6amp SP MCB
10.12	APFC relay	Microprocessor based relay for automatic control of minimum 12 capacitors in sequential or cyclic switching fashion with settable time delay 0 -180 sec.
10.13	APFC relay LCD display with self monitoring feature	To show no. of capacitors energized, actual PF & target PF, voltage & current
10.14	Target power factor setting range	0.8 lag to 0.9 lead in steps of 0.1
10.15	APFC relay sensing	3 phase CT input 5 amp to sense max load current
10.16	No volt protection in relay	To switch OFF all capacitors
10.17	Capacitor unit 25KVAR type	Double layer All Poly Propylene (APP) or Mixed Poly Propylene (MPP)
10.18	Capacitor unit construction	1.5mm thick sheet metal welded tank or Al cylindrical construction
10.19	Capacitor unit impregnant	Dry type filler or non PCB liquid
10.20	Capacitor unit conducting layer	Al foil or metalized film
10.21	Capacitor sealing	Hermetic sealing after vacuum process
10.22	Capacitor unit safety	Pressure sensitive dis-connector or internal fuse for each element
10.23	Discharge resistor	Between all three phases of capacitor unit, to reduce the voltage across the capacitor to 50V or less in one minute
10.24	Terminal bushings	For rated voltage class 1 KV Suitable wires / terminals brought out from capacitor unit is also acceptable.
10.25	Earth connection for individual capacitor container	To be done & connected to main earth bus bar of the panel
10.26	APFC Operational features	
10.26.1	Automatic power factor correction	To achieve target lagging power factor without hunting
10.26.2	Operation for rated output	At continuous rated voltage (440 V) & frequency (50 Hz)
10.26.3	Operation with over voltage	115% of rated voltage for 12 hours in a day
10.26.4	Operation with harmonic distortion	THD voltage – 5% & THD current 3%
10.26.5	Maximum permissible over current	1.3 times rated current, continuous
10.26.6	Dielectric loss	0.2 watt per KVAR maximum

10.26.7	Temperature Category & Maximum temperature rise	- 5 / 60 deg C Not exceeding 10 deg C over 60 deg C.
10.26.8	Residual voltage after disconnection from mains	50 volts maximum after 60 seconds
10.26.9	Design life of capacitor unit	Minimum 10 years
10.27.0	Data Logger	
10.27.1	General	Accuracy class 0.5, microprocessor based with LCD display, with 3 CTs for measurement of cumulative KWH, power factor, voltage & current of transformer secondary, THD of voltage.
10.27.2	Data logging and Software	Data logging of KWH value at every 30 minutes to give cumulative reading of KWH for 45 days minimum, data downloadable in ASCII-II or MS Excel format. Software for downloading the data from data logger to be provided by data logger vendor.
10.27.3	Display and communication	Display of DATE, TIME, station ID -Display & log power parameters phase wise & total (load current, kVA, kW & PF). -Display & log kVAr phase wise & total. -Display TDH V or current. -The logger shall be with built in communication facility of RS485 to down load all parameters on demand. Integration of APFC relay with FRTU for SCADA monitoring and control.

11.0 Energy Meter Box

111.1	Energy meter	In the scope of purchaser
11.2	Location	To be provided mounted on enclosure wall in LV compartment.
11.3	Energy meter box Size	650 mm height x 450 mm width x 275 mm depth.
11.4	Box door design	With antitheft hinge, padlock facility, door fixed by stainless steel Allen screw M6 size.
11.5	Fixing of energy meter within box	On slotted horizontal channel 40 x 12 mm size, channel shall be movable on vertical slotted angle 40 x 40 mm size at two ends.
11.6	Meter reading window	Front door shall be with acrylic sheet for viewing the energy meter.
11.7	Sealing arrangement	02 no's sealing arrangement shall be provided on meter box's door.
11.8	Data downloading port	Slot shall be provided on door of meter box for fixing 9 pin DB connector.
11.9	Test Terminal Block	No Test terminal block shall be provided.

11.10	Cables and wires	PVC insulated, extruded PVC inner sheathed, armored, extruded PVC outer sheathed 1100 V grade control cable as per latest edition of IS 1554 part 1 minimum 2.5 sq mm for PT and 4 sq mm for CT with multi strand copper conductor.
11.11	Cable Glands	Nickel plated brass double compression weatherproof cable gland.
11.12	Wiring diagram	To be fixed on the back of door along with CT spec. etched on Anodised Aluminium plate fixed by rivet.
11.13	CT Secondary/VT wires	All CT secondary wire and VT wires shall be routed through metallic conduit. All secondary wires shall be bunched and kept for termination without any terminal/ TTB in between.

12.0 Other Provisions: illumination, Hooter & Fire extinguisher

12.1.1	RMU, transformer & LV compartment illumination	By 36w CFL fixture controlled through SPMCB & door limit switch
12.1.2	RMU, transformer & LV compartment power socket	5/15amp 3 pin socket through 32 amp SPMCB
12.2	Smoke Detector in each compartment	Minimum 02 no's Smoke Detectors in each LV, HV and Transformer compartment , wiring to be provided for RMU tripping and SCADA indication.
12.3	Energy meter box	To be provided on transformer LT side along with wiring.
12.4	Portable Modular Fire Extinguisher for HV, LV and Transformer compartment	a) The Portable modular FE, ABC (Stored Pressure) shall conform IS 13849. b) The powder in the extinguisher must be MAP 90%. c) The Dry powder used in FE shall conform IS 4308. d) The internal and external surface of the body shall be epoxy powder coated of minimum 0.050mm thickness. e) The wall thickness shall be as per IS 13849 f) All Internal and external surface of the body shall be completely coated with lead-tin alloy (tin not less than 10%) by means of hot dipping or by electrolytic process to a thickness not less than 0.012 mm. The thickness of the coating shall be measured as given in IS 3203:1982. Epoxy powder coating can also be used for anti-corrosive treatment with 0.050 mm thickness. g) The extinguisher body and valve assembly shall be capable of withstanding the Internal

		hydraulic pressure of 3 0 MN/m2 (30 kgf/cm2) without rupture, leakage or visible distortion for a period of 2 minute". Make Cease fire/ Mini Max
12.5	Other requirements	Substation internal cabling, lighting & earthing system along with required hardware, gaskets, gland plates etc.

13.0 PSS Enclosure Earthing

13.1	Earth bus connection brought out of package substation enclosure to earth pad for connection to earth pit	a) Two earth pads for RMU, transformer & LV compartment each. b) Two earth pads for transformer neutral
13.2	Earth bus size	a) 50x6 GI flat up to 1000kVA rating of PSS b) 2X50x6 GI flat for 1600kVA and 2000kVA rating of PSS
13.3	Earth bus fault current capacity	a) 26.3kA for 1 sec up to 1000kVA rating b) 43KA for 1 sec up to 1600kVA rating and 2000kVA rating of PSS
13.4	Earth connection of all covers, doors & structural parts to GI bus	By metallic jumper connection
13.5	Earth connection of RMU, ACB & transformer body parts to GI bus	By two numbers of 50x6mm GI flat per equipment
13.6	Earth bus identification	Shown by letter 'E'

14.0 Labels & painting

14.1	Name plate on package enclosure	Fixing by rivet only
14.1.1	Material	Anodized aluminum 16SWG / Stainless Steel (SS)
14.1.2	Background	SATIN SILVER
14.1.3	Letters, diagram & border	Black
15.1.4	Process	Etching

14.2	Name plate details	a) Month & year of manufacture b) transformer rating c) Purchaser name & order number d) Guarantee period e) Ref. IS / IES No. Shall be provided inside enclosure as well as outside enclosure.
14.3	Labels for meters & indications	Anodized aluminium with white character on black background OR 3 ply Lamicoid
14.4	Danger plate on doors of RMU compartment & LV compartment	Etched on 16 swg anodised aluminium / SS plate with white letters on red background
14.5	BSES Insignia	a) 02 no's b) HV and LV side of PSS enclosure. c) Shall be etched on anodized aluminium 16SWG / SS plate. d) Details shall be finalized during drawing approval.
14.6	Enclosure painting surface preparation	Shot blasting or 7 tank chemical process
14.7	Enclosure painting external finish Powder coated epoxy polyester base	Hot dip galvanizing – 80 micron thick grade A, shade - RAL 7032, uniform thickness 60 micron minimum .
14.8	Enclosure painting internal finish	Powder coated epoxy polyester base grade A, shade -white, uniform thickness 80 micron minimum

15.0 Approved makes

15.1	RMU	ABB/Schneider/Siemens/C&S
15.2	Transformer	ABB/Raychem/TMC/Voltamp
15.3	FRTU	ABB/Schneider/Siemens/Phoenix
15.4	FPI	EASI/ EMG/Siemens/C&S
15.5	Protection Relay	Ashida ADR241S -761/ C&S-CSPR-V2-500
15.6	Battery charger and BHMU	Allan/Gagate
15.7	Oil type transformer	ABB/ Schneider/Danish/kotson/Toshiba
15.8	Bushings make	Baroda bushing / CJI / Jaipur
15.9	Winding Temperature Indicator	Precimeasure/ Pecon
15.10	ACB	L&T / Schneider-MG /Siemens / ABB
15.11	MCCB	GE / ABB/Schneider/Siemens
15.12	APFC	ABB/Schneider/Epcos
15.13	Switch	ABB / Siemens / L&T (Salzer)
15.14	HRC Fuse Links	Alstom / Siemens / L&T / GE
15.15	Load manager	L&T / Enercon / AE / DUCATI / Phasetrac M-40 / TAS POWERTECH

