BSES Yamuna Power Limited

Tender Notification for

DESIGN, ENGINEERING, CIVIL WORKS, SUPPLY, ERECTION, TESTING, & COMMISSIONING OF NEW 33/11KV GIS & POWER TRANSFORMER ALONG WITH ALLIED EQUIPMENTS AND WORKS OF SYSTEM UPGRADATION ON TURNKEY BASIS AT MOTIA KHAN GRID SUBSTATION, NEW DELHI FOR BYPL, DELHI (INDIA)

NIT NO CMC/BY/19-20/RB/SV/008

Due Date for Submission: 23.05.2019, 14:30 HRS

BSES YAMUNA POWER LIMITED (BYPL)
SHAKTI KIRAN BUILDING, KARKARDOOMA,
DELHI-110032
CIN: U40109DL2001PLC111525
TEL: 011 3999 7111
WEBSITE: www.bsesdelhi.com
GSTIN: 07AABCC8569N1Z0

BSES Yamuna Power Limited

SECTION – I: REQUEST FOR QUOTATION

1.00 Event Information

1.01 BSES Yamuna Power Ltd (hereinafter referred to as **"BYPL"**) invites sealed tenders in 2 envelopes for DESIGN, ENGINEERING, CIVIL WORKS, SUPPLY, ERECTION, TESTING, & COMMISSIONING OF NEW 33/11KV GIS & POWER TRANSFORMER ALONG WITH ALLIED EQUIPMENTS AND WORKS OF SYSTEM UPGRADATION ON TURNKEY BASIS AT MOTIA KHAN GRID SUBSTATION, NEW DELHI FOR BYPL, DELHI (INDIA). The bidder must qualify the requirements as specified in clause 2.0 stated below. All envelopes shall be duly superscribed as — **"DESIGN, ENGINEERING, CIVIL WORKS, SUPPLY, ERECTION, TESTING, & COMMISSIONING OF NEW 33/11KV GIS & POWER TRANSFORMER ALONG WITH ALLIED EQUIPMENTS AND WORKS OF SYSTEM UPGRADATION ON TURNKEY BASIS AT MOTIA KHAN GRID SUBSTATION, NEW DELHI FOR BYPL, DELHI (INDIA)" "NIT NO CMC/BY/19-20/RB/SV/008 DUE ON 23.05.2019, 14:30 HRS"**

Sl. No.	Description	Estimated Cost (₹)	Cost of EMD (₹)	Qty.	Delivery & Installation at
1	Survey, design, engineering, manufacture, shop testing, inspection, packing, dispatch, loading, unloading and storage at site, transit/storage and construction insurance, assembly, erection, civil, structural, architectural work, complete pre-commissioning checks, testing & commissioning at site, obtaining statutory clearance & certification from State Electrical Inspector, and handing over to the Owner after satisfactory commissioning of new 33/11kv gis & power transformer along with allied equipments and works of system upgradation on Turnkey basis conforming to Technical Specification & SOW	11.44 Crore	11.44 Lakh	AS PER BOQ (Bidder is requested to verify the same before bidding by visiting the site)	MOTIA KHAN GRID, NEW DELHI FOR BYPL, DELHI (INDIA)

1.02 The schedule of specifications with detail terms & conditions can be obtained from address given below against submission of non-refundable demand draft of **Rs.1,180/-** drawn in favour of BSES Yamuna Power Ltd, payable at Delhi. The tender papers will be issued on all working days upto **23.05.2019, 17:00 P.M**. The tender documents & detail terms and conditions can also be downloaded from the website **www.bsesdelhi.com --> BSES YAMUNA POWER LTD --> Tender --> Open Tenders**

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.

1.03 Offers will be received upto **23.05.2019, 14:30 PM.** at the address given below. Part A of the Bid shall be opened on **23.05.2019, 15:30 PM**. Part B of the Bid will be opened in case of Techno-Commercially qualified Bidders and the date of opening of same shall be intimated in due course. It is the sole responsibility of the bidder to ensure that the bid documents reach this office on or before the last date.

Head of Department
Contracts & Materials Deptt.
BSES Yamuna Power Ltd
3rd Floor, A Block
Shaktikiran Building, Karkardooma
Delhi 110032

1.03 Bid will be summarily rejected if:

(i) Earnest Money Deposit (EMD) of requisite value & validity.
(ii) Tender fee of requisite value.
(iii) The offer does not contain "FOR NEW DELHI" prices indicating break-up towards all taxes & duties.
(iv) Complete Technical details are not enclosed.
(v) Tender is received after due date and time**.**

2.00 **Qualification Criteria**

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

a) The bidder should be a manufacture of any two major equipments out of three – 33/11KV 20/25 MVA Power Transformer, 33KV GIS and 11KV AIS.
b) The bidder should have infrastructure in India for providing service & spare support to BYPL. The relevant documents including details of manufacturing units, locations and works from where supply & spares against this tender shall be proposed to be furnished.
c) The bidder should have established project management, field quality assurance system & safety organization designed to achieve high level of reliability at various stages of field services required for successful erection, testing & commissioning. The bidder should have successfully designed, supplied, installed & commissioned minimum two 33KV GIS Grid substations or higher rating projects in last 5 years. Details of these projects including customer name, PO number (with date), date of completion and rating (Capacity/Voltage etc) shall be provided.
d) Performance certificate for 1 (One) year satisfactory performance from at least 2 executed projects of 33KV GIS or higher voltage rating should be submitted.
e) Bidder shall procure equipment's from the approved vendor list of BYPL for individual items (attached in Scope of work - SP-SWGIS-124-R1). The bidder is supposed to have agreement with manufacturer/service provider to provide support to BYPL for any service & spares related issues for time stipulated in the specification or service life of the equipments. The bidder must submit the undertaking for the same.
f) The bidder must have adequate Financial Stability and status to meet the financial obligation pursuant to the scope of work and shall have average annual turnover of minimum Rs 200 Crores during last three (3) Financial Years preceding the date of opening of bid, duly certified CA certificate to be submitted.

g) The bidder should possess valid Electrical Contractor License issued by competent statutory agency to undertake work in NCT Delhi. In case bidder is not having this license, Bidder to give the undertaking that it will be obtained by them before the start of the work at site or suitable sub-contractor having the valid license shall be engaged for works at site where copy of valid license shall be submitted to BYPL before the start of the work.

h) An undertaking (self certificate) that the bidder has not been blacklisted/debarred by any central/state government institution including electricity boards.

i) The bidder should have registered under GST ACT and shall submit PAN, EPF and GST Registration Number, in addition to other statuary compliances. The bidder must submit the copy of registrations and submit an undertaking that the bidder shall comply all the statutory compliances as per the applicable laws/rules etc before the start of the work.

Notwithstanding anything stated above, BYPL reserves the right to assess bidder's capability to perform the contract, assess the capability and installed capacity of the Bidder for carrying out the supplies, should the circumstances warrant such assessment in the overall interest of the purchaser. In this regard the decision of the purchaser is final.

3.00 Bidding and Award Process

Bidders are requested to submit their offer strictly in line with this tender document. **NO DEVIATION IS ACCEPTABLE**. BYPL shall response to the clarifications raised by various bidders and the will be distributed to all participating bidders through website.

3.01 BID SUBMISSION

The bidders are required to submit the bids in 2(two) parts and submitted in **1 original + Duplicate** to the following address:

Head of Department
Contracts & Material Deptt.
BSES Yamuna Power Ltd
3rd Floor, A Block
Shaktikiran Building, Karkardooma
Delhi 110032

PART A :: TECHNICAL **BID** comprising of following

- EMD in prescribed format
- Non-refundable demand draft for Rs 1180/- in case the forms are downloaded from website
- Details of constitution of the company (Proprietary/Limited/etc along with the details)
- Memorandum of Association of the company
- Documentary evidence in support of qualifying criteria i.e, Copies of the following for last 3 years i) Balance sheet ii) Annual profit & loss statement iii) Annual turn over, iv) Capacity, v) CA certificate etc
- Copies of following i) Orders ii) Execution/Performance Certificates, & other documents to support the QC as per Clause 2.0
- Technical Literature/ GTP/Type test report etc
- Organization Chart/Qualified Manpower available
- Testing Facilities

- Original Tender documents duly stamped & signed on each page as token of acceptance
- Acceptance to Commercial Terms and Conditions viz. Delivery schedule/period, Payment terms, BG, Power-of-Attorney etc

PART B :: FINANCIAL **BID** comprising of

- Price strictly in the Format enclosed indicating Break up of basic price, taxes & duties, Freight etc

3.02 **TIME SCHEDULE**

The bidders should complete the following within the dates specified as under:

S.No.	Steps	Due date
1	Last Date of Sale of Bid Documents	22.05.2019, 17:00 HRS
2	Last Date of Queries, if any	13.05.2019, 15:00 HRS
3	Pre-Bid Meeting	13.05.2019, 15:00 HRS
4	Last Date of Receipt of Bid Documents	23.05.2019, 14:30 HRS
5	Date & Time of Opening of PART A - Technical and Commercial Bid	23.05.2019, 15:30 HRS

NOTE: In case last date of submission of bids & date of opening of bids is declared as holiday in BYPL office, the last date of submission will be following working day at the same time.

This is a two part bid process. Bidders are to submit the bids in 2(Two) parts

Both these parts should be furnished in separate sealed covers super scribing NIT no. DUE DATE OF SUBMISSION, with particulars as **PART-A TECHNICAL BID & COMMERCIAL TERMS & CONDITIONS** and **Part-B FINANCIAL BID** and these sealed envelopes should again be placed in another sealed cover which shall be submitted before the due date & time specified.

Part – A:: Technical Bid should not contain any cost information whatsoever and shall be submitted within the due date**.**

PART B:: This envelope will be opened internally after techno-commercial evaluation and only of the qualified bidders.

REVERSE AUCTION CLAUSE :: Purchaser reserves the right to use reverse auction as optional tool through SAP – SRM as an integral part of the entire tendering process. All the bidders who are techno-commercially qualified on the basis of tender requirements shall participate in reverse auction.

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.

BIDS RECEIVED AFTER DUE DATE AND TIME MAY BE LIABLE TO REJECTION

BSES Yamuna Power Limited

4.00 **Award Decision**

4.01 Purchaser intends to award the business on a lowest bid basis, so suppliers are encouraged to submit the bid competitively. The decision to place purchase order/LOI 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.