15.16	APFC relay	Beluk / ABB / Fraco / Ducati/ TAS / POWERTECH
15.17	AC Contactors	ABB / Schneider
15.18	Push buttons / Actuator	L&T / Teknic / Siemens
15.19	MCCB	ABB / L&T / Siemens/Schneider –MG
15.20	Capacitors	FRACO / DUCATI/ABB/shrim
15.21	Fans	EBM Nadi
15.22	Terminals	Connectwell / Elmex
15.23	Transformer Bushings (HV side)	Baroda/CJI/ any other make approved by BSES
15.24	Termination kits for RMU	3m/ Raychem/ Denson
15.25	Termination kits for Transformer	3M/ Raychem/ Denson / any other make approved by BSES
15.26	Cold applied cable boots	3M/ Raychem/KD joshi
15.27	Interposing relay	ABB / Tyco/OEN
15.28	Modem	Niseva/Lantronix/Pheonix
15.29	CT and Aux PT	Narayan Power Tech (NPT)/Gilbert Maxwell, Pragati, Nortex
15.30	CBCT (Both for Earth fault and Over current protection)	EMG/Schneider/SIEMENS/C&S
15.31	Battery	HBL/Exide
15.32	Protocol converter	ABB/Tyco/OEN
15.33	DC power connector	Wago/Havells/Connectwell
15.34	Surge protector	Phoenix
15.35	Vacuum Interrupter	CG/ABB/Schneider/BEL

Note – Any other make of component offered by the bidder maybe reviewed & approved by BSES

16.0 Quality assurance Inspection & testing

16.1	Vendor quality plan	To be submitted for purchaser approval for all components listed in clause 4.0 For transformer, RMU & APFC panel sub vendor quality plan to be submitted.
16.2	Inspection points in quality plan	To be mutually identified & agreed
16.3	Quality – Process Audits	BSES shall carryout vendor process audits.
16.4	Type test as per IS / IEC	a) Only type tested quality equipment(s) shall be offered. b) Type test certificates mentioned in this clause shall be submitted along with offer for scrutiny c) The test report should not be more than 5years old. d) If identical rating type test reports for transformers are not available vendor to carryout Short circuit withstand test, Lightning impulse test & temperature rise test without any additional cost.
16.4.1	Package substation assembly	As per IEC 62271-202

16.4.2	11kv RMU, transformer, ACB, MCCB, APFC system and capacitor units	As per relevant IS/ IEC
16.5	Routing tests	
16.5.1	Routine tests of PSS	As per IEC 62271-202
16.5.2	Routine tests of transformer, RMU, LT panel & APFC	As per relevant IS/ IEC
16.6	Inspection and acceptance testing	a) Purchaser reserves the right to inspect /witness all tests on the meters at manufacture's works at any time, prior to dispatch, to verify compliance with the specification/ standards. b) Manufacturer should have all the facilities/ equipments to conduct all the acceptance tests during inspection. All the testing equipment should be calibrated. c) Stage and / or final inspection call intimation shall be given at least 15 days in advance to the purchaser.
16.6.1	Stage inspection of transformer	Purchaser shall inspect transformers at the core and coil assembly stage at the manufacturer's premises.
16.6.2	Final inspection of transformers	The sequence of testing shall be as follows a) Visual and dimension check for completely assembled transformer. b) Measurements of voltage ratio. c) Measurements of winding resistance at principal tap and two extreme taps. d) Vector Group and polarity test. e) *Measurements of insulation resistance and polarization index. f) Separate sources voltage withstand test. g) Measurement of iron losses and exciting current at rated frequency and 90%, 100% and 110% rated voltage. h) Induced voltage withstand test. i) Load losses measurement. j) Impedance measurement of principal tap (HV and LV) of the transformer. k) Measurement of Iron loss (to be repeated if type test are conducted). l) Measurement of capacitance and Tan Delta for HV and LV bushings and Tan Delta for transformer oil (for all transformers). m) Oil leakage test on assembled transformer n) Magnetic balance test. o) Power frequency voltage withstand test on all auxiliary circuits p) Measure of zero seq. impedance (Cl. 16.10 IS 2026 Part I). q) Measurement of acoustic noise level (Cl. 16.12 of

		IS 2026 Part I). r) Measurement of harmonic level on no load current. s) Partial discharge test *Insulation resistance measurement shall be carried out at 5kV for HV and 1kV for LV. Value of IR should not be less than 1000 Mohms. Polarization Index (PI = IR10min/IR1min) should not be less than 1.5 (If one minute IR value is above 5000 Mohms and it is not be possible to obtain an accurate 10 minutes reading, in such cases polarization index can be disregarded as a measure of winding condition.)
16.6.3	Final Inspection of package substation after complete assembly	As per IEC 62271-202 and relevant IS/ IEC of equipment. a) Visual check b) Dimensional and sheet thickness check c) Verification of Wiring & BOM d) Paint thickness inside and outside of PSS enclosure. e) Functional test i. Operation of switchgear and control gear. ii. Mechanical operation and alignments of PSS doors. iii. Fixing of insulating barriers. iv. Voltage indication check v. Checking of temperature and liquid level of the transformer. vi. Fitting of earthing devices. vii. Cable testing viii. Replacement of LTCT ix. Operation of transformer tap changer x. Operation of illumination system xi. Trip function of HV switchgear. f) IR test g) HV test on power circuit h) HV test on auxiliary circuits i) Operational and interlocks check
16.6.4	Acceptance Test of RMU	a) Physical inspection , BOM & wiring checks b) Insulation Resistance test c) HV Test for one minute d) Operation & Interlock check e) Measurement of resistance of main circuit f) Voltage indication check of VPI g) Functional testing of FPI for alarm h) Primary current injection test for circuit breaker feeder on both ration's of all CT's with relay i) Breaker closing and opening time measurement

16.6.5	Acceptance Test of LT Panel / APFC Panel	a) Visual, dimension, wiring & BOM check. b) Operational check. c) IR Test. d) HV Test
16.7	Special acceptance tests	
16.7.1	Transformer	Temperature rise test shall be carried out on 01 no transformer of each rating randomly selected from the offered lot.
16.7.2	PSS	Temperature rise test of PSS along with transformer as per IEC 62271-202.
16.8	Right to waive off tests	Reserved by Purchaser

17.0 Shipping, Handling and Site support

17.1	Packing Protection	Against corrosion, dampness, heavy rains, breakage and vibration
17.2	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection & identification Label
17.3	Packing Identification Label (Anodized Aluminum Plate)	On each packing case, following details are required:
		a) Individual serial number
		b) Purchaser's name
		c) PO number (along with SAP item code, if any) & date
		d) Equipment Tag no. (if any)
		e) Destination
		f) Manufacturer / Supplier's name
		g) Address of Manufacturer / Supplier / it's agent
		h) Description of PSS.
		i) Country of origin
		j) Month & year of Manufacturing
		k) Case measurements
		l) Gross and net weights in kilograms
		m) All necessary slinging and stacking instructions
17.4	Shipping	The seller shall be responsible for all transit damage due to improper packing.
17.5	Handling and Storage	a) Manufacturer instruction shall be followed. b) Detail handling & storage instruction sheet / manual to be furnished before commencement of supply.

18.0 Deviations

18.1	Deviations from this Specification shall be stated in writing with the tender by reference to the Specification clause/GTP/Drawing and a description of the alternative offer. In absence of such a statement, it will be assumed that the bidder complies fully with this specification.

19.0 Drawings Submission

Drawing submission shall be as per the matrix given below.

a) All documents/ drawing shall be provided in soft copy only in returnable Pen drives
b) Language of the documents shall be English only.
c) Incomplete submission shall be liable for rejection.
d) Document check sheet compliance shall be the first sheet for each submission stage i.e. Technical bid, Drawing Approval, Pre Dispatch
e) No submission is acceptable without check list compliance.
f) Order of documents shall be strictly as per the check list.
g) Any drawing not included in the below table but necessary for detailed engineering shall be deemed to be included in bidder's scope.

S No.	Description	Bid	For Approval	Pre Dispatch
19.1	Copy of specification along with company seal & signature on each page.	Required		
19.2	Duly filled GTP as per BSES specification	Required	Required	
19.3	GA drawing (Complete assembly, RMU, transformer, LT panel + other items)	Required	Required	
19.4	BOM of Packaged substation	Required	Required	
19.5	Valid type test reports	Required		Required
19.6	Transformer BIS license	Required	Required	Required
19.7	Reference list of clients/suppliers list for last 3 years	Required		
19.8	Performance certificates executed in last 5 years	Required		
19.9	Calculation for sizing of Transformer	Required	Required	
19.10	Sizing Calculation of busbar in support of its Guaranteed S.C. rating / Capability	Required	Required	
19.11	Deviation Sheet (if any)	Required	Required	
19.12	Catalogues & manuals for Package substation + RMU + Transformer + LT switchgear items + APFC			Required

S No.	Description	Bid	For Approval	Pre Dispatch
19.13	User manual for Hermetically Sealed Transformers. The manual must be provided with, but not limited to, maintenance schedule, frequency & method of oil- sampling, procedures for oil-filling & oil-filtration, etc.			Required
19.14	Quality plan for Packaged substation	Required	Required	
19.15	Installation, commissioning manual for all items in Packaged substation. (for information)		Required	Required
19.16	Operation & maintenance manual for all items in Packaged substation. (for information)			Required
19.17	Transport / Shipping dimensions with weights, wheel base details, un tanking height		Required	
19.18	Recommended spare parts and consumable items for five years of operation and spare parts catalogue with price list	Required	Required	
19.19	Inspection and test reports carried out in manufacturers works			Required
19.20	Test certificates of all bought out items.			Required

Annexure A Service Conditions

The package substation shall be designed & tested to operate satisfactorily under following conditions -

Sr No	Description	Data by purchaser
1.	Location	Delhi
2.	Reference design ambient temperature	40°C for Delhi
3.	Maximum ambient temperature	50°C for Delhi
4.	Relative humidity	85% for Delhi
5.	Seismic zone	Zone IV for Delhi

Annexure B Guaranteed Technical Particulars (Data by Supplier)

i. Bidder shall furnish the GTP format with all details against each clause.

ii. Bidder shall not change the format of GTP or clause description.

iii. Bidder to submit duly filled GTP in hard copy format with company seal.

Sr. No.	Description	Data to be filled by Manufacturer
1	Manufacturer Name	
2	Manufacturer Address	
2.1	Telephone no	
3	Manufacturer contact person	
4	Manufacturer brand name (Give catalogue reference)	
4.1	Conformance to specification	Yes/No
4.2	If NO for above, Submission of clause wise deviation sheet	Yes/No
5	RMU	
5.1	Equipment make	
5.2	Equipment type / brand name	
5.3	Panel overall dimensions in mm	
5.3.1	Width (measured from front)	
5.3.2	Depth	
5.3.3	Height	
5.4	Panel weight in kg	
5.5	Panel enclosure protection offered	
5.6	Panel tested for internal arc	Yes / No
5.7	Insulation level for complete panel	
5.7.1	Impulse withstand	(KV peak)
5.7.2	Power frequency withstand	(KV rms)
5.8	Bus bar	
5.8.1	Material & grade	
5.8.2	Bus bar cross section area in sq mm	
5.8.3	Bus bar rated current in amp	
5.8.4	Max temperature rise above reference ambient	
5.8.5	Short time current withstand capacity for 3 seconds (in KA)	
5.8.6	Bus bar clearances in mm P-P / P-E	
5.8.7	Bus bar with insulation sleeve / barriers	
5.8.8	Bus bar support insulator type	
5.8.9	Bus bar support insulator voltage class	
5.8.10	Bus bar support insulator minimum creepage distance / mm	
5.9	Earth bus bar	
5.9.1	Earth bus bar material & grade	
5.9.2	Earth bus bar cross section area in sq mm	
5.9.3	Bus bar rated current in amp	

	i) at designed 40 deg.C ambient ii) at 50 deg.C ambient	
5.9.4	Max temperature rise above reference ambient of 40 deg C	
5.9.5	Short time current withstand capacity for 3 seconds (in KA)	
5.9.6	Bus bar clearances in mm P-P / P-E	
5.9.7	Bus bar with insulation sleeve / barriers	
5.9.8	Bus bar support insulator type	
5.9.9	Bus bar support insulator voltage class	
5.9.10	Bus bar support insulator minimum creepage distance / mm	
5.9.11	Earth bus bar material	
5.9.12	Earth bus bar size	
5.9.13	Cable compartment	
5.9.13.1	C-C distance between bushings	
5.9.13.2	Phase to Phase Clearance (Min)	
5.9.13.3	Phase to Earth (Min) Clearance	
5.9.13.4	Impulse Withstand Voltage of design tested	
5.9.13.4	IAC level – Cable compartment / RMU Tank	
5.10	Circuit breaker type –VCB	
5.10.1	Rated voltage & frequency	
5.10.2	Rated current in amp	
5.10.3	Rated breaking current – KA rms symmetrical	
5.10.4	Short time withstand capacity in KA for 3 sec	
5.10.5	Rated making current - KA peak	
5.10.6	Breaker total opening time at rated breaking capacity (in milliseconds)	
5.10.7	Number of breaks per pole	
5.10.8	Total length of contact travel in mm	
5.10.9	No of circuit breaker operation cycles (close & open) guaranteed at rated current, Electrical endurance class	
5.10.9.1	25% rated current -	
5.10.9.2	50% rated current -	
5.10.9.3	75% rated current -	
5.10.9.4	100% rated current -	
5.10.10	No of breaker opening operations guaranteed at rated fault current, Electrical Endurance class	
5.10.11	No of breaker mechanical operation cycles (close & open) guaranteed at zero current,	

	Mechanical endurance	
5.10.12	Contact material	
5.10.13	Operating mechanism – trip free	
5.10.14	Motorized/Manual Sprig charge type	
5.10.15	Spring charging motor rating - Watt	
5.10.16	Spring charging motor rated DC voltage	
5.10.17	Closing coil wattage & rated DC voltage	
5.10.18	Trip coil wattage & rated DC voltage	
5.11	Minimum permissible SF6 gas pressure (For SF6 type RMU only)	
5.12	Capacitor type cable voltage indication provided?	Yes / No
5.13	Operation counter provided – Yes/ No	
5.14.1	Disconnect switch continuous rating (Amp)	
5.14.2	Disconnect switch Short time withstand rating -20kA for 3 sec minimum	Yes / No
5.15	Earth Switch	
5.15.1	Minimum number of operations at no load- Mechanical Endurance class	
5.15.2	Making capacity endurance of earth switch – Electrical endurance class	
5.16	Self Powered Relay (Transformer VCB module)– Make / Model	
5.16.1	CT Input	
5.16.2	IDMT Setting Range 4 element – Over Current & Earth fault & steps	Overcurrent- Earth Fault- Instantaneous O/C Instantaneous E/F-
5.16.3	Operating Time	Over Current – Curves Instantaneous
5.16.4	Pick up Current	
5.16.5	Resetting Current	
5.16.6	Relay Burden	
5.16.7	Time Accuracy	
5.16.8	Tripping Coil O/P – type & duration	
5.16.9	Fault Current Display	
5.16.10	No of Fault Current Latching with time stamping	
5.16.11	Display Facility / Type	
5.16.12	Operational Indicators	
5.16.13	Potential Free Output Contacts	
5.16.14	Thermal Withstand Capacity of Relay	

5.17	Fault Passage Indicator (for Cable feeder module 1 & 2)	
5.17.1	CBCT	
5.17.1.1	Type	
5.17.1.2	Mounting Arrangement	
5.17.1.3	CT to indicator connection	
5.17.1.4	ID of sensor	
5.17.2	Earth Fault Indicator	Make / Model
5.17.2.1	Sensing Current	
5.17.2.2	Sensing Time	
5.17.2.3	Indication	
5.17.2.3	Reset Time	
5.17.2.4	Resetting Facility	
5.17.2.5	Output Contact	
5.17.2.6	Contact Rating	
5.17.2.7	Aux Power Supply	
5.17.2.8	Degree of Protection	
5.17.2.9	Mounting Arrangement	
5.17.2.10	Ambient Temperature	
5.18	DC charger rating in amps – min 10 Amp Dual	Yes/No
5.18.1	MCB rating at 230V AC input of charger	Amp
5.18.2	MCB rating at 24V DC output of charger	Amp
5.18.3	Charger heat sink temperature rise (max 55 deg C above ambient 40 deg C)	
5.18.4	Voltage variation in 24v Dc output for FRTU	(Max +/-1 V)
5.18.5	Charger with natural cooling (no cooling fans)	Yes/No
5.18.6	Charger tested for input supply voltage regulation test (input variation 150v-250v, output DC voltage variation +/- 1 volt max)	Yes/No
5.18.7	Charger temperature rise test certificate submitted	Yes/No
5.19	DC battery rating in Ah – 26Ah (mini) OR as approved battery sizing during detail engineering ,whichever is higher.	
5.20	DC charger changeover – Diode rating 10A min	Yes/No
5.21	HT Cable termination - 3cX300sqmm AYFY cable– Height of power terminal from gland plate	mm
5.22	Mimic diagram, labels & finish as per specification	Yes / No
5.23.1	Cable termination –	Mm

	Height of power terminal from gland plate	
5.23.2	Torque required for tightening terminal lug	
5.24	Submission of RMU / component catalogue	Yes/No
5.25	Unit price for Conversion kit offered separately for converting the RMU from single cable termination design to double cable termination design	Yes/No
5.26	FRTU Panel	
5.26.1	FRTU	
5.26.1.1	Make & Model No	
5.26.1.2	No of DI Modules	
5.26.1.3	No of DO Modules	
5.26.1.4	No of AI Modules	
5.26.1.5	Make of Protocol converter	
5.26.2	Modem	Ethernet Type
5.26.2.1	Make	
5.26.2.2	Serial port Isolator provided	Yes / No
5.26.2.3	Type – 4G Back compatible to 3G & 2G Refer FRTU Specifications	Yes / No
5.26.3	Interposing relay with freewheeling diode	
5.26.3.1	Make	
5.26.3.2	Capacity	
5.26.3.3	Model	
5.26.4	AC & DC MCB	
5.26.5	Terminal Blocks	
5.26.6	Disconnecting type fuses	
5.26.7	Enclosure	
5.26.7.1	Sheet steel thickness	
5.26.7.2	Painting process	
5.26.7.3	Construction of steel according to IEC 529 , index of protection	
5.26.7.4	Shade	
5.26.7.5	Louvers with filters	
5.26.8	Dimensions & Weight of FRTU	
5.28	Submission of RMU / component catalogue	Yes/No
6.0.0	11kv cable	from RMU to transformer
6.1.0	Cable size 3CX150 sqmm AYFY	Yes/No
6.2.0	Cable rated voltage - 11000v	Yes/No
6.3.0	Cable short circuit current capacity for 1 sec	kA
6.4.0	Type of insulation - XLPE	Yes/No
6.5.0	Outer insulation sheath – PVC with armor	Yes/No