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

4.03 In the event of your bid being selected by purchaser (and / or its affiliates) and you 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 NIT/RFQ.

4.04 In case any bidder is found unsatisfactory during the Project execution, the award will be cancelled and BYPL reserves the right to award other bidders who are found fit.

4.05 Bidders are requested to quote their lowest No-Regret prices since BYPL would not prefer to negotiate the price further.

5.00 **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/NIT.

6.00 **Supplier Confidentiality**

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

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

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

7.0 **Contact Information**

Technical clarification, if any, as regards this RFQ shall be sought in writing and sent by post/courier to following address. The same shall not be communicated through phone

	Technical	**Commercial**
Contact Person	Mr Ashwani Aggarwal Copy to : Mr. Rakesh Bansal	Mr Rakesh Bansal & Rajesh Srivastava
Address	BSES Yamuna Power Ltd , 3rd floor, B Block, Shaktikiran Building, Karkardooma, Delhi 110032	C&M Deptt. 3rd Floor , A-Block, BSES Yamuna Power Ltd Shaktikiran Building, Karkardooma, Delhi 110032
E-Mail ID	ashwani.aggarwal@relianceada.com	rakesh.bansal@relianceada.com rajesh.r.srivastava@relianceada.com

BSES Yamuna Power Limited

SECTION – II: INSTRUCTION TO BIDDERS

A. GENERAL

1.00 BSES Yamuna 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 material notified earlier in this bid document.

2.00 **SCOPE OF WORK**

2.01 The scope shall include design, engineering, civil works, supply, erection, testing, & commissioning of new 33/11kv gis & power transformer along with allied equipments and works of system upgradation on turnkey basis at motia khan grid substation, new delhi for bypl, delhi (india)

3.0 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 anyway 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 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 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:

(a) Request for Quotation (RFQ) - Section - I
(b) Instructions to Bidders (ITB) - Section - II
(c) Terms & Conditions of SUPPLY (T&C) - Section -III
(d) Price Format - Supply - Section IV
(e) Summary T&C - Supply - Section V
(f) Bid Form - Section VI
(g) Acceptance Form RA - Section VII
(h) EMD BG Format - Section VIII
(i) Terms & Conditions of SERVICES (T&C) - Section –IX
(j) Price Format – ETC - Section –X
(k) GRAND SUMMARY OF THE QUOTED PRICE- Section –XI
(l) Vendor Code of Conduct - Section –XII
(m) Appendix
(n) Technical Specifications (TS) - Section –XIII

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.

6.0 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 web site **www.bsesdelhi.com** and the same 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. The same shall be published as a corrigendum in website **www.bsesdelhi.com**

6.04 Purchaser shall reserve the rights to following:
a) extend due date of submission,
b) modify tender document in part/whole,
c) cancel the entire tender

6.05 **Bidders are requested to visit website regularly for any modification/clarification/corrigendum/addendum of the bid documents.**

C. PREPARATION OF BIDS

7.0 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.

8.0 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 Technical Specification.

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

(c) Tender documents duly stamped and signed on each page by authorized signatory.

8.0 **BID FORM**

8.01 The Bidder shall submit one "Original", "Copy- 1", of the Bid Form, Supporting Documents & Technical Data Sheets duly filled in as per attached specification/BOM etc enclosed.

9.0 **EMD**

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

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

(a) Bank Guarantee drawn in favour of BSES Yamuna Power Ltd, payable at Delhi.

(b) EMD shall be valid for One Hundred Fifty (150) days after due date of submission drawn in favour of BSES Yamuna Power Ltd

The EMD may be forfeited in case of:

(a) the Bidder withdraws its bid during the period of specified bid validity

or

(b) the case of a successful Bidder, if the Bidder does not

(i) accept the Purchase Order, or

(ii) furnish the required contract performance BG.

10.0 **BID PRICES**

10.01 Bidders shall quote for the entire Scope of Supply/Work with a break-up of prices for individual items and Taxes & Duties. 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 with taxes, duties & freight upto destination.

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.

10.03 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/**

Price Variation Clause will be treated as non-responsive and rejected.

10.04 The qty break-up shown else-where in Price Schedule is tentative. The bidder shall ascertain himself regarding material required for completeness of the entire work. Any item not indicated but is required to complete the job, shall be deemed to be included in the prices quoted.

11.0 BID CURRENCIES

11.01 Prices shall be quoted in Indian Rupees Only.

12.0 PERIOD OF VALIDITY OF BIDS

12.01 Bids shall remain valid for 150 days from the due date of submission of the Bid.

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 and sent by post/courier/e-mail.

13.0 ALTERNATIVE BIDS

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

14.0 FORMAT AND SIGNING OF BID

14.01 The original Bid Form and accompanying documents, clearly marked "Original Bid" plus copy1, must be received by the Purchaser at the date, time and place specified pursuant to Clauses 15.0 and 16.0. In the event of any discrepancy between the original and the copies, the original shall govern.

14.02 The original and copies 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.

15.0 SEALING AND MARKING OF BIDS

15.01 Bid submission: One original, & copy1 (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 price bid shall be inside another sealed envelope with superscribed "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, & copy1. The envelopes should be superscribed with —"Tender Notice No. & Due date of opening".

15.03 The Bidder has the option of sending the Bids in person. Bids submitted by Email/Telex/Telegram /Fax will be rejected. No request from any Bidder to the Purchaser to collect the proposals from Courier/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 earlier.

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

17.0 **ONE BID PER BIDDER**

Each Bidder shall submit only one Bid by itself. No Joint venture is acceptable. A Bidder who submits or participates in more than one Bid will cause all those Bids to be rejected.

18.0 **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 may be rejected and returned unopened to the Bidder.

19.0 **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

20.0 **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.

21.0 **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.

22.0 **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. Purchaser may ask for submission of original documents in order to verify the documents submitted in support of qualification criteria.

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 & qualifying 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) Delivery Schedule

(b) Conformance to Qualifying Criteria

(c) 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 adjustments in price, which result from the above procedures, 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 If any Bidder wishes to contact the Purchaser on any matter related to the Bid, from the

time of Bid opening to the time of contract award, the same shall be done in writing only.

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 to award 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 to other bidders in the tender, provided it is required for timely execution of project & provided he agrees to come to the lowest rate.

Though the contract is for Turnkey in nature, the Purchaser intends to issue 2 (two) separate Purchase/Works Orders viz.

a) Purchase Order for Supply Portion.
b) Work Order for Installation, Testing & Commissioning.
c) Work Order for Civil Works.

All individual contracts will contain cross fall breach clause (i.e., a breach of one will constitute breach of the others)

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 with in 7 days of issue of the letter of intent /Notification of Award by Purchaser. The date of LOI/LOA shall be treated as Start date of Project.

29.0 CONTRACT PERFORMANCE BANK GAURANTEE

Within 15 days of the receipt of Notification of Award/ Letter of Intent/PO from the Purchaser, the successful Bidder shall furnish Contract Performance Bank Guarantee towards faithful performance of Contract for an amount of 10% (Ten percent) of the Contract Price. The Performance Bond shall be valid upto completion period/handing over, whichever is earlier plus 3 months claim period. Upon submission of the performance security, the EMD shall be released. 03 (three) nos. separate CPBG's shall be submitted against Supply, ETC & Civil Contract.

BSES Yamuna Power Limited

30.0 **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 for award 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 Terms and Conditions of Contract.

31.0 **COMPLETION PERIOD (PROJECT)**

31.01 10 months from the date of issuance of LOI/PO's.

BSES Yamuna Power Limited

SPECIAL TERMS AND CONDITIONS OF CONTRACT

1.01 Bidders are requested to visit the site to understand the scope of work, site conditions and requirements prior to Bidding. Hence, no price/time escalation shall be admissible on these accounts.

1.02 As this is the Turnkey Project, so additional cost will not be paid to successful bidders even if the size and quantity of cables or other minor material mentioned in BOM changed as per the site requirements.

1.03 Statutory variation will be allowed for direct supplies only wherever breakup of Taxes & Duties are available in Price Bid.

1.04 Bidder has to submit the technical parameters with details of Spares for each rating with catalogue, reference codes etc.

1.05 Bidder has to submit the item wise price bifurcation in bid. Unprice copy must be attached with the Part A. Reverse Auction will be carried out on Lump sum Basis/Total Landed Cost i.e. Supply + ETC + Civil Works.

1.06 Successful bidder has to compliance the statutory compliance.

1.07 In case of any major deviation, deletion or addition which bidder may feel is relevant to this project & for its safe operation and completion of works; Bidder may clearly highlight and communicate the same to the purchaser with his bid.

1.08 Necessary Statutory Clearances & any other authority for energizing the substation shall be in the scope of this tender. However, any statutory fees shall be borne by BYPL on production of documentary evidence.

1.09 Problem Troubleshooting & Restoration In Warranty Period For A Particular Equipment:

a) Service Engineer Availability to Attend, Identify & Restore Defects (Minor) Of Grid Equipments under Guarantee Period within 48 Working Hours (Exclusion of Material Support Cases)

b) Spare Material Delivery For Restoration Of Grid Equipment (Major Defect) Under Guarantee Period Within Two Weeks. Seller must keep Requisite Inventory of Critical Switchgear Spares & Other Equipment's Covered in Guarantee Period to Restore Equipment within Two Weeks.

c) In Case Of Complete Replacement of Equipment, Complete Equipment to Be Replaced Within a Period Of 4 Weeks.

1.10 PROJECT INFORMATION & COMPLETION

The contractor shall be fully responsible to complete the project in time. It is desired that the total project should complete in 180 days from the date of LOI or purchase order whichever is earlier. The detail completion schedule shall be prepared by vendor and shall be submitted at the time of detailed engineering for approval. Vendor has to submit the progress report fortnightly in the format attached with this tender/as asked by the Purchaser.

1.11 PROJECT IMPLEMETATION & EXECUTION CONTROL

The bidders are requested to submit the following along with the bid, about the project implementation & execution methodology.

a) Write up/overview of project Plan

b) Implementation Methodology

The successful Bidder shall be required to prepare detailed Network(s) and project implementation plans & programmes and finalize the same with the Employer as per requirement specified in Technical Specifications, which shall form a part of the Contract.

BSES Yamuna Power Limited

SECTION III

GENERAL TERMS AND CONDITIONS – SUPPLY

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 BSES Yamuna Power 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 BYPL in accordance with the specification.