6.6.0	Cable termination type & make		
7.0.0	400/630/1000KVA Cast Resin Transformer		
7.1.0	Make		
7.2.0	Type- Cast Resin Dry Type	Yes / No	
7.3.0	Transformer continuous rating when placed in package substation enclosure	HV winding	LV winding
		KVA	KVA
7.4.0	Rated voltage (kV)	HV winding	LV winding
		11 KV	0.433 KV
7.5.0	Rated current	HV winding	LV winding
		Amps	Amps
7.6.0	Transformer vector group – Dyn11	Yes / No	
7.7.0	Impedance at principal tap rated current and frequency, ohm @130 °C	As per the specification	
7.7.1	Impedance at lowest tap	Ω	
7.7.2	Impedance at highest tap	Ω	
7.8.0	Resistance of the winding at 130°C in ohm	HV winding	LV winding
		Ω	Ω
7.9.0	Zero sequence impedance in ohm	HV winding	LV winding
		Ω	Ω
7.10.0	Guaranteed maximum losses at principal tap full load and 130°C without any positive tolerance, kW		
7.10.1	No load losses (max.)	KW	
7.10.2	Load losses (max.)	KW	
7.10.2	Total losses (max.),	KW	
7.10.4	No load loss at maximum permissible voltage and frequency (approx.),	KW	
7.11.0	Temperature rise over reference ambient		
7.11.1	Winding by resistance: Outside the PSS enclosure / inside the PSS enclosure $_0$ C	80°C/ 90°C	
7.11.2	Maximum hot spot temperature, Deg. C	°C	
7.12.0	Efficiency	at 130°C and unity power factor	
7.12.1	at 110% load	%	
7.12.2	at 100% load	%	
7.12.2	at 80% load	%	
7.12.3	at 60% load	%	
7.12.4	at 40% load	%	
7.12.5	at 20% load		
7.13.0	Maximum hot spot temperature, Deg. C	at 130°C and 0.8 power factor lag	
7.13.1	Efficiency	%	

7.13.2	at 110% load	%
7.13.3	at 100% load	%
7.13.4	at 80% load	%
7.13.5	at 60% load	%
7.13.6	at 40% load	%
7.14.0	Maximum efficiency at 130°C	%
7.14.1	% Load and power factor at which it occurs	
7.15.0	Regulation at full load at 130°C	
7.15.1	at unity power factor	
7.15.2	at 0.8 power factor lagging	
7.16.0	Regulation at 110% load at 130^0 C	
7.16.1	at unity power factor	
7.16.2	at 0.8 power factor lagging	
7.17.0	Core	
7.17.1	Core material grade	Premium grade minimum M3 or better
7.17.2	Thickness of lamination mm	mm
7.17.3	Insulation of lamination	
7.17.4	Design Flux Density at rated condition at principal tap, Tesla- 1.7 Tesla (Max)	
7.17.5	Maximum flux density at 10 % over excitation /overfluxing, Tesla -1.9 Tesla (Max)	
7.17.6	Equivalent cross section area	
7.18.0	Guaranteed No Load current At 100% rated voltage , Amps	
7.18.1	HV	
7.18.2	LV	
7.19.0	Guaranteed No Load current At 110% rated voltage, Amps	
7.19.1	HV	
7.19.2	LV	
7.20.0	Type of Winding	
7.20.1	HV	
7.20.2	LV	
7.20.3	Conductor material	
7.20.4	Current density Amps/sqmm	
	HV winding	
	LV winding	
7.20.5	Gauge/area of cross section of conductor, sqmm	
	HV	
	LV	

7.21.0	Tapping - Off Ckt	Yes / No	
7.21.1	Capacity	Full Capacity	
7.21.2	Range- steps X % variation		
7.21.3	Taps provided on HV winding	Yes / No	
7.21.4	Tap link Current rating , A		
7.22.0	Insulating material and thickness	Material	Thickness
7.22.1	HV Turn		mm
7.22.2	LV Turn		mm
7.22.3	LV to Core		mm
7.22.4	HV to LV		mm
7.23.0	Minimum design clearance, mm		
7.23.1	HV to earth in Air	mm	
7.23.2	LV to earth in Air	mm	
7.23.3	Between HV & LV in Air	mm	
7.23.4	Top winding and yoke	mm	
7.23.5	Bottom winding and yoke	mm	
7.24.0	Bushing / Support Insulator		
7.24.1	Make		
7.24.2	Type		
7.24.3	Reference Standard		
7.24.4	Voltage class, kV		
7.24.5	HV side Bushing / Support insulator		
7.24.6	LV side line and neutral bushing / Support insulator		
7.24.7	Creepage factor for all bushing	mm / KV	
7.24.8	Weight	KG	
7.24.9	HV bushing / Support insulator		
7.24.10	LV line and neutral bushing / Support insulator		
7.24.11	Free space required for bushing / Support insulator removal, mm		
7.24.12	HV bushing / Support insulator		
7.24.13	LV line and neutral bushing / Support insulator		
7.25.0	HV Termination arrangement	Suitable for 3CX150 mm^2 AYFY 11KV	
7.25.1	Phase to phase clearance	mm	
7.25.2	Phase to earth clearance	mm	
7.25.3	HV side bus bar size		
7.25.4	HV Termination height	mm	
7.26.0	L.V termination arrangement	Suitable to 100x12 mm for phase & neutral	
7.26.1	Phase to phase clearance,	25 mm minimum	

7.26.2	Phase to earth clearance ,	25 mm minimum
7.26.3	LV side bus bar size	
7.26.4	LV Termination Height	mm
7.27.0	Current Transformer on LV phases	
7.27.1	Type	
7.27.2	Make	
7.27.3	Reference Standard	
7.27.4	CT Ratio	
7.27.5	Burden, VA	
7.27.6	Class of Accuracy	
7.28.0	WT scanner terminal box size	
7.29.0	Alarm and Trip contact ratings of protective devices	
7.29.1	Rated / making/ breaking currents , Amp @ Voltage for	
7.29.2	Winding temperature scanner	
7.30.0	Fittings and Accessories as per Cl. 8.9 provided	(YES / NO)
7.31.0	Over all transformer dimensions	
7.31.1	Length	mm
7.31.2	Width	mm
7.31.3	Height	mm
7.32.0	Weight data	
7.32.1	Core	KG
7.32.2	Frame parts, kG	KG
7.32.3	Core and frame, kG	KG
7.32.4	Total Winding, kG	KG
7.32.5	Core , Frame, Winding, kG	KG
7.32.6	Enclosure, kG	KG
7.32.7	Total Transport weight of the transformer, kG	KG
7.32.8	Total weight of the transformer with all accessories	KG
7.33.0	Shipping Data	
7.33.0	Weight of heaviest package, kG	KG
7.33.0	Dimensions of the largest package (L x B x H)	mm
7.34.0	Surge Arrestor requirement	
7.34.1	Type	
7.34.2	System Voltage , kV rms	
7.34.3	Rated Voltage of Arrestor, kV rms	
7.34.4	Continuous operating voltage , kV rms	
7.34.5	Maximum Continuous operating voltage, kV	

	rms	
7.34.6	Nominal Discharge Current, kA peak	
7.34.7	Energy Absorption Capability, kJ/kV	
7.34.8	Creepage factor	
7.34.9	Reference std	
7.35.0	WTI Scanner Details	
7.35.1	Make	
7.35.2	Model no.	
7.35.3	No of Channel / Input	
7.35.4	Manual submitted	
8.0.0	Low voltage bus bar system	To connect transformer LV side to ACB & to MCCB
8.1.0	Bus bar material tinned copper	Yes / No
8.2.0	Bus bar size	sqmm
8.3.0	Bus bar continuous current rating	Amp
8.4.0	Bus bar insulator voltage class	kV
8.5.0	Bus bar droppers size from ACB to MCCB (50X10 tinned copper)	
8.6.0	Maximum bus bar temperature rise	
9.0.0	ACB, MCCB	As per IS 13947
9.1.0	ACB make	
9.1.1	ACB rated voltage 415v +/- 10%	
9.1.2	ACB type 4 pole with isolable neutral link	Yes / No
9.1.3	ACB continuous current capacity at 415v 50Hz, at 50 deg C	amp
9.1.4	ACB short circuit breaking capacity Ics =Icu = 50kA minimum	kA
9.1.5	ACB SC making current capacity 100kAp	kA peak
9.1.6	ACB short time current withstand capacity for 1 sec (Icw= 50kA)	kA
9.1.7	ACB rated impulse withstand voltage for main & aux circuit in kv	
9.1.8	ACB closing time in ms	
9.1.9	ACB opening time in ms	
9.1.10	Guaranteed number of close & open operations at no load	
9.1.11	Guaranteed number of close & open operations at rated load	
9.1.12	ACB dimensions	
9.1.13	ACB operating mechanism -Trip free, anti pumping type, manual as well as motor	Yes / No
9.1.14	Spring charging motor supply	volt

9.1.15	Close & trip coil supply	volt
9.1.16	ACB utilization category -B as per IS	
9.1.17	ACB indications - ON, OFF & TRIP	
9.1.18	ACB operation - manual - ON, OFF by push buttons	
9.1.19	ACB operation – electrical - ON, OFF by TNC switch	
9.1.20	L/R switch for remote operation	Yes / No
9.1.21	ACB overload, short circuit & earth fault protection - By static or micro processor based releases	
9.1.22	Inbuilt CT burden, ration & class	
9.1.23	Overload release setting range	
9.1.24	Short circuit release setting range	
9.1.25	Earth fault release setting range	
9.2.0	MCCB make	
9.2.1	MCCB type -4 pole, double break / pole	Yes / No
9.2.2	MCCB - On & OFF by Manual handle and electrical	Yes / No
9.2.3	L/R switch for remote operation	
9.2.4	MCCB Neutral connection - Fully isolable link sized for rated current	
9.2.5	MCCB rated voltage 415v +/- 10% at 50Hz	
9.2.6	MCCB rated continuous current (630/1250 As per the type of PSS enquiry)	
9.2.7	MCCB 3 ph short circuit breaking capacity Ics = Icu =35kA	
9.2.8	MCCB 3 ph short circuit withstand capacity, Icw =8kA for 1 sec	
9.2.9	MCCB SC making current capacity	
9.2.10	MCCB rated insulation level	
9.2.11	MCCB mechanical & electrical endurance as per IS 13947 / IEC	
9.2.12	MCCB category of duty - B as per IS / IEC 947	Yes / No
9.2.13	MCCB indications -ON, OFF ,TR & L/R switch	
9.2.14	MCCB protection - Microprocessor release + earth fault	
9.3.0	Connection to ACB main bus by Cu bar with double PVC insulation	Yes / No
9.3.1	630 amp MCCB	
9.4.0	Connection to outgoing cables by bus bar terminals suitable for 2x4CX300sqmm AYFY	

	1100 volt grade cable	
9.4.1	No.of LT Outgoings as per the PSS type	
9.4.2	Only for Type 5 & 6- Provisions in LT panel to increase LT outgoing by 02 no's by adding MCCB's in future.	(YES/ NO)
10.0.0	APFC system	
10.1.0	Rating of APFC system	KVAR
10.2.0	Rated voltage & frequency	Volts at 50Hz
10.3.0	Rated line current of APFC system	Amp
10.4.0	Rated capacitance	micro Farad
10.5.0	Capacitor steps – Type I: 12x25KVAR? Type II: 8 X 25 KVAR?	Yes / No
10.6.0	Rated current of each 25KVAR unit	Yes / No
10.7.0	Rated capacitance – 25KVAR unit	micro Farad
10.8.0	Three phase connection – star / delta	
10.9.0	Capacitor dielectric type –	APP / MPP
10.10.0	No of series group / capacitor unit	
10.11.0	No. of parallel elements / series group	
10.12.0	Thickness of PP film in micron	
10.13.0	Thickness of Al foil in micron	
10.14.0	No. of PP film layers	
10.15.0	Maximum voltage stress per each PP film layer	
10.16.0	Discharge device material	
10.17.0	Capacitor tank steel thickness	mm
10.18.0	Capacitor unit dimension (L x D x H)	
10.19.0	APFC dimensions in mm (L x D x H)	
10.20.0	APFC system weight in kg	
10.21.0	Heat generated by APFC in Kw with all capacitor steps ON	
10.22.0	Operation with over voltage 115% of rated voltage for 12 hours in a day	
10.23.0	Operation with harmonic distortion THD 5% voltage & current	
10.24.0	Maximum permissible over current of	
10.25.0	1.3 times rated current continuous	
10.26.0	Dielectric loss less than 0.2w / KVAR	
10.27.0	Guaranteed minimum capacitor switching operations (ON/OFF) per year	
10.28.0	Maximum temperature rise above ambient of 45 Deg C	Deg C

10.29.0	Residual voltage after de-energiszation & at 60 seconds	
10.30.0	Design life of capacitor unit	
10.31.0	APFC panel insulation level	
10.32.0	1 minute power frequency withstand	KV
10.33.0	Impulse withstand voltage	KVp
10.34.0	Main bus bar material / size (sqmm)	
10.35.0	Main bus bar rated current	
10.36.0	Main bus bar short time withstand	
10.37.0	CT make & accuracy class	
10.38.0	CT ratio & burden (VA)	
10.39.0	APFC relay make / type	
10.40.0	APFC relay catalogue enclosed?	Yes / No
10.41.0	Data logger make / type	
10.42.0	Data logger catalogue enclosed?	Yes / No
10.43.0	AC contactor make	
10.44.0	AC contactor rating	Amp
10.45.0	AC contactor utilization category as per IS	
10.46.0	100amp MCCB make	
10.47.0	100amp MCCB current breaking capacity Ics=Icu=35kA	
10.48.0	Copper wire size from MCCB to contactor & capacitor – 35sqmm Cu	
11.0.0	Energy meter box as per specification provided?	Yes / No
12.0	Enclosure for package substation	
12.1	Service conditions for outdoor use	Yes / No
12.2	Material for enclosure – Galvanised Sheet steel 2.5mm thick CRCA for all side doors, covers with painting	Yes / No
12.3	Enclosure construction -Frame supported construction with all doors, covers welded with steel channel ribs at every 1000mm minimum	Yes / No
12.4	Lifting lugs for site handling / lifting by crane - qnty	
12.5	Doors for RMU compartment, Transformer compartment & LV compartment with anti theft hinge minimum 3 nos., with lockable handle & with padlocking facility	Yes / No
12.6	Top & other side walls of enclosure welded sheet metal	
12.7	Removable canopy above top cover -2.5mm thick sheet metal with 10º slope	Yes / No
12.8	Enclosure integral steel base frame ‘I’	

	section size	
12.9	Base frame bottom support pads for fixing by bolt to foundation - minimum six numbers to rest on foundation	Yes / No
12.10	Enclosure compartments -separate compartments for RMU, transformer & LV switchgear/APFC	Yes / No
12.11	Separation between RMU & transformer compartment by sheet steel 2.5mm thick	Yes / No
12.12	Separation between transformer compartment & LV compartment by sheet steel 2.5mm thick	Yes / No
12.13	Degree of ingress protection against solids & water as per IS12063	
12.13.1	IP53 for RMU compartment	
12.13.2	IP23 for transformer compartment	
12.13.3	IP33 for LV compartment	
12.14	Louvers on side covers of transformer compartment & side walls of LV compartment with steel wire mesh welded from inside so as to meet IP requirement as above	Yes / No
12.15	Louver area on cover / side wall -1500mm height x 1500mm minimum	
12.16	Exhaust fans mounted for APFC system to discharge air in transformer compartment - Controlled by SPMCB & thermostat to operate above 35 deg C, 2x150CFM, 1 ph 230v 50Hz	
12.17	Gland plate for RMU compartment - 2.5mm thick MS plate suitable for 3x3c300sqmm AYFY 11kv cable	
12.18	Gland plate for LV compartment -2.5mm thick MS plate suitable for 10x4c400sqmm cable + 10x7c2.5sqmm cable	
12.19	Class of enclosure as per IEC 62271-202 = 10K	Yes / No
12.20	Overall dimensions of package substation (LxWxH)	In mm
12.21	Overall weight of package substation	Kg
13.0	Enclosure earthing & illumination	
13.1	Two earth bus connection brought out of package substation enclosure to earth pad for connection to earth pit -Two earth pads for RMU, transformer & LV compartment each -One earth pads for transformer neutral	
13.2	Earth bus size 50X 6 mm GI flat	

13.3	Earth bus fault current capacity 26.3kA for 1 sec	
13.4	Earth connection of all covers, doors & structural parts to GI bus by metallic jumper connection	Yes / No
13.5	Earth connection of RMU, ACB & transformer body parts to GI bus by two numbers of 50x6mm GI flat per equipment	
13.6	Earth bus identification shown by letter 'E'	Yes / No
13.7	RMU, transformer & LV Compartment illumination by 36w CFL fixture controlled through SPMCB & door limit switch	
13.8	RMU, transformer & LV compartment power socket - 5/15amp 3 pin socket controlled through 15 amp SPMCB	
13.9	Paint shade external for enclosure	
13.10	Paint shade internal for enclosure	
13.11	Paint material & thickness	
13.12	Name plate & labels as per specification provided?	Yes / No
13.13	Smoke Detector	Yes / No
13.13.1	Make	
13.13.2	No Of Aux Contacts	
13.14	Hooter	Yes / No
14.0	Type test report submitted with GTP for RMU, transformer, ACB, MCCB, APFC system?	Yes / No
14.1	GA drawing of package substation submitted with GTP?	Yes / No
14.2	Bill of material submitted with GTP?	Yes / No
14.3	Clause wise deviation to technical specification submitted?	Yes / No

Bidder / Vendor seal / signature ----------

Name of the bidder	
Address of bidder	
Name of contact person	
Telephone no & email id	

Annexure D Recommended spares (Data by supplier)

List of recommended spares as following

Sr No	Description of spare part	Unit	Quantity
1	Battery Charger set for RMU – Dual RMU	Nos	limited to 10% of order

			quantity of PSS
2	FPI	Nos	limited to 10% of order quantity of PSS
3	VPIS	Nos	limited to 10% of order quantity of PSS
4	Manometer with pressure indicator switch	Nos	limited to 10% of order quantity of PSS
5	Motor Kit for LBS	Nos	limited to 10% of order quantity of PSS
6	Self Powered Relay	Nos	limited to 10% of order quantity of PSS
7	Aux Relays	Nos	limited to 10% of order quantity of PSS
8	Aux Switches	Nos	limited to 10% of order quantity of PSS
9	Modem with antenna	Nos	limited to 10% of order quantity of PSS
10	CPU with Power Supply Card, I/O Adapter Board, rack,relay board etc	Nos	limited to 10% of order quantity of PSS
11	DO Card – 8 channel	Nos	limited to 10% of order quantity of PSS
12	DI Card -16 channel	Nos	limited to 10% of order quantity of PSS
13	AI Card- 6 channel	Nos	limited to 10% of order quantity of PSS
14	Voltage/current transducer	Nos	limited to 10% of order quantity of PSS
15	BHMU Module	Nos	limited to 10% of order quantity of PSS
16	Battery	Nos	limited to 10% of order quantity of PSS
17	Interlock card	Nos	limited to 10% of order quantity of PSS
18	ACB Release	Nos	limited to 10% of order quantity of PSS
19	MCCB Release	Nos	limited to 10% of order quantity of MCCB

Any additional spares, if required shall be separately listed by bidder. Unit price for each spare item to be provided.