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

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

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.

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 elsewhere.

4.03 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 to proceed with the work past a hold point only after clearance by purchaser or a witness waiver letter from BYPL.

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 only be dispatched after receipt of dispatch instructions issued by the Purchaser.

5.05 All in-house testing and inspection shall be done with out any extra cost. The in-house inspection shall be carried out in presence of BSES/BSES authorized third party inspection agency. Cost of Futile/abortive visit(s) shall be debited from the invoices

5.06 Purchaser reserves the right to send any material being supplied to any recognized laboratory for testing, wherever necessary and the cost of testing shall be borne by the Bidder. 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 bidder's representative.

6.0 Packing, Packing List & Marking

6.01 **Packing:** Supplier shall pack or shall cause to be packed all Commodities in crates/boxes/drums/containers/cartons and otherwise in such a manner as shall be reasonably suitable for shipment by road or rail to BYPL, Delhi/New Delhi stores/site 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, extreme outside dimensions (length, width & weight) of each container/box/drum/carton, Item SAP Code, PO No & date. One copy of the packing list shall be enclosed in each package delivered.

7.01 Price basis for supply of materials

a) Bidder to quote their prices on Landed Cost Basis and separate price for each items. FIRM prices for supply to BYPL Delhi/New Delhi stores inclusive of packing, forwarding, loading at manufacturer's premises, payment of GST, Freight, Custom Duty, any other local charges. Octroi is presently not applicable in Delhi and however if applicable shall be reimbursed at actual**.**

b) The above supply prices shall also include unloading at BYPL Delhi/New Delhi stores/site.

8.0 Terms of payment and billing – SUPPLY

a) 5% of the total supply contract price shall be paid as initial interest free advance on fulfillment against 1) acceptance of LOI/PO, 2) submission of BG of equivalent amount valid upto completion period/handing over, whichever is earlier plus 3 months claim period and 3) Submission of Contract Performance Bank Guarantee of 10% of the contract price valid upto completion period/handing over, whichever is earlier plus 3 months claim period. In case of delay, the BG shall be extended suitably. The advance shall be adjusted against R/Bills.

b) 10% of the total supply contract price shall be paid as interest free advance against submission of BG of equivalent amount valid upto completion period/handing over, whichever is earlier plus 3 months claim period, approval of drawings under Category-1 of major drawings (shall be mutually agreed at the time of award), Quality Plans, Pert Chart, Network Diagram, Field Quality Plan, posting of project Manager and commencement of the first mile stone of the work mutually agreed. In case of delay, the BG shall be extended suitably. The advance shall be adjusted against R/Bills.

c) 60% prorata of supply value shall be payable against R/A bills for supply of equipment and material within 30 days against receipt & acceptance of material at site and submission of following documents against dispatch of each consignment at our Vendor Support Cell (VSC) duly certified by BYPL Project-in-charge:

I. Consignee copy of LR.
II. Detailed invoice showing commodity description, qty, unit & total price.
III. Original certificate issued by BYPL confirming receipt of material at site & acceptance.
IV. Dispatch clearance & inspection report issued by the inspection authority.
V. Packing List, Test Reports.
VI. Guarantee Certificate.
VII. Performance Bank Guarantee equivalent to 10% of Supply value of the Contract valid upto Defect Liability period plus 3 months Claim period.

d) 10% prorata on account of supply value of the actual executed value after completion of installation/erection of equipment duly certified by BYPL Project-in-charge.

e) Balance 15% on account of supply value of the actual executed value shall be paid in 30 days after completion of successful acceptance testing, commissioning and handing over of complete systems duly certified by BYPL Engineer-in-Charge specified in the tender and on submission of performance Bank Guarantee of 10% amount, in our format valid up to a defect liability period for 36 months from the date of handing over of the scheme including submission of Electrical Inspector Clearance Certificate, Compliance of final punch point, No Demand Certificate, Letter of Indemnity by the supplier (The format of No Demand Certificate and Letter of Indemnity are attached as Annexure) and after reconciliation & adjustments of payments, if any towards quantities of materials issued from purchaser's stock and consumed by the contractor for expeditious completion of the job.

8.02 Purchaser has the right to recover tax loss, interest and penalty suffered due to any non-compliance of tax laws by the Vendor. In the event, Purchaser is not able to avail any tax credit due to any short coming on the part of the Vendor (which otherwise should have been available to Purchaser in the normal course), then the Vendor at his own cost and effort will get the short coming rectified. If for any reason the same is not possible, then the Vendor will make 'good' the loss suffered by Purchaser due to the tax credit it lost . In such event, any amount paid to the Vendors shall be first attributable to the tax (GST) charged in the invoice and the balance shall be considered towards the 'value' of supply of goods/ services.

8.03 Purchaser shall deduct "Tax Deducted at Source" wherever applicable and at the rate prescribed under the GST Laws or any other Indian law and remit the same to the Government. Necessary TDS certificates as per law shall be issued by the purchase to the vendor.

8.04 Any liability arising out of dispute on the tax rate, classification under HSN, calculation and payment of tax to the Government will be to the Vendor's account.

8.05 Where the supply of Goods are liable to GST under reverse charge mechanism, then the supplier should clearly mention the category under which it has been registered and also that "the liability of payment of GST is on the Recipient of Supply".

9.0 Price Validity

9.01 All bids submitted shall remain valid, firm and subject to unconditional acceptance by BYPL Delhi for 150 days from the due date of submission. For awarded suppliers/contractors, the prices shall remain valid and firm till contract completion.

10.0 Performance Guarantee

10.01 Bank guarantee shall be drawn in favour of BSES Yamuna Power Ltd as applicable. The performance Bank guarantee shall be in the format as specified by BYPL.

11.0 Forfeiture

11.01 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 BYPL of this Performance Bond, to the relevant bank referred to above, together with a simple statement that supplier has failed to comply with any term or condition set forth in the Contract.

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

12.0 Release

12.01 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 Clause10.0) except for the case set forth in Clause 21.0.

13.0 Warranty/Defects Liability Period

13.01 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 36 months from the date of handing over of entire Installation. 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.

14.0 Return, Replacement or Substitution.

14.01 BYPL shall give Supplier notice of any defective Commodity promptly after becoming aware thereof. BYPL may in its discretion elect to return defective Commodities to Supplier for replacement, free of charge to BYPL, or may reject such Commodities and

purchase the same or similar Commodities from any third party. In the latter case BYPL 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. BYPL may set off such costs against any amounts payable by BYPL to Supplier. Supplier shall reimburse BYPL for the amount, if any, by which the price of a substitute Commodity exceeds the price for such Commodity as quoted in the Bid.

15.0 Effective Date of Commencement of Contract:

15.01 The date of the issuance of the Letter of Acceptance/Purchase Order shall be treated as the effective date of the commencement of Contract.

16.0 Time – The Essence of Contract

16.01 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.

17.0 The Laws and Jurisdiction of Contract:

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

17.02 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 Delhi in India.

18.0 Events of Default

18.01 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 BYPL.

19.0 Consequences of Default.

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

(b) In the event of an Event of Default, BYPL 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 BYPL may incur as a result of Supplier's default.

20.0 Liquidated Damages

20.01 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 basic (ex-works) price of the contract for every week delay or part thereof delay until the actual date of completion.

20.02 The total amount for delay under the contract will be subject to a maximum of Ten percent (10%) of the basic (ex-works) price.

20.03 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.

21.0 Statutory variation in Taxes and Duties

21.1 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.

21.2 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.

21.3 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.

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

21.5 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.

21.6 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.

22.0 Force Majeure

22.01 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 event 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.

22.02 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 :

(i) The following events and circumstances:

a) Effect of any natural element or other acts of God, including but not limited to storm, flood, earthquake, lightning, cyclone, landslides or other natural disasters.

b) Explosions or fires

(ii) War declared by the Government of India, provided that the ports at Mumbai are declared as a war zone.

(iii) Dangers of navigation, perils of the sea.

22.03 Notice of Events of Force Majeure If a force majeure event prevents a party from performing any obligations under the Contract in part or in full, that party shall:

i) Immediately notify the other party in writing of the force majeure events within 7(seven) working days of the occurrence of the force majeure event

ii) Be entitled to suspend performance of the obligation under the Contract which is affected by force majeure event for the duration of the force majeure event.

iii) Use all reasonable efforts to resume full performance of the obligation as soon as practicable

iv) Keep the other party informed of all such efforts to resume full performance of the obligation on a regular basis.

v) Provide prompt notice of the resumption of full performance or obligation to the other party.

22.04 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.

22.05 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.

22.06 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.

22.07 The Purchaser may terminate the contract after giving 15 (Fifteen) days notice if any of following occurs:

a) Contractor fails to complete execution of works within the approved schedule of works, terms and conditions.
b) In case the contractor commits any Act of Insolvency, or adjudged insolvent.
c) Has abandoned the contract.
d) Has failed to commence work or has suspended the progress of works.
e) Has failed to proceed the works with due diligence and failed to make such due progress.

22.08 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.

22.09 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.

22.10 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."

23.0 Transfer and Sub-Letting

23.01 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.

24.0 Recoveries

24.01 When ever 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.

25.0 Waiver

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

26.0 Indemnification

26.01 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.

27.01 DOCUMENTATION

The Bidder shall procure all equipment from BYPL approved sources as per attached specifications. The Bidder's shall submit 5 copies of Material/Type Test Certificates, O&M Manuals, and Approved & As-built drawings, related to various equipment. The Bidder's shall ensure for the strict compliance to the specifications and Field Quality Procedures issued by BYPL Engineer in-charge.

27.0 Limitation of Liability

Except as provided otherwise in the Contract and except for willful misconduct or gross negligence, neither Party shall be liable to the other Party for loss of use of any Works, loss of profit, loss of any contract or any other indirect or consequential loss or damage which may be suffered by the other Party in connection with the Contract. The total liability of the Contractor to the Purchaser under the Contract shall not exceed the Contract Value. Except that this Clause shall not limit the liability of the Contractor:

(a) Under any other provisions of the Contract which expressly impose a greater liability,

(b) In cases of fraud, willful misconduct or illegal or unlawful acts, or

(c) In cases of acts or omissions of the Contractor which are contrary to the most elementary rules of diligence which a conscientious Contractor would have followed in similar circumstances.