Annexure E Specification of 4G Ethernet Modem for FRTU

1. **Module:** 4G with backward compatible 3G /GSM GPRS
   a) FDD LTE: B1 (1920-1980/2110-2170) / B3 (1710-1785/1805-1880) / B8 (880-915/925-960) / B20 (800) MHz

b) TDD LTE: B38 (2570-2620) / B39 (1880-1920) / B40 (2300-2400) / B41 (2496-2690)
c) HSPA / UMTS: B1 (2100) / B8 (900) /800/850/1900 MHz
d) GSM: 900/1800/ MHZ Class 10

2. WAN Protocol: PPP/IPCP over Asynchronous HDLC with PAP/CHAP Authentication.

3. Modem shall be compatible with IPv4 & IPv6 scheme

4. Console Interface: RS232 on RJ45 connector.

5. LAN Interface: 10/100 Base-T complying to IEEE 802.3 / ANSI 8802-3 on RJ45 connector.

6. Support for SCADA Protocols in transparent pass through mode.

7. Network Protocols: PPP, IPCP, PAP, CHAP, ARP, IP, ICMP, TCP, UDP, IPSEC, SNTP, TFTP.

8. Support for NAT and Port forwarding.

9. Management: Serial, HTTP, Telnet & via SMS, Port Mapping, Event Log & Upload. Firmware Upgrade

10. Modem shall have self healing capability to recover from dead lock situation.

11. Status Monitoring: ICMP to 4 destinations for Keep Alive & Self Heal. Signal Strength & LEDs.

12. SIM Interface: External with locking provision.

13. AT Commands Interface: Supporting AT commands for dialing from FRTU through RS-232 serial port to modem.

14. Communication Interface: Remote management features like telnet & remote download facility

15. LED Indications: Power ON, Network–Signal strength, SIM availability, Ethernet link

16. Connectors: RJ45 Ethernet Port, SIM Card Holder, DC power connector, SMA Antenna connector
17. Power Supply: 24V DC (with reverse current protection) with 2 numbers Terminal Block without adapter.

18. Enclosure: Metallic Extrusion
19. Mounting: DIN Rail Mounting
20. Temperature: Operating (-10 to 60 Degree Centigrade), 95% Humidity

21. Antenna: High Gain Antenna with SMA connector.
22. Accessories:
    a) 1 Meter cable for connecting to external DC power source (24 V)
    b) 1 Meter Standard Ethernet (Straight) data cable
    c) Standard Console cable for diagnostic port of Modem
    d) 1 Meter serial cable for dialing modem from FRTU
23. Certification:
    a) Conducted Immunity : IEC61000-4-6
    Measure emission of the device (referenced to earth) on power mains and to compare them with specified limits to ascertain that the device will not disturb other equipments
    Frequency : 0.15MHz to 80MHz
    Modulation : 80% AM at 1 KHz
    Test Voltage : 3V

    b) Electrostatic Discharge (ESD):IEC61000-4-2
    Check immunity against discharge of static electricity that may occur when a charged operator touches the device
    Contact Discharge : 4KV
    Air Discharge : 8KV
    No of Discharge : 10 at pre-selected spots
    Positive & Negative Polarity

    c) EN55022 CLASS B
    Immunity characteristics of the device when subjected to continuous conducted noise
    Conducted Emission : Frequency - 150 KHz - 30 MHz
    Radiation Emission : Frequency – 30 MHz - 1000 MHz
24. Warranty period: 5 years

Annexure F Specification for FRTU

1.0.0 Scope of Supply & Work

This document defines the scope of supply, including spares and scope of work of installation, testing & commissioning including interfacing/ integration with RMU, DT

monitoring, ACB, LT panel, APFC, fire protection system and wireless sensors for acquisition of real time status and control functions associated with the same.

1.0.1 Scope of Supply

The specification covers design, engineering, manufacturing, factory testing, packaging and delivery of FRTU for complete PSS automation. The system should be completely wired up with all the required accessories to make the system capable of SCADA data acquisition and controlling of all components of PSS system. The scope of supply also covers the required spares that are to be supplied along with the system as per detail given under Spares, Accessories & Tools, clause 1.6.0.

1.0.2 Scope of Work

a) The specification covers site survey, engineering, installation, testing and commissioning of FRTU system, to make the system capable of SCADA data acquisition and controlling of complete accessories of PSS system at site.
b) The scope also covers the interfacing/ inter-connecting of FRTU with RMU, DT monitoring, ACB, LT panel, APFC and fire protection system used in PSS. The details are as per the clause 1.5.3 SAT is also included in the scope of work as defined in the document.
c) Any firmware up-gradation meets the protocol requirement of MCC/ BCC communication protocol (IEC 60870-5-104) to be made available by the supplier engineer.
d) End to end testing from MCC/ BCC to be carried out in presence of the supplier engineer. If any change is required for operation and monitoring of the RMU system to be made by the bidder without any price implication to owner.

1.1.0 Applicable Standards

FRTU shall comply with the requirements stated in the latest editions of the following recommendations, standard and specifications:

a) International Electro technical Commission (IEC),
b) Institute of Electrical and Electronics Engineering (IEEE),
c) American National Standards Institute (ANSI),
d) National Equipment Manufacturers Association (NEMA) standards

1.2.0 Technical Requirements

1.2.1 FRTU Functionalities:

FRTU shall contain all the functions required for SCADA data acquisition and controlling of the complete accessories used in PSS.

a) It should be capable of handling minimum 750 DP(data points) respectively.
b) FRTU shall have serial port, configurable RS485/RS232 for MODBUS serial protocol and serial IEC 103.
c) FRTU shall have TCP/IP port for Modbus TCP/IP and IEC 61850 communication.
d) Ethernet and serial ports for interfacing with IEC 60870-5-104 protocol to communicate with MCC and BCC.

e) Ethernet port should be configured for IEC 60870-5-104 protocol as a slave.
f) Built in optical couplers to isolate the field signals and field communication channels.
g) Support for battery availability and battery health check feature.
h) Suitable provision in FRTU to supervise and prevent accidental serious discharge of battery.
i) FRTU shall support event storage capacity as measurand events (10,000), system events (1,000), alarms (1,000) and normal events (5,000). Events should be stored on the basis of FIFO.
j) Local viewing of all events shall be possible.
k) FRTU DI/ DO and AI communication channel capacity should be such that it can fulfill automation of complete PSS system.
l) FRTU shall support web based monitoring from remote as well as local.
m) All DI/ DO and AI communication channels should have individual LED indications.
n) FRTU shall support feature of remote configuration as well as diagnosis.
o) FRTU system shall support communication with 4 Nos. master stations simultaneously.
p) FRTU shall support hot swap feature.
q) As the SCADA/ DMS system will use public domain such as RF/ GPRS etc., therefore it is mandatory to guard the data/ equipment from intrusion/ damage/ breach of security & shall have SSL VPN based security.
r) FRTU shall support SNMP (Simple Network Management Protocol).
s) Capability of time synchronization with GPS receiver and SCADA MCC/ BCC.
t) FRTU system should be modular and expandable.
u) FRTU should be capable to store the configuration programme in detachable flash memory card.
v) FRTU shall have console port with console cable.

1.2.2 CPU Module:

a) 32 bit ARM core CPU, operating @ minimum 450 MHz.
b) Internal memory minimum 128MB and RAM 64MB, suitable for handling the PSS data acquisition and controlling the RMU, DT monitoring, ACB, LT panel, APFC and used in PSS.
c) RTC- Real Time Clock
d) Display to show the error code and status of the processor.

1.2.3 Communication Ports:

a) FRTU shall have the following port for communications

S. No	Communication With	Communication Protocol	Physical Layer		Connecting Cable	Required Qty
			Interface	Physical Port		
1	Master station(s)	IEC 60870-5-104	Ethernet	RJ45	CAT VI	1
2	LT panel/Transformer	IEC 61850	Ethernet	RJ45	CAT VI	1

S. No	Communication With	Communication Protocol	Physical Layer		Connecting Cable	Required Qty
			Interface	Physical Port		
3	Local Configuration	_	RS232	USB/DB9	Console Cable	1
4	Protection relays	IEC 103	RS485	Terminal Block	Shielded RS485 Twisted Copper Cable	1
5	MFM	MODBUS	RS485	Terminal Block	Shielded RS485 Twisted Copper Cable	1
6	LT panel/Transformer	MODBUS	RS485	Terminal Block	Shielded RS485 Twisted Copper Cable	1
Total						6

b) Each Serial port should be capable of handling minimum 10 Nos. devices on the network with same communication settings.
c) The settings of Ethernet and serial ports should be programmable.
d) System should have the capability to increase TCP/ IP Ethernet and serial ports for communication by addition of communication modules.

1.2.4 MCC/ BCC Communication Protocol:

a) FRTU system shall be configured to communicate with MCC/ BCC simultaneously on IEC 60870-5-104 protocol.
b) FRTU shall support periodic reporting of analog data that shall be configurable upto 1 hour poling delay.
c) Digital status data shall have higher priorities as compared to the analog data.
d) Dead band for reporting analog values shall be programmable for the full scale value.

1.2.5 Communication between FRTU, MFMs and Protection Relays:

a) FRTU can acquire analog values from MFMs and protection relay through RS485 serial communication port using serial MODBUS and serial IEC 103 protocol respectively.
b) Communication of ACB/MCCBs on Modbus TCP/IP / IEC 61850 protocol.
c) MFM and protection relay will act as slaves to the FRTU. The FRTU shall transmit these analog values to master station by using IEC 60870-5-104 protocol.
d) To protect the serial communication port(s), optical isolation is required which is mandatory to avoid damage to FRTU channels.

1.2.7 Digital Input Module:

a) FRTU shall be capable of accepting isolated potential free contact status inputs.
b) FRTU shall provide necessary sensing voltage, current, optical isolation for each status input.
c) FRTU shall be capable to configure re-bounce filtering for each input.
d) The sensing voltage of input module should be 24VDC.
e) The FRTU shall accept two types of status input: Single point and double point.
f) Single point status input represented by 1 Bit in the protocol message whereas double point status input represented by 2 Bits in the protocol message.
g) FRTU configuration software shall have the capability to invert the DI signal value required in the configuration.
h) There shall be channel wise visual indication of all DIs modules installed in the FRTU panel for troubleshooting problems.
i) Digital Input module should have hot swap compliance.