28.0 Liability of Contractors

28.1 Subject to the due discharge of its obligations under the Contract and except in case of gross negligence or willful misconduct on the part of the Contractor or on the part of any

person acting on behalf of the Contractor, with respect to any loss or damage caused by the Contractor to the Purchaser's property or the Site, the Contractor shall not be liable to the Purchaser for the following:

(a) For any indirect or consequential loss or damage; and

(b) For any direct loss or damage that exceeds:

(i) The total payments made and expected to be made to the Contractor under the Contract including reimbursements, if any; or

(ii) The insurance claim proceeds which the Contractor may be entitled to receive from any insurance purchased by the Contractor to cover such a liability, whichever is higher.

28.2 This limitation of liability shall not affect the Contractor's liability, if any, for damage to any third party, caused by the Contractor or any Person or firm acting on behalf of the Contractor in executing the Works.

28.3 Notwithstanding anything contained in the Contract, the Contractor shall not be liable for any gross negligence or willful misconduct on the part of the Purchaser or any of its affiliates, any vendor, or any party, other than Contractor and/or, its directors, officers, agents or representatives or its affiliates, or Subcontractor, or the vendor or any third party engaged by it.

28.4 Notwithstanding anything contained in the Contract, including but not limited to approval by the Purchaser of any drawings, documents, vendor list, supply of information or data or the participation of the Purchaser in any meeting and/or discussion or otherwise, shall not absolve the Contractor from any of its liabilities or responsibilities arising in relation to or under the Contract.

29.0 Intellectual Property Rights and Royalties

29.1 The Contractor shall indemnify the Purchaser and the Purchaser's Representative from and against all claims and proceedings on account of infringement (or alleged infringement) of any patent rights, registered designs, copyright, design, trademark, trade name, know-how or other intellectual property rights (hereinafter collectively referred to as "**Intellectual Property Rights**") in respect of the Works, Contractor's Equipment, machines, Works method, Plant, Materials, or anything whatsoever required for the execution of the Works and from and against all claims, demands, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto. In the event of infringement of any Intellectual Property Rights of any third party as a result of the execution of the Works (or any part thereof) by the Contractor, the Contractor shall rectify, modify or replace, at its own cost, the Works, Plant or Materials or anything whatsoever required for the Works so that infringement ceases to exist or, in the alternative, the Contractor shall procure necessary rights/ licenses from the affected third party so that there is no infringement of Intellectual Property Rights.

29.2 The Contractor shall be promptly notified of any claim made against the Purchaser. The Contractor shall, at its cost, conduct negotiations for the settlement of such claim, and any litigation or arbitration that may arise from it. The Purchaser or the Purchaser's Representative shall not make any admission which might be prejudicial to the Contractor, unless the Contractor has failed to take over the conduct of the negotiations, litigation or arbitration within a reasonable time after having been so requested. In the event of Contractor failing to act at the Purchaser's Representative's notice, the Purchaser shall be at full liberty to deduct any such amount of pending claim from any amount due to the Contractor under the Contract or any other contract and the balance portion of claim shall be treated as debt due from the Contractor.

29.3 All Intellectual Property Rights in respect of any Plant, Materials, Drawings and Designs, plans, documents, specifications, data, materials, know how, charts, information, etc., provided to the Contractor by the Purchaser pursuant to this Contract for the execution of the Works, belongs to and shall continue to belong to the Purchaser and the Contractor shall not have any rights in the same other than the limited right for its use for the purpose of execution of the Works.

29.4 Intellectual Property Rights in respect of any Plant, Materials, Drawings and Designs, plans, calculations, drawings, documents, know-how and information relating to the Works which are proprietary to the Contractor and/ or its third party licensors ("**Contractor's IPR**") shall continue to vest with the Contractor and/ or its third party licensors and the Contractor shall grant and/ or procure from its third party licensors, at its own cost, a worldwide, perpetual, royalty free, non-exclusive license (along with the right to sub-license) to use and reproduce such Contractor's IPR for the use, operation, maintenance and repair of the Works.

29.5 If any patent, trademark, trade name, registered design or software is developed by the Contractor or its Subcontractor specifically for the execution of the Works, then all Intellectual Property Rights in respect of such design, trademark, trade name or software shall be the absolute property of the Purchaser and shall not be utilized or retained by the Contractor (or its Subcontractors) for any purpose other than with the prior written consent of the Purchaser.

29.6 If the Contractor uses proprietary software (whether customized or off the shelf) for the purpose of storing or utilizing records in relation to the Works, the Contractor shall obtain at its own expense, the grant of a worldwide, royalty-free, perpetual licence or sublicence (including the right to sublicense) to use such software, in favour of the Purchaser provided that the use of such software under the licence or the sublicense may be restricted to use any such software only for the design, construction, reconstruction, manufacture, installation, completion, reinstatement, extension, repair and operation of the Works or any part thereof.

29.7 If any software is used by the Contractor for the execution of the Works over which the Contractor or a third party holds pre-existing title or other rights, the Contractor shall obtain for the Purchaser, a worldwide, royalty free, perpetual license for the right to use and apply that software (together with any modifications, improvements and developments thereof).

30.01 Commissioning Spares

30.01 Commissioning Spares shall be deemed to be included in the quoted prices.

31.0 Tax Indemnity Clause:

31.1 Vendor (along with its affiliates in India or overseas including any agent/ third party contractor or any other person appointed by such affiliates for the purpose of this agreement) agrees that it will be solely responsible for performing all compliances and making payments of all taxes (direct tax or indirect tax including but not limited to income-tax, transfer pricing, value added tax, SGST, CGST, IGST, UTGST, GST Compensation Cess custom duty, excise duty, Research and Development Cess, etc.), cesses, interest, penalties or any other tax/ duty/ amount/ charge/ liability arising either out of laws/ regulations applicable in India and overseas or because of a demand/ recovery initiated by any revenue authority under laws/ regulations applicable in India or overseas.

31.2 In case any tax liability (including but not limited to income-tax, transfer pricing, value added tax, SGST, CGST, IGST, UTGST, GST Compensation Cess custom duty, excise duty, Research and Development Cess, etc.), cesses, interest, penalties or any other tax/

duty/ amount/ charge/ liability becomes payable by Purchaser due to failure of the Vendor, or any of its affiliates in India or overseas including any agent/ third party contractor or any other person appointed by such affiliates for the purpose of this agreement, to comply with the relevant laws/ regulations applicable in India or overseas, Vendor undertakes to indemnify Purchaser for an amount equal to amount payable by Purchaser.

31.3 Further, Vendor undertakes to keep Purchaser indemnified at all times against and from all other actions, proceedings, claims, loss, damage, costs and expenses which may be brought against Purchaser or suffered or incurred by Purchaser and which shall have arisen either directly or indirectly out of or in connection with failure of The Vendor, or any of its affiliates in India or overseas including any agent/ third party contractor or any other person appointed by such affiliates for the purpose of this agreement, to comply with relevant obligations/ compliance under any law/ regulations applicable in India and overseas.

31.4 The parties agree to follow the following process in case any communication of demand, arising out non-compliance by Vendor (along with its affiliates in India or overseas including any agent/ third party contractor or any other person appointed by such affiliates for the purpose of this agreement), is received by Purchaser :

31.4.1 On Purchaser receiving any communication from a competent authority demanding tax liability (including but not limited to income-tax, transfer pricing, value added tax, SGST, CGST, IGST, UTGST, GST Compensation Cess custom duty, excise duty, Research and Development Cess, etc.), cesses, interest, penalties or any other tax/ duty/ amount/ charge/ liability, Purchaser shall, within 5 common working days from the date of receipt of such communication (save where the period to respond to the relevant authority is less than five days, in which case, as soon as reasonably possible) inform Vendor in writing of such communication.

31.4.2 Pursuant to receiving communication from Purchaser, Vendor shall suggest to accept the communication and pay the demand amount to the competent authority. In such an event, Vendor shall reimburse such amount paid to Purchaser within 5 working days from the date of payment by Purchaser to the competent authority.

31.4.3 If Vendor advises in writing and Purchaser agrees to dispute the demand, then Purchaser shall dispute the matter with competent authority as per due process prescribed under the regulations and Purchaser shall not pay the Tax Demand. In such scenario, cost of litigation including but not limited to Counsel cost, filing fees, other related charges, should be reimbursed by Vendor to Purchaser. Additionally, If any coercive steps of recovery are initiated by the department, then Purchaser would pay such amount (including by way of adjustment of refunds due to it) and the same would be reimbursed by Vendor within 5 working days from date of such recovery from Purchaser. Purchaser will take all necessary steps to avoid such recovery measures.

31.4.4 On determination of the demand through an Order issued by a Tribunal or any other similar Authority, by whatever name called, under any law applicable in India or overseas, if the demand or any part thereof becomes payable and is paid by Purchaser, then Vendor undertakes to reimburse such amount to Purchaser within 10 days from the date of payment. Alternatively, if on determination of the demand through an Order, no amount is payable by Purchaser then any refund arising to Purchaser due to such an Order shall be passed on to Vendor within 10 days from the date of receipt of refund.

32.0 TRANSIT INSURANCE:

32.1 Transit Insurance shall be arranged by the Bidder.

32.2 DAMAGE / LOSS OF CARGO IN TRANSIT: Vendor shall be solely responsible for coordinating with the concerned insurance company for procuring insurance for material and/or Goods, processing claim lodgment and settlement. Notwithstanding the insurance

cover, in case of loss / damage to material and/or Goods, in any manner and for any cause whatsoever, Vendor shall cause the damaged cargo to be replaced and delivered to the Purchaser with new material and/or Goods within 30 days of such loss / damage. The Vendor shall be solely responsible for all expenses in relation to the replacement and delivery in such circumstances.

33.0 Acceptance:

33.1 Vendor confirms to have gone through the Policy of BYPL on legal and ethical code required to be followed by vendors encapsulated in the "Vendor Code of Conduct" displayed on the official website of BYPL (www.bsesdelhi.com) also, which shall be treated as a part of the contract/PO/WO.
Vendor undertakes that he shall adhere to the Vendor code of Conduct and also agrees that any violation of the Vendor Code of Conduct shall be treated as breach of the contract/PO/WO.
In event of any such breach, irrespective of whether it causes any loss/damage, Purchaser (BYPL) shall have the right to recover loss/damage from Vendor.
The Contractor/Vendor herby indemnifies and agrees to keep indemnified the Purchaser (BYPL) against any claim/litigation arising out of any violation of Vendor Code of Conduct by the Contractor/Vendor or its officers, agents & representatives etc.

33.2 Acceptance of the CONTRACT implies and includes acceptance of all terms and conditions enumerated in the CONTRACT in the technical specification and drawings made available to Contractor consisting of general conditions, detailed scope of work, detailed technical specification, detailed equipment drawing and complete scope of work.

33.3 Contractor and Company contractual obligation are strictly limited to the terms set out in the CONTRACT. No amendments to the concluded CONTRACT shall be binding unless agreed to in writing for such amendment by both the parties

BSES Yamuna Power Limited

SECTION IV

PRICE FORMAT – SUPPLY (A) (Items shown are indicative, Kindly refer BOQ, attached as Annexure)

DESCRIPTION OF GOODS	HSN CODE	QTY	UoM	UNIT RATE	UNIT FREIGHT	UNIT GST & CESS AS APPLICABLE (CGST & SGST/UTGST or IGST)		UNIT LANDED COST (₹)	TOTAL LANDED COST (₹)
						%	AMT		
Items as per BOQ i.e. shall be utilized to furnish price break-up.									
GRAND TOTAL LANDED COST									
In words ……									

NOTE:

1) Bidder shall include & indicate any others taxes under the applicable law(s) for supply and services to be performed in the purchaser's country.
2) The bidder shall, at its own, handle all imported equipment's and handle all formalities for custom clearances, port charges, etc if any.
3) Item-wise breakup of Recommended Spares for 5 years to be indicated as below.
4) All Tools & Tackles, Consumables and Commissioning Spares required to complete the work shall be included in the quoted rates.
5) Any other items not mentioned above but are required for successful completion of the substation shall be deemed to be included in the above quoted rates.

BSES Yamuna Power Limited

SECTION V

SUMMARY COMMERCIAL TERMS AND CONDITIONS – SUPPLY

Sl No	ITEM DESCRIPTION	AS PER BYPL	BIDDER'S CONFIRMATION
1	Validity	150 days from the due date of submission	
2	Price basis	a) Firm, FOR Delhi store basis. Prices shall be inclusive of all taxes & duties, freight upto Delhi stores. b) Unloading at site stores - in vendor's scope c) Transit insurance in Bidders scope	
3	Payment terms	As per Clause 8.0 of Part I, Page 18	
4	Completion time	10 months from date of LOI/PO	
5	Defect Liability period	36 months from the date of Handing over of entire Installation.	
6	Liquidated damages	1% of basic price for every week delay subject to maximum of 10% of basic PO value	
7	Contract Performance Bank Guarantee	10% (Ten percent) of the Contract Price valid upto completion period/handing over	
8	Performance Bank Guarantee	10% (Ten percent) of the Contract Price valid upto Defect Liability Period plus 3 months towards claim period	

Bidder should furnish the below details for future communication:-

General Information
Full Name of the Company:
Postal Address:
GSTIN:

For Technical Clarification(s)
Name:
Designation:
E-Mail:
Mobile No.:
Telephone No.:

For Commercial Clarification(s) / Reverse Auction
Name:
Designation:
E-Mail:
Mobile No.:
Telephone No.:

BSES Yamuna Power Limited

SECTION VI

BID FORM

To

Head of Department
Contracts & Material Deptt.
BSES Yamuna Power Ltd
Shaktikiran Building, Karkardooma,
Delhi 110032

Sir,

1 We understand that BYPL is desirous of procuring…….. for it's licensed distribution network area in Delhi

2 Having examined the Bidding Documents for the above named works, we the undersigned, offer to deliver the goods in full conformity with the Terms and Conditions and technical specifications for the sum indicated in Price Bid or such other sums as may be determined in accordance with the terms and conditions of the contract .The amounts are in accordance with the Price Schedules attached herewith and are made part of this bid.

3 If our Bid is accepted, we under take to deliver the entire goods as) as per delivery schedule mentioned in Section IV from the date of award of purchase order/letter of intent.

4 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 Terms and Conditions.

5 We agree to abide by this Bid for a period of 150 days from the due date of bid submission and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

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

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

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

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

Dated this..... day of..... 20.....

Signature..... In the capacity of ……

.....duly authorized to sign for and on behalf of

(IN BLOCK CAPITALS) .....

SECTION VII

BSES Yamuna Power Limited

ACCEPTANCE FORM FOR PARTICIPATION IN REVERSE AUCTION EVENT

(To be signed and stamped by the bidder)

BSES Yamuna Power Ltd (hereinafter referred to as **"BYPL"**) intends to use the reverse auction through SAP-SRM tool as an integral part of the entire tendering process. All the bidders who are found as techno commercial qualified based on the tender requirements shall be eligible to participate in the reverse auction event.

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

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

Signature & seal of the Bidder

BSES Yamuna Power Limited

SECTION VIII

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*] (herein after called the "Bidder") has submitted its bid dated[*date of submission of bid*] for the supply of [*name and/or description of the goods*] (here after 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 Yamuna Power Ltd., with it's Corporate Office at Shaktikiran Building, Karkardooma, Delhi -110032, (herein after called —the "Purchaser")in the sum of Rs…… (Rupees…… only) 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____.

TH E CONDITIONS of this obligation are:

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

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

(a) fails or refuses to execute the Contract Form ,if required; or

(b) fails or refuses to furnish the performance security, In accordance with the Instructions to Bidders/ Terms and 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 condition(s), specifying the occurred condition or condition(s).

This guarantee will remain in force up to and including One Fifty (150) days after the due date of submission bid, and any demand in respect thereof should reach the Bank not later than the above date.

(Stamp & signature of the bank)

Signature of the witness

BSES Yamuna Power Limited

LITIGATION HISTORY

Year	Name of client	Details of contract & date	Cause of Litigation/arbitration and dispute	Disputed amount

CURRENT CONTRACT COMMITMENTS/ WORK IN PROGRESS

Year	Name of client	Details of contract & date	Value of outstanding work	Estimated completion date

FINANCIAL DATA

(Duly Certified by Chartered Accountant)

	Actual in previous 5 financial years				
	FY 15-16	FY 14-15	FY 13-14	FY 12-13	FY 11-12
Total assets					
Current assets					
Total Liability					
Current Liability					
Profit before taxes					
Profit after taxes					

BSES Yamuna Power Limited

CHECK LIST

Sr No	Description	Compliance
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	DOCUMENTS IN SUPPORT OF QUALIFICATION CRITERIA	YES/NO
6	TECHNICAL BID	YES/NO
7	ACCEPTANCE TO COMMERCIAL TERMS AND CONDITIONS	YES/NO
8	FINANCIAL BID (IN SEALED ENVELOPE)	YES/NO
9	EMD IN PRESCRIBED FORMAT	YES/NO
10	DEMAND DRAFT OF RS 1000/- DRAWN IN FAVOUR OF BSES YAMUNA POWER LTD	YES/NO
11	POWER OF ATTORNEY/AUTHORISATION LETTER FOR SIGNING THE BID	YES/NO
12	FINANCIAL DATA IN TABULAR FORMAT	YES/NO
13	LIST OF CURRENT COMMITMENTS/WORK IN PROGRESS	YES/NO
14	BANK SOLVENCY CERTIFICATE	YES/NO
15	NO LITIGATION CERTIFICATE	YES/NO

BSES Yamuna Power Limited

SECTION IX

GENERAL TERMS & CONDITIONS - SERVICES

1. DEFINITIONS and INTERPRETATION

The following terms shall have the following meanings:

1.1 "Company/Employer": means BSES Yamuna Power Ltd, a company incorporated under the Companies Act 1956 and having its office at BSES Yamuna Power Limited having its office at Shaktikiran Building, Karkardooma, Delhi -110032, which expression shall include its authorized representatives, agents, successors and assigns.

1.2 "Contractor": shall mean the successful Tenderer / vendor to whom the contract has been awarded

1.3 "Rate": The unit rates for the work to be carried out at site shall be as per finalized unit rates through tender. The finalized rates shall be firm for the entire duration of work to be carried out by the Contractor under the work order and are not subject to escalation for any reason whatsoever.

1.4. CONTRACT SPECIFICATION: The terms "CONTRACT Specification" shall mean the Technical specification of the work as agreed by you and description of work as detailed in Annexure-I enclosed herewith and all such particulars mentioned directly/referred to or implied as such in the contract.

1.5 SITE: The terms "Site" shall mean the working location in BYPL area. Under this tender, working location shall be as mentioned elsewhere.

1.6 ENGINEER IN CHARGE: "Engineer In-charge" means the Company's authorized representative for the purpose of carrying out the work.

1.7 PRIORITY OF CONTRACT DOCUMENTS:
The several documents forming the Contract are to be taken as mutually explanatory of one another, but in case of ambiguities or discrepancies, the same shall be explained and adjusted by the Employer, who shall thereupon issue to the Contractor, instructions thereon. In such event, unless otherwise provided in the Contract, the priority of the documents forming the Contract shall be as follows:

1.1. SAP Work Order duly acknowledged by Contractor
1.2. Price Schedule
1.3. Special Condition of Contract
1.4. Technical specification and Tender Drawing
1.5. Erection Conditions of Contract
1.6. General Conditions to the Contract

2. EXAMINATION OF SITE AND LOCAL CONDITIONS:

The contractor is deemed to have visited the site of the work and ascertained therefore all site conditions and information pertaining to his work. The company shall not accept any claim whatsoever arising out of the difficult site/terrain/local conditions, if any.

3. LANGUAGE AND MEASUREMENT:

The CONTRACT issued to the contractor by the company and all correspondence and documents relating to the CONTRACT placed on the Contractor shall be written in English language.

Metric System shall be followed for all dimension, units etc.

4. SCOPE OF WORK:

The scope of work shall be as per SOW at Site, New Delhi". Schedule of work shall be as mentioned in the Bill of quantity attached herewith.

Free Issue Material as required for the completion of work under the scope of the Contract shall be issued free of cost by the Employer / Owner from its stores. Transportation from store to the work area shall be in scope of the Contractor.

The Contractor shall requisition the free issue materials in the prescribed format(s) to the Employer and Employer shall arrange to issue the same on Free of Cost basis.

The Contractor shall take proper care of the materials supplied to the Contractor and protect the same from weathering and any other damages. Any material rendered unserviceable or damaged while in Contractor's custody shall be replaced by the Contractor at his cost as determined by the Engineer.