1.2.8 Digital Output Module:

a) FRTU shall provide the capability for master station to select and change the state of Digital output points.
b) These control outputs shall be used to control power system devices such as circuit breakers, isolators and other two state devices which shall be supported by FRTU.
c) FRTU should also support single command output to reset FPI operation.
d) The output contact shall be rated to operate RMU motor, ACB, LT MCCB, APFC and other signals used in PSS.
e) Incase control output module of FRTU does not provide potential free control output of required rating then separate control output relays shall be provided.
f) There shall be channel wise visual indication of DOs available in FRTU panel and command issued for any digital channel for troubleshooting the problem.
g) DO modules should have the capability to configure for a single as well as double command output.
h) Digital Output module should have hot swap compliance.

1.2.9 Analog Module:

a) FRTU analog module should be capable of connecting universal type of analog value (±20mA, ±10V).
b) FRTU should have the capability to configure the analog channel for any value of universal analog input through the FRTU configuration software.
c) Analog module should be 16 Bit, bipolar.
d) Analog module should have hot swap compliance.
e) There shall be channel wise visual indication of AIs card available in FRTU panel.

1.2.10 Interfacing of FRTU system with all the components used in PSS

a) RMU, DT monitoring, LT panel, APFC, wireless sensor signal connections should be terminated in bay wise and extension of the signals from the each equipment TB (Terminal Block) to FRTU TB through cable connectors, bay wise.
b) Separate multi-core cable for Interconnection of FRTU with RMU, LT panel, DT monitoring, APFC, Sensors with suitable size and length.

c) Male and female connector with cable for interconnection should be provided in FRTU panel.
d) Use 2.5/ 4 sqmm multi-strand copper wire/ cable of suitable length for connecting the battery bank and battery charger placed in the in FRTU cabinet.
e) Supply and dressing of inter-connecting cables through suitable size PVC duct are in the supplier scope.
f) Interconnections should have proper lugs, ferrules etc.

1.2.11 Communication Package:

a) Communication media should support GSM/ GPRS.
b) 1 no. of Ethernet, 4G/3G GPRS gateway with 1 ethernet 10/ 100 BaseT port.
c) 3G GPRS Gateway, RF should support multi NAT configuration.
d) Driver software
e) Gateway shall be remotely manageable and configurable.
f) Antenna with 5m coaxial pig tail (extension of antenna cable should be possible).
g) Rated voltage: 9- 48 VDC.
h) Cable to connect the communication module of FRTU.

1.2.12 Troubleshooting:

a) FRTU should be configurable using web based configuration and maintenance tool.
b) FRTU shall have proper diagnosis tool for troubleshooting the failures related to the following from remotely as well as locally. Supplier shall consider all required configuration and diagnosis cable and software with each supplied FRTU with license if any.
c) Communication of FRTU with master
d) Communication of MFM with FRTU
e) Communication of DI/ DO/AI
f) Communication with Protection Relay

1.2.13 Programmable Logic Control (PLC):

a) FRTU shall be provided with the PLC license.
b) FRTU should have the functionality of logic development and perform the task using its own CPU.
c) FRTU should have the capability to run more than one PLC tasks at a time.

1.2.14 Cyber Security:

The FRTU shall support the advanced cyber security standard ISO 27002 2005 (previously known as ISO IEC 17799 2005), NERC CIP-009-1 and ISA-99.02.01[5]-[7].

FRTU should have following features:
a) User level configuration
b) User wise authentication like system admin, configuration admin, control, operator.
c) Disabling the DNS

d) Disabling, enabling & configuration of TCP/ IP and UDP ports.
e) Door lock alarm integration with FRTU.

1.3.0 General Construction of Enclosure:

a) FRTU system housed in suitably sized panel, fabricate steel plate with mini 2mm thick frame and 2.0 mm thick CRCA sheet with seven tank process for indoor and for outdoor of protection mini IP 55 with safety lock of good quality. the cabinet shall have adequate space for installation of other hardware's like modem, battery charger and battery as well as shall have at least 30% spare space.
b) It is suitable class of IP 55 protection as per indoor and outdoor applications.
c) Enclosure fabricated with double door, swing frame type with proper pad lock arrangement to avert the theft of the equipment fitted inside.
d) The component and accessories to be mounted on mounting plate of FRTU.
e) Enclosure should have proper illumination, , universal type socket and laptop stand, Drawing pocket etc

1.4.0 FRTU Power Supply

a) Power supply for FRTU shall be on 24V DC system which would be made wired from batteries housed in RMU to battery chargers in FRTU cabinet.
b) The main DC circuits shall be protected by incoming circuit breakers. Each circuit shall be tapped through single pole MCBs so as to provide an individual DC feed to each of the I/O modules, modems and protocol converters. Contractor shall provide maximum power consumption data of each of the type of FRTU. To protect the batteries form the theft the battery in RMU compartment should have separate pad lock arrangement.
c) Power supply system should have redundant battery charger to provide the supply to FRTU system as well as to charge the battery.
d) Pluggable Surge Protection Device in accordance with IEC 61643 with KEMA & UL approval must be installed at the incoming power supply of FRTU.
e) DIN Rail Mounted Suitable Surge Protection must be installed on all communication lines (Ethernet/RS 485)

1.5.0 FRTU Type and Routine Tests

1.5.1 Type Tests

The FRTU's shall have passed type tests carried out by government accredited labs and in accordance with IEC 255-4, 255-5, 255-6, 801-2, and 801-3 to demonstrate that the FRTU's comply with the ratings stated in these standards. As a minimum, certificates for the following type tests shall be furnished:

a) Dielectric test
b) Impulse voltage withstand test
c) High frequency disturbance test
d) Thermal requirement test
e) Mechanical requirement test

f) Limiting dynamic value test

g) Contact performance test

h) Electromagnetic radiation susceptibility test

i) Electrostatic discharge susceptibility test

1.5.2 Routine Tests

The FRTU's shall pass the Manufacturer's standard routine tests in accordance with the referenced standards.
In addition to the tests described in the IEC standards, the routine tests and test report of the FRTU's shall include the following:

a) Visual tests to confirm that construction and sizing requirements have been met.

b) Rigorous testing of each input and output function of the FRTU's. This shall include the fault detection and the disturbance data storage functions as well as the operation and performance of the FRTU time and date facilities.

c) Verification of the use of the FRTU test equipment for maintenance and testing.

d) Verification of the ability to download parameters and configuration data from the SCADA/DMS master station.

e) Verification that FRTU software and firmware support FRTU sizing and expansion requirements.

f) Verification of successful communications (i.e. protocols) at all the required data rates.

g) Testing for secure operation, including verification that: a) Communication errors are detected. b) SCBO procedures are properly performed for control outputs. c) No erroneous control operation occurs and no incorrect data is generated when power is turned on or off or when operating on low battery voltage.

1.5.3 SAT

This document exclusively covers the SAT for FRTU system.

After the successful commissioning and testing of the FRTU system and liquidation of all punch points, the system will be put on continuous running mode for a cycle of minimum thirty (30) days after clearance on punch-points. During this period, if the FRTUs performance due to configuration and/ or hardware does not meet the criteria as per Technical Requirements of this document, the cycle will be reset.

During the cycle, availability and operational efficacy in regard of the supplied FRTU system will be checked and after successful validation, SAT will be concluded.

SAT will include the validation of the following:

a) Network
b) FRTU availability and operational efficacy
c) Validation of SOE
d) Indication, Command and Measured data

BYPL reserves the right to financially penalize the supplier on failure of SAT as per the technical and tender document.

1.6.0 Spares, Accessories & Tools:

a) Bidder should provide minimum 10% spare of each and every equipments and parts of the equipment that will be recommended by the bidder for 5 years for trouble free operations.
b) The recommended spares of FRTU and accessories to be approved by the engineering in-charge of SCADA- DMS.
c) The cost of spares is part of the tender and should not be considered separately.
d) All software license shall be provided for programing, configuration, troubleshooting and diagnosis shall not be hardware/Machine specific. In case software's are machine or hardware specific mini two numbers of such software shall be supplied.
e) The bidder shall provide all license software package (system/application/antivirus) required by the system for meeting the intent, functional, parametric and performance requirement of the specification. As a customer support, the bidder shall periodically inform and upgrade the provided software till completion of warranty period.

1.7.0 Software / Firmware

The term software is used in this Technical Specification to mean software or software implemented through firmware. All software shall be implemented according to the Contractor's latest established design and coding standards. Complete and comprehensive documentation shall be provided for all software. Contractor should provide windows based software as it is preferred for its user friendliness.

1.7.1 General

a) A real-time non-proprietary operating system that is capable of managing the FRTU applications shall be provided.
b) This software shall provide automatic restart of the FRTU upon power restoration, memory parity errors, hardware failures, and manual request. The software shall initialize the FRTU and begin execution of the FRTU functions without intervention by the SCADA/DMS master station. All restarts shall be reported to the SCADA/DMS.
c) The software shall be prepared in a high level language and shall be documented in detail. No separate licensing charges or agreements shall attach to the FRTU software or its underlying operating system.
d) In order to easily support the system under continuously changing site conditions all protocol, configuration, and application data must be contained in easily programmable non-volatile memory such as Flash EPROM.
e) The FRTU design shall be independent of any communication protocol that would impose restrictions on the flexibility or functionality of the FRTU. Protocol changes shall be accomplished by software/firmware changes only.

1.7.2 Diagnostic Software

Software shall be provided to continuously monitor operation of the FRTU and report FRTU hardware errors to the SCADA/DMS. The software shall check for memory, processor, and input/output errors and failures. It is desirable that internal diagnostics be sufficiently detailed to detect malfunctions to the level of the smallest replaceable component.
The FRTU shall facilitate isolation and correction of all failures and shall include features that promote rapid fault isolation and component replacement. All functional module nodes shall be designed with integrated on-line diagnostic functions. The results of these diagnostics shall be reported to the central processing module. The central module shall store this information and report it to the SCADA/DMS as permitted by the protocol. FRTU shall be able to access from remote (BCC/MCC) for down loading configuration.

1.8.0 Service Life and Warranty Support

Service Life:

BYPL prefers that the major equipments of FRTU system shall be capable of complying with this standard, including performing its intended purpose, for a minimum of 5 years from the date of supply.