The Contractor shall have to furnish an Indemnity Bond (Annexure attached) for the materials supplied free of cost by the Employer / Owner. Further, he shall be responsible for the safe custody of materials till the materials are utilized, fabricated, erected and accounted for in all respect in the Project.

After completion of work of above grid, contractor has to obtain the Electrical Inspectorate's Clearance from the Electrical Inspector of Delhi Govt. However the Electrical Inspectors clearance fees shall be paid by the company.

Engineer In-Charge shall arrange any permission like Road cutting clearance etc. from the Delhi Civic authorities like MCD,DDA, PWD and DJB. However, the contractor shall make follow up with local authorities and other connected persons that may be required to carry out the job under this work order.

All the labour, plant appliance, ladder, scaffoldings, materials, cranes, tool and tackles, and technical supervision etc. are including in your scope of work. Adequate number of engineers, supervisors and labours (skilled & unskilled) shall be posted at site and the list of the same along with certificate of Qualification of technical staff should be submitted by the Contractor to the Engineer In Charge for checking the adequacy immediately (with in seven days) after award of contract.

The Contractor shall also make his own arrangement for the accommodation/conveyance requirements for its staff at site. Company will provided at site the adequate open space for contractor's site store for storing the materials, tools, tackles etc. The entire Contractor's storage will be within the site premises. All the incoming and outgoing materials, equipment, tools, tackles and any other items related to said work shall be entered into the register kept for this purpose and shall be in the custody of Contractor, however company does not hold any responsibility for any loss or damage of Contractor's material etc.

All loading/unloading, of materials at work-site shall be your responsibility. Involvement of Crane/Hydra/Tractor/Trailer for this type of work shall be in your scope. Adequate weather

protection shall be provided by the contractor to keep the materials safe from sun & rain by providing covered storage space as well as using tarpaulins.

The Contractor will make his own arrangement for electricity and water requirement from Local sources for construction requirements.

The Contractor will be required to make his own arrangement for distribution of water/power on the site by erecting temporary lines. All such work shall be carried out according to local regulation. The temporary lines will be removed forthwith after the completion of work. If there is hindrance caused to the other work done to the alignment of these lines, the contractor will re-route and remove the temporary lines at his own cost

Under no circumstances the delay in work shall be attributed to non-availability or inadequate power and / water supply.

5. SITE MOBILIZATION:

5.1 Contractor shall commence the work as per the plan.
5.2 Contractor shall submit deployment plan for the T&P and Man power required for the project. If the Contractor is not able to deploy the required T&P, manpower & construction materials, Employer, at its sole discretion, may opt to arrange the same on behalf of Contractor and an amount of cost plus 20% shall be deducted from any amount due or becoming due to the Contractor.
5.3 Quality Assurance Plan: Contractor to submit QAP / FQP for the complete scope within 02 weeks of issue of order for Employers / Owners Approval. Works to be executed as per approved QAP.
5.5 Schedule of work to be performed shall be as per implementation schedule (to be finalized during kick-off meeting).
The Network so finalised shall also be used for the purpose of contract execution, monitoring progress of work, payments and operation of all other terms and conditions of the Contract strictly.
The Schedules shall be reviewed periodically with the Employer / Owner to ensure that the completion dates for different milestones will be met and to institute all corrective steps such as mobilising additional resources in terms of labour, materials, equipment, tools and plant, night work etc. at no extra cost to the Employer / Owner to achieve any accelerated progress at any time to the extent required to adhere to the completion dates. The Employer / Owner reserves the right to revise the work schedule at his discretion in order to ensure completion date and to suit the project requirements and such alterations shall not entitle the Contractor to any extra payment.

6. RATES:

The rates finalized for this order shall be firm for the entire duration of work carried out by the Contractor under the order and are not subject to any variation and escalation for any reason whatsoever.

Rate for all the extra items shall be mutually negotiated and fixed on the basis of cost of materials, consumables, labour and T&P expenses plus overhead expenses and profit upto maximum 10%.

The cost of insurance during loading/unloading of materials/ equipments during its storage and handling/erection at site for installation is included in the contractor's scope and value is included in the unit rates finalized.

The unit rates finalized are also inclusive of barricading and watch & ward during execution and no separate charges shall be paid for the same.

7. TAXES AND DUTIES:

Prices are inclusive of all taxes and duties including labour cess and GST as applicable. However, IT as per applicable rate will be deducted from your bills as Tax Deduction at Source (TDS).
The total order value shall remain **FIRM** and shall only be adjusted on account of any variations in Statutory Taxes, duties and Levies imposed by Competent Authorities by way of fresh notification(s) within the stipulated delivery period.

8. BILL SUBMISSION PROCEDURE:

All bills shall be submitted to the Engineer In charge / Package Engineer for certification. Bills shall be complete in all respect including ESI / HR compliance, Quality compliance, HSE compliance, Store compliance, Finance compliance etc. An established procedure is followed at site. Incomplete bills / invoices will not be considered for processing payments.

9. POWER TO WITHHOLD PAYMENT BY EMPLOYER:

9.1 Employer shall have power to withhold payment of RA Bill in full or in parts for the reason of non compliance of major contract terms and conditions such as quality of work, progress of work etc as per the discretion of Engineer In Charge.
9.2 Such withholding of payment neither relieve the contractor to execute the work with due diligence and speed, nor entitle contractor to claim any interest, loss of anticipated profit, etc there on.
9.3 All the compliances to be done by the Contractor before next RA bill and hold amount to be released. In case contractor is not able to do the compliance before next RA bill such hold amount shall be released as and when such compliances are fulfilled to the satisfaction of Employer.
9.4 If the work is not performed in strict accordance with the contract ,or if the work of any other contract between the contractor herein and the Employer is not performed in strict accordance with its terms ,or if the Employer has a claim against the contractor herein for any other reason whatsoever ,or if any claim ,just or unjust (including claims for wrongful death and for injuries to person property), which arises out of the performance of work is made against the Employer, the Employer shall have the right to withhold out of any payment, final or otherwise, such sums as the Employer may deem ample to protect it against delays or loss or to assure the payment of such claims.
9.5 Deduction of Defective Work as Alternative to Requiring Corrections: If the Employer deems it inexpedient to require the Contractor to Correct Work damaged or not done in accordance with the Contract, an equitable deduction from the Contract Price shall be made by agreement between the Contractor and Employer. In the event of failure of said parties to reach an agreement, the amount to be so deducted shall be settled in accordance with the procedure hereinafter provided for the settlement of disputes. Until such settlement, the Employer may withhold such sum as it deems just and reasonable from monies, if any, due the Contractor.

10. TERMS OF PAYMENT

Payment shall be made to you as under:

(i) 5% of the total services contract price shall be paid as initial interest free advance on fulfillment against 1) acceptance of LOI/PO, 2) submission of BG of equivalent amount valid upto completion period/handing over, whichever is earlier plus 3 months claim period and 3) Submission of Contract Performance Bank Guarantee of 10% of the contract price valid upto completion period/handing over, whichever is earlier plus 3 months claim period. In case of delay, the BG shall be extended suitably. The advance shall be adjusted against R/Bills.
(ii) 80% prorata of total services value shall be payable against R/A bills payable within 30 days after completion duly certified by Engineer in charge.
(iii) Balance 15% on account of total services value of the actual executed value shall be paid in 30 days after completion of successful acceptance testing, commissioning and handing

over of complete systems duly certified by BYPL Engineer-in-Charge specified in the tender and on submission of performance Bank Guarantee of 10% amount, in our format valid up to a defect liability period for 36 months from the date of handing over of the scheme including submission of Electrical Inspector Clearance Certificate, Compliance of final punch point, No Demand Certificate, Letter of Indemnity by the supplier (The format of No Demand Certificate and Letter of Indemnity are attached as Annexure) and after reconciliation & adjustments of payments, if any towards quantities of materials issued from purchaser's stock and consumed by the contractor for expeditious completion of the job.

All the Bank guarantees shall be submitted as per Company's format (Appendix I) and from any scheduled Bank approved by Company.

Company shall make payments of the bills either; By crossed cheque or by electronic transfer directly to Contractor's designated bank account.

8. DEFECT LIABILITY PERIOD:

Work executed shall be guaranteed against any defect or failure which may arise due to faulty materials, design or workmanship for a period of 36 months from the date of handing over of the entire installation.
If during the Defect 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.

9. COMPLETION PERIOD:

You are required to mobilize your manpower and Tools & Tackles and furnish a list of equipments to be used for erection and commence the execution activity as per instructions of Engineer In-charge. The entire erection work should be completed within project completion of 05 months from the date of issue of LOI/WO. The detailed schedule and milestone completion dates would be as per the contract schedules given from time to time by Engineer In-charge at site. You shall submit a weekly progress report to Engineer In charge.

10. CLEANLINESS:

All debris shall be removed and disposed of at assigned areas on daily basis. Surplus excavated earth shall be disposed of in an approved manner. In short, you shall be fully responsible for keeping the work site clean at all times. In case of non- compliance, company shall get the same done at Contractor's risk and costs.

11. COMMISSIONING & ACCEPTANCE TEST:

After completion of the work, the Contractor shall conduct trial run/ operation in the presence of Engineer In charge. During such trial run the system shall be operated under the supervision of the Contractor. If any rectification/modification required during this period the Contractor shall do all necessary measures.
On satisfactory completion of above, the system shall be deemed to have energized and placed in commercial operation. The Engineer In Charge will issue an acceptance certificate.

12. WORK COMPLETION CERTIFICATION, HANDING OVER:

The work carried out by the Contractor under this order has to be certified by Engineer In-charge for satisfactory completion of work allotted to the contractor with respect to specifications / Field Quality Procedures as per applicable standards. In case of modification/correction to be carried out, contractor shall carry out the said modifications/correction without additional cost. The

Contractor shall remain in close contact with Engineer In-Charge at site to report the general findings of the fieldwork during the initial as well as later stage of the work at site.

13. RECONCILIATION:

Reconciliation of free issue material, BOQ items shall be done on monthly basis and same shall form part of the running bills. The contractor shall maintain an accurate and exhaustive record detailing out the list of all items received by him for the purpose of erection and keep such record open for the inspection of the company. All measurement of works shall be done in The Joint Measurement Book, jointly signed by Engineer In Charge / Package Owner and contractor's representative. Copy of measurement sheet shall form part of both running bill and final bill.