The supplier shall provide a service support letter containing:
a) The date at which the product was released for sale.
b) The anticipated date at which the product will be withdrawn from sale, but support will continue to be supplied.
c) The anticipated date of when the product support will be withdrawn i.e. spares will no longer be available and technical support will no longer be provided.

1.9.0 Trainings & Hands-on

The supplier personnel who are experienced instructors and who speak understandable English shall conduct training. The supplier shall arrange on its own cost all hardware training platform required for successful training and understanding at BYPLs works. The supplier shall provide all necessary training material. Each trainee shall receive individual copies of all technical manuals and all other documents used for training. These materials shall be sent to BYPL at least one (1) months before the scheduled commencement of the particular training course. Class materials, including the documents sent before the training courses as well as class handouts, shall become the property of BYPL. BYPL reserves the right to copy such materials, but for in-house training and use only. Hands-on training shall utilize equipment identical to that being supplied to BYPL. The schedule, location, and detailed contents of each course will be finalized during BYPL and supplier's discussions. If the supplier has utilized 3rd party equipment or outsourced work to a 3rd party then experienced instructors of the 3rd party are required to be part of the training sessions.

1.9.1 FRTU System Hardware Course

A computer system hardware course shall be offered, but at the system level. The training course shall be designed to give BYPL hardware personnel sufficient knowledge of the overall design and operation of the system, so that they can correct obvious problems, configure the hardware, perform preventive maintenance, run diagnostic programs, and communicate with contract maintenance personnel. The following shall be covered:

a) System hardware design architecture overview: Configuration of the system hardware.
b) Equipment Maintenance: Basic theory of operation, maintenance techniques and diagnostic procedures for each element of the computer system, e.g., processors, auxiliary memories, Ethernet, routers and printers. Configuration of all the hardware equipment.
c) System Expansion: Techniques and procedures to expand and add equipment such as loggers, monitors and communication channels.
d) System Maintenance: Theory of operation, maintenance techniques and practices, diagnostic procedures and (where applicable) expansion techniques and procedures. Classes shall include hands-on training for the specific subsystems that are part of BYPLs equipment or part of similarly designed and configured subsystems. All interfaces to the computing equipment shall be taught in detail.
e) Operational Training: Practical training on preventive and corrective maintenance of all equipment, including use of special tools and instruments. This training shall be provided on BYPLs equipment or on similarly configured systems.

1.9.2 FRTU System Software Course

The contractor shall provide a computer system software course that covers the following subjects:

a) System Programming: Including all applicable programming languages and all stand-alone service and utility packages provided with the system. An introduction to software architecture, effect of tuning parameters (OS software, Network software, database software etc.) on the performance of the system.
b) Operating System: Including the user aspects of the operating system, such as program loading and integrating procedures, scheduling, management, service and utility functions and system expansion techniques and procedures.
c) System Initialization and Failover: Including design, theory of operation and practice
d) Diagnostics: Including the execution of diagnostic procedure and the interpretation of diagnostic outputs.
e) Software Documentation: Orientation in the organization and use of system software documentation.
f) Hands-on Training: One week, with allocated computer time for trainee performance of unstructured exercises and with the course instructor available for assistance as necessary.

1.9.3 FRTU Application Software Course

The supplier shall provide comprehensive application software courses covering all applications including the database and display building course. The training shall include:

a) Overview: Block diagrams of the application software and data flows. Programming standards and program Interface conventions.

b) Application Functions: Functional capabilities, design and major algorithm. Associated maintenance and expansion techniques.
c) Software Development: Techniques and conventions to be used for the preparation and integration of new software functions.
d) Software Generation: Generation of application software from source code and associated software configuration control procedures.
e) Software Documentation: Orientation in the organization and use of functional and detailed design documentation and of programmer and user manuals.
f) Hands-on Training: One week, with allocated computer time for trainee performance of unstructured exercises and with the course instructor available for assistance as necessary.

1.9.4 Requirement of Training

The supplier shall provide training for a batch (maximum of 10 people) for five (5) days in two slots (Time of which will be decided by BYPL and supplier) on the following courses.

Name of Course:

a) System Hardware
b) System Software
c) Application Software

1.10.0 Drawings & Documents

The bidder shall submit all the standard and customised FRTU documents for review and approval which includes the following:

a) FRTU function design document
b) FRTU hardware description document & all the documents referred therin to meet all the clauses of the specification.
c) FRTU Test equipment user documents
d) FRTU user guide
e) FRTU Operation & Maintenance document
f) FRTU training documentation
g) FRTU database document
h) FRTU I/O list (as build) after the execution
i) FRTU Test procedures
j) Data Requirement Sheet (DRS) of all items
k) Protocol documentation including implementation profile etc.

l) FRTU installation and layout, GA, BOQ, schematics and internal wiring drawings for each FRTU site

Following Technical documents shall be submitted in addition to Commercial Documentation based on Statutory Requirements and shall be submitted along with the bid:

S. No.	Description	For Approval	For Review	Final Submission
1	GTP	✓		✓
2	GA Drawing	✓		✓
3	Installation Instruction			✓
4	Manual/ Catalogues		✓	✓
5	Dimension drawing		✓	✓
6	QA & QC plan	✓	✓	✓
7	Test Certificates	✓	✓	✓

After the award of the contract, bidder shall submit 4 copies of Drawings describing the equipment in detail and forward for approval before final dispatch of the equipment.
Soft copy of all the Drawings, GTP, Test certificates shall be submitted for final approval by BYPL. All the documents & drawings shall be in English language.

1.11.0 FRTU DI/DO/AI list

FRTU configuration DI/ DO/AI Channel requirement is indicated in the Table given below

1.11.1.1	FRTU configuration	DI-64 no's DO-16 no's AI-6 no's
1.11.2	**Digital Inputs**	
1.11.2.1	Cable feeder VCB module 1 & 2	CB ON
		CB OFF
		Disconnector ON position
		Disconnector OFF position
		Earth position ON position
		Earth position OFF position
		Fault Indicator ON Status
		Fault Indicator OFF Status
		L/R switch in remote
		Control circuit Healthy
1.11.2.2	Transformer VCB	CB ON
		CB OFF
		Disconnector ON position

		Disconnector OFF position
		Earth position ON position
		Earth position OFF position
		Auto Trip
		L/R switch in remote
		Control circuit Healthy
1.11.2.3	Common Signals	SF6 Low
		Battery Charger 1 Fail
		Battery Charger 2 Fail
		Battery low(BHMU & Charger)
		Battery Unhealthy/fail
		Battery Test in progress
		Command Acknowledgement
		Door Open/Close
1.11.2.4	Transformer signals	Transformer Oil level low
		OTI Alarm from field
		WTI Alarm from field
		WTI trip
		Transformer pressure relay operated
1.11.2.5	APFC	APFC Incomer MCCB ON
		APFC Incomer MCCB OFF
		APFC Incomer MCCB Trip
		L/R switch in remote
		Control supply healthy
1.11.2.6	LT ACB (through microprocessor release)	LT ACB ON
		LT ACB OFF
		LTACB Trip
		L/R switch in remote
		Control supply healthy
1.11.2.7	Outgoing MCCB (through microprocessor release)	LT Outgoing MCCB ON
		LT Outgoing MCCB OFF
		L/R switch in remote
		Control supply healthy
1.11.2.8	Fire Extinguisher & smoke detector	Fire Extinguisher Operated
		In service
		Fire Alarm
1.11.3	**Digital Outputs (Commands)**	
1.11.3.1	Cable feeder VCB module 1 & 2	CB ON
		CB OFF
		FPI Reset
1.11.3.2	Transformer VCB module 3	CB ON
		CB OFF
1.11.3.3	LT ACB (through microprocessor release)	LT ACB ON
		LT ACB OFF
1.11.4	Measuring inputs	
1.11.4.1	Energy Meter (energy meter in purchaser	IR
		IY

	scope)	IB
		VAR
		W
		VA
		PF
		VRY
		VYB
		VBR
		VRN
		VYN
		VBN
		IN
1.11.4.2	ACB release	IR
		IY
		IB
		W
		VA
		VAR
		PF
		Harmonic
1.11.4.3	MCCB release	IR
		IY
		IB
		W
		VA
		VAR
		PF
		Harmonic
1.11.4.3	WTI Scanner	Oil temperature
		LV Winding temperature
		HV Winding temperature
1.11.4.4	APFC relay	Switching Step
		IR
		IY
		IB
		PF
		VA
		VAR
		W

1.12.0 Guaranteed Technical Documents

(Vendors shall furnish the General Technical Particulars along with their offer)

Sr. No.	Description	Requirement	Vendors Data
1	Vendors Name		
2	Guarantee period	5 yrs	
3	Make of FRTU base module		
4	No. of DI modules	40	

5	No. of DO modules	16	
6	No. of AI modules	6	
7	Dimensions & Weight of FRTU	Vendor shall provide	
8	Dimensions of FRTU panel	Vendor shall Provide	
9	Make of protocol converter	Vendor shall provide	
10	Interposing relay with freewheeling diode		
10.1	Make	ABB / SCHNEIDER/SIEMENS	
10.2	Capacity	>8 A	
10.3	Model	CR-P with 2C/O contacts	
11	Surge protection		
11.1	Incoming to FRTU supply		
11.2	Serial communication		
11.3	Ethernet port		
12	AC & DC MCB	Merlin & Gerin / Protec / Indokopp	
13	Terminal Blocks	Elmex / Connectwell / Phoenix	
14	Disconnecting type fuses	Elmex / Connectwell / Phoenix	
15	Enclosure		
15.1	Sheet steel thickness	Mini 2 mm	
15.2	Painting process	7 tank	
15.3	Construction of steel according to IEC 529 , index of protection	IP55	
15.4	Shade	As PSS	
15.5	Louvers with filters	2 Nos	