The contractor shall be solely responsible for any shortage or damage of materials issued to them handling of and / or in storage and erection at site and cost of the same will be recovered from the contractor as certified by Engineer In-Charge.

14. PUNCH LIST AND OUTSTANDING WORK:

14.1 The Contractor shall, in conjunction with the Employer / Owner, prepare and update on a continuing basis during the period between completion of structure and final completion, punch lists (based on the preliminary punch list) of outstanding items requiring completion or rectification.

14.2 The Contractor shall rectify or complete to the standards specified in the Contract and in accordance with the schedule stated in the punch list any outstanding items of work or plant noted as requiring rectification or as incomplete. In the event that the Contractor fails to commence and / or diligently proceed with the execution of any such outstanding items of work in accordance with such schedule, the Employer / owner may arrange for the outstanding work to be done and reasonable cost thereof shall be certified by the Employer / Owner and deducted from the contract price or paid by the Contractor to the Employer / Owner.

14.3 The parties may in any event agree that any outstanding items of work shall be carried out by the Employer / Owner or shall otherwise be deleted from the punch list referred to above, subject to the agreement of any appropriate sum to be paid or allowed by the Contractor to the Employer / Owner in respect of such outstanding item.

14.4 Rectification / Correction and Replacement of faulty / defective / damaged work

The Employer may reject defective or unsatisfactory work or materials. The Contractor shall proceed immediately with the correction of rejected, defective, or unsatisfactory workmanship or materials and shall have all objectionable materials and defective work removed from the site (or any place used for storing materials for use on the work) and replaced.

15. REMEDY FOR CONTRACTOR'S DEFAULT:

In case the quality of works performed by the Contractor is found to be not meeting the requirements of the contract, then the Employer / Owner shall have the right to demolish such work and get it re-executed at the risk and cost of the contractor. In case the contractor is not able to perform as per the time schedule and other requirements of the contract, then, the Employer / Owner, upon giving a notice of 7 (seven) days to the contractor, can get the works rectified/completed by some other agency, at the risk and cost of the contractor.

16. DEMOBILIZATION:

16.1 Prior to Handing over, the contractor shall remove all the belonging from the site.

16.2 Debris, Rubbish etc. so as to take all practical measures to prevent damage to the site or any other property on or near the site or work area. As soon as reasonably practicable, but in any event prior to handing over, the contractor shall remove or dispose of in accordance with applicable laws all such rubbish, debris, etc. and all contractor's Equipment, supplies, materials and wastes brought or produced by the contractor on the site or the work area.

16.3 Labour and Hutments: Labour and work men engaged by the contractor for the works along with their hutments, sheds and dwellings, notwithstanding the foregoing, the contractor shall be responsible for the removal of all its temporary structures built at site.

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17. CONTRACT CLOSURE:

As per Annexure - Contract closure document

18. CODES AND STANDARD:

All required codes and standard detailed in the specifications are to be adhered to. The plant equipment material and works shall be completely furnished in all the respects in accordance with the technical specification as per the acceptable codes & standards.

20. PENALTY AND LIQUIDATED DAMAGES:

20.1 Penalty: A penalty of 2.5% of bill amount shall be levied in each case of non-compliance of safety practices and site cleanliness.

20.2 Liquidated Damages: In the event of any delay in completion of the work beyond the stipulated time given by in order due to reasons solely attributable to the Contractor, the Contractor shall pay to the Company liquidated damages.

If the Contractor failed perform the services within the time period specified in the order, the Company shall, without prejudice to its other remedies under the contract, deduct liquidated damages a sum equivalent to 1 % of the work value (basic) for each week or part there of delay until the actual date of completion up to a maximum deduction of 10% of order value (basic). Once the maximum is reached to Company may consider termination of contract without any liabilities to Company.

20.3 The Liquidated Damages shall not in any way relieve the Contractor from any of its obligations to complete the Work or from any other obligations and liabilities of the Contractor under the Contract.

20.4 Notwithstanding the above, in the event the Contractor fails to complete the package as per the schedule; and delays the Employer 'Handing Over' of the plant / Structure / unit(s) up to a period for which the Liquidated Damages for time delay becomes more than 5% of the Contract Price, then the Employer at his sole discretion, shall be entitled to treat the failure as an act of default by the Contractor and same shall entitle the Employer to terminate the Contract and get the work done by some other agency, at the Risk & Cost of Contractor.

20.5 Employer shall issue notice to Contractor in writing before recommending any risk & cost to contractor. The Contractor shall immediately provide an action plan to make good of any balance Work/deficient Work within seven (07) days of receiving such notice. Any non response by the Contractor to the Risk and Cost proposal of the Employer or failure to provide an action plan shall be deemed as acceptance of the Risk and Cost proposal by the Contractor.
20.6 The Liquidated Damages for delay will be recovered at the sole discretion of the Employer from the Contract Price or from other securities/ BG's available with the Employer or jointly.
20.7 Time is essence of the Contract. After issuance of the Work order, the Contractual network / L2 network will be finalized and approved by the Employer.

Engineer In charge should specifically mention the amount of LD levied on the bill of contractor.

21. MITIGATION OF CONSEQUENCES OF DELAY:

In all cases where such an event for delay has occurred, the Contractor shall advise the Employer / Owner of -
21.1 "The extent of the actual and contemplated delay and its anticipated effect upon the date of "Handing-Over".
21.2 "The Contractor's plans to take steps to overcome or minimize the actual or anticipated delay and
21.3 The Contractor's plans to adopt any methods suggested by the Employer / Owner to overcome or minimize the delay, and shall use all reasonable endeavors to take such steps and/or adopt such methods.

22. SAFETY CODE:

The Contractor shall ensure adequate safety precautions at site as required under the law of the land and shall be entirely responsible for the complete safety of their workman as well as other workers at site and premises. The contractor shall not deploy any worker below the age of 18 years.

The contractor shall observe the safety requirements as laid down in the contract and in case of sub-contract (only after written approval of company), it shall be the responsibility of main contractor that all safety requirements are followed by the employees and staff of the sub-contractor.

The contractor employing two hundred employees or more, including contract workers, shall have a safety co-ordinator in order to ensure the implementation of safety requirements of the contract and a contractor with lesser number of employees, including contract workers, shall nominate one of his employees to act as safety co-ordinator who shall liaise with the safety officer on matters relating to safety and his name shall be displayed on the notice board at a prominent place at the work site.

The contractor shall be responsible for non-compliance of the safety measures, implications, injuries, fatalities and compensation arising out of such situations or incidents.

In case of any accident, the contractor shall immediately submit a statement of the same to the owner and the safety officer, containing the details of the accident, any injury or casualities, extent of properly damage and remedial action taken to prevent recurrence and in addition, the contractor shall submit a monthly statement of the accidents to the owner at the end of each month.

23. STATUTORY OBLIGATIONS:

The Contractor shall take all steps as may be necessary to comply with various Acts, Rules, including but not limited to The Child Labour (Prohibition & Regulation) Act, 1986, The Contract Labour (Regulation & Abolition) Act, 1970. The Employees Pension scheme , The Employees Provident Funds and miscellaneous provisions Act, 1952 ,The Employees state Insurance Act,1948,The Equal Remuneration Act, The Industrial Dispute Act,1947, The Maternity Benefit Act , 1961, The Minimum Wages Act, 1948, The payment of Bonus Act ,1965, The Payment of Gratuity Act,1972, The Payment of wages Act, 1936, The Shops & Establishment Act, The Workmen's Compensation Act , 1923, Building and Other Construction Workers (Employment and Regulations) Act 1996, Building and Other Construction Workers (Cess) Act 1996, The Employers Liability Act,1938, Indian Electricity Act, 2003 and Indian Electricity Rules, VAT and GST etc., and all other applicable laws as amended and rules framed there under including any statutory approval required from the Central/State Govt. Ministry of Labour. Broadly, the compliance shall be as detailed below, but not limited to:

a) An Electrical license.
b) PF Code No. and all employees to have PF A/c No. under PF every Act, 1952.
c) All employees to have a temporary or permanent ESI Card as per ESI Act.
d) ESI Registration No.
e) Sales Tax registration number, if applicable.
f) PAN No.
g) Work Contract Tax Registration Number/ VAT Registration.
h) Labour License under Contract Labour Act (R & A) Act 1970.
i) Delhi Building and other Construction Worker (Regulation of Employment and Conditions of Services) Rules, 2002(B.O.C.W.)

(Bidder responsible for execution of the job should obtain a copy of Labour License before start of the work by the contractor.)

The Contractor must follow:

a) Third party Insurance Policy before start of work.
b) To follow Minimum Wages Act prevailing in the state.
c) The Salary/wages to all deployed manpower is to be distributed through ECS only into the bank accounts of all individuals and not later than 7th of succeeding month. In case of unavoidable circumstances the payment may be made through crossed cheques in the name of the individual and information of all such cases need to be submitted to HR(CMC).
d) To maintain Wage- cum - Attendance Register.
e) To maintain First Aid Box at Site.
f) Latest P.F. and E.S.I. challans pertaining to the period in which work was undertaken along with a certificate mentioning that P.F. and E.S.I. applicable to all the employees has been deducted and deposited with the Authorities within the time limits specified under the respective Acts.
g) Workman Compensation Policy. {If applicable}.
h) Labour license before start of work. {If applicable}.

Before commencing the work it would be mandatory for the Contractor to furnish the Company the permanent PF code no and ESI of the employees.

24. WORKMAN COMPENSATION:

The Contactor shall take insurance policy under the Workman Compensation Act to cover such workers who are not covered under ESI and PF by the Contractor however engaged to undertake the jobs covered under this order and a copy of this insurance policy will be given to Company for reference and records. This insurance policy shall be kept valid at all times. In case there are no worker involve other than those who are covered under ESI and PF by the Contractor, the Contractor shall certify for the same.

The contractor shall keep the company indemnified at all times, against all claims of compensation under the provision of Workmen Compensation Act 1923 and as amended from time to time or any compensation payable under any other law for the time being workman engaged by the contractor/sub-contractor/sub-agent in carrying out the job involved under this work order and against costs and expenses, if any, incurred by the company in connection therewith and without prejudice to make any recovery.

The company shall be entitled to deduct from any money due to or to become due to the Contractor, moneys paid or payable by way of compensation as aforesaid or cost or expenses in connection with any claims thereto and the Contractor shall abide by the decision of the Company as to the sum payable by the Contractor under the provisions of this clause.

25. STAFF AND WORKMAN:

(I) It shall be responsibility of contractor:

(a) To obtain Contract Labour License from the concerned authorities and maintain proper liaison with them. Necessary Forms for obtaining Labour License would be issued by the company. However you will bear all expenses for obtaining Labour license and registration in PF Department for your scope of work. You will deposit PF of your staff/laborer each month and all related documents should be furnished to us.
(b) To obtain workman insurance cover against deployment of workers etc.

(II) To maintain, proper records relating to workmen employed, in the form of various Registers, namely.

(a) Register of workmen.
(b) Register of muster roll.
(c) Register of overtime.
(d) Register of wages.
(e) Any other register as per latest amendment Labour Act.

(III) To disburse monthly wages to your workers/ supervisors in time and in the presence of Company representatives or as directed by the Labour authorities.

(IV) To maintain proper liaison with the Project authorities, local police and all other government and local bodies.

(V) To pay your workmen at least not less than the minimum prescribed wages as per state/Central Labour laws as may be, applicable. The contractor shall, be responsible for compliance of all the provisions of minimum Wages Act, PF, ESIC Act workmen Compensation Act and Contract Labour Regulation & Abolition Act the rules made there under. In case of non-Compliance of the statutory requirements. The company would take necessary action at the risk and cost of the Contractor.

(VI) To employ required number of skilled/semi-skilled and unskilled workmen as per site requirement to complete the entire project as per schedule. To provide safety shoes, safety helmets, safety belts, gloves etc. to your worker/staff as per requirement during erection work.

(VII) To employ necessary engineering and supervisory staff for completion of the Project in time. While day-to-day management of the site and supervision of the works shall be the responsibility of your Engineer - In charge, he will report to the our Engineer in charge to assist him to discharge the overall responsibility of the execution of the project.

26. INSURANCE:

Before commencing the execution of the work the Contractor shall take at his own cost Transit Insurance policy, Third party insurance and suitable insurance policy for his own men and material. Please note that these insurance policies shall be taken in consultation with the Employer, where Employer is to be named as Co-insured and a copy of the insurance policy shall have to be furnished to Employer within 30 days of the date of order. For all the insurance policies (whether taken by the Employer or Contractor), the Contractor shall be responsible for settlement of claims with the underwriters without any liability on the Employer / Employer and will arrange replacements / rectification expeditiously without waiting for settlement of insurance claim, at contractor's own cost and this shall arrange the comprehensive Insurance policy for workmen's compensation, General liability Insurance, Automobile insurance, Third party insurance for damage of any movable and immovable properties and lives. This shall not entitle the Contractor for any extension of time.

Third Party Risk and Public Liability Insurance –
The Contractor, at his own cost, shall take necessary insurance to indemnify third party risk arising out of the work to be done by him. The contractor shall also take out the following Public Liability and Property Damage Liability Insurance Cover for the entire period of contract as given below.

A Public Liability and Property Damage Liability Insurance Covering All Operations the contract
Limits for bodily injury or death up to and including Rs. 200000/- for one person and Rs. 500000/- for each accident.

Limits for property damage up to and including Rs. 500000/- for each accident.

B Automobile Liability Insurance

On all self –propelled vehicles used in connection with this contract, whether owned, non-owned or hired by the contractor, limits of insurance shall be as follows:

For Public Liability up to and including Rs. 200000/- for one person and Rs. 500000/- for each accident.

For property damage up to and including Rs. 200000/- for each accident.

Insurance for contractor's personnel

The contractor shall effect and maintain insurance against liability for claims, damages, losses and expenses (including legal fees and expenses) arising from injury, sickness, disease or death of any person employed by the contractor or any other of the Contractor's personnel.

Before commencing the execution of the work the CONTRACTOR shall take Accidental insurance policy for the staff engaged by him for this work to insure against any loss of life which may occur during the contract for the work of the COMPANY. The policy shall have coverage of Rs. 10 Lacs (Table C- Death + Permanent Total Disability + Partial permanent Disability due to external accidents). The Contractor shall be responsible for on the spot same day claim settlement with the victim's legal heirs without waiting for settlement by insurance claim without any liability on BYPL. The premium amount for such life cover policy shall be borne by the contractor. The contractor shall furnish copy of policy when demanded by BYPL.

27. SECURITY/WATCH & WARD:

All security rules and safety rules enforced at site by company shall be strictly observed.

28. ENVIRONMENTAL, HEALTH & SAFETY PLAN:

Contractor will make ensure that the Environment, Health & Safety (EHS) requirements are clearly understood and faithfully implemented at all levels at site as per instruction of Company. Contractors must comply with these requirements:

a) Comply with all of the elements of the EHS Plan and any regulations applicable to the work.
b) Comply with the procedures provided in the interests of Environment, Health and Safety.
c) Ensure that all of their employees designated to work are properly trained and competent.
d) Ensure that all plant and equipment they bring on to site has been inspected and serviced in accordance with legal requirement and manufacturer's or suppliers' instructions.
e) Make arrangements to ensure that all employees designated to work on or visit the site present themselves for site induction prior to commencement of work.
f) Provide details of any hazardous substances to be brought onsite.
g) Ensure that a responsible person accompanies any of their visitors to site.

All contractor's staff are accountable for the following:

1. Use the correct tools and equipment for the job and use safety equipment and protective clothing supplied, e.g. helmets, goggles, ear protection, etc. as instructed.
2. Keep tools in good condition.
3. Report to the Supervisor any unsafe or unhealthy condition or any defects in plant or equipment.
4. Develop a concern for safety for themselves and for others.
5. Prohibit horseplay.
6. Not to operate any item of plant unless they have been specifically trained and are authorized to do so.

29. TEST CERTIFICATE & QUALITY ASSURANCE:

The Contractor shall procure all equipment from genuine sources as approved by the Company and as per Company specifications. The Contractor shall submit all the test certificates and joint inspection reports related to major equipment wherever applicable. The contractor shall ensure for the strict compliance to the specifications and Field Quality Procedures issued by company / Engineer in-charge.

30. SUB-CONTRACTING / SUBLETTING:

CONTRACTOR shall not assign or transfer the whole or any part of this Work Order or any other benefits accruing there from nor shall it subcontract / sublet the whole or any part of the Works without the prior written consent of COMPANY.

In the event the contractor assigns this work order, contractor's assignees shall be bound by the terms and conditions of this work order and shall , if deemed necessary by COMPANY at the time of such assignment, undertake in writing to be so bound by this Work Order.

Notwithstanding the subletting / subcontracting of any portion of the works, contractor shall remain wholly responsible for the carrying out, completion and satisfactory execution of Works in all respects in accordance with this Work Order, specification, approved drawings and data sheets.

31. INDEMNITY:

Contractor shall indemnify and save harmless COMPANY against and from any and all liabilities, claims, damages, losses or expenses arising due to or resulting from:

a) Any breach non-observance or non-performance by contractor or its employees or agents of any of the provisions of this Work Order.
b) Any act or omission of contractor or its employees or agents.
c) Any negligence or breach of duty on the part of contractor, its employees or agents including any wrongful use by it or them of any property or goods belonging to or by COMPANY.

Contractor shall at all times indemnify COMPANY against all liabilities to other persons, including he employees or agents of COMPANY or contractor for bodily injury, damage to property or other loss which may arise out of or in consequence of the execution or completion of Works and against all costs charges and expenses that may be occasioned to COMPANY by the claims of such person.

32. EVENTS OF DEFAULTS:

COMPANY may, without prejudice to any of its other rights or remedies under the Work Order or in law, terminate the whole or any part of this Work Order by giving written notice to the Contractor, if in the opinion of COMPANY, contractor has neglected to proceed with the works with due diligence or commits a breach of any of the provisions of this work order including but not limited to any of the following cases.

a) Failing to complete execution of work within the terms specified in this work order.
b) Failing to complete works in accordance with the approved schedule of works.
c) Failing to meet requirements of specifications, drawings, and designs as approved by COMPANY.
d) Failing to comply with any reasonable instructions or orders issued by COMPANY in connection with the works.
e) Failing to comply with any of the terms or conditions of this work order.

In the event COMPANY terminates this work order, in whole or in part, on the occurrence of any event of default, COMPANY reserves the right to engage any other subcontractor or agency to complete the work or any part thereof, and in addition to any other right COMPANY may have under this work order or in law including without limitation the right to penalize for delay under clause 15.0 of this work order, the contractor shall be liable to COMPANY for any additional costs that may be incurred by COMPANY for the execution of the Work.

33. RISK & COST:

If the Contractor fails to execute the work as per specification / as per the direction of Engineer's In-charge within the scheduled period and even after the extended period, the contract shall got cancel and company reserves the right to get the work executed from any other source at the Risk & Cost of the Contractor. The Extra Expenditure so incurred shall be debited to the Contractor.

34. ARBITRATION:

To the best of their ability, the parties hereto shall endeavor to resolve amicably between themselves all disputes arising in connection with this LOA. If the same remain unresolved within thirty (30) days of the matter being raised by either party, either party may refer the dispute for settlement by arbitration. The arbitration to be undertaken by two arbitrators, one each to be appointed by either party. The arbitrators appointed by both the parties shall mutually nominate a person to act as presiding arbitrator before entering upon the reference in the event of a difference between the two arbitrators and the award of the said presiding arbitrator in such a contingency shall be conducted in accordance with this provisions of the Indian Arbitration & Conciliation Act, 1996 and the venue of such arbitration shall be in the city of New Delhi only.

35. FORCE MAJEURE:

27.1 General:

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

(i) Such event or circumstance, despite the exercise of reasonable diligence, could not have been prevented, avoided or reasonably foreseen by such Party;

(ii) 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 parties ability to perform its obligations under this Contract and to mitigate the consequences thereof. 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 event is not the direct or indirect result of the failure of such Party to perform any of its obligations under this Contract; and

(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

27.2 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: The following events and circumstances:

(i) Effect of any natural element or other acts of God, including but not limited to storm, flood, earthquake, lightning, cyclone, landslides or other natural disasters, and

(ii) Explosions or fires

(iii) Declaration of the Site as war zone

Any order, regulation, directive, requirement from any Governmental, legislative, executive or judicial authority.

27.3 Notice of Events of Force Majeure:

If a force majeure event prevents a party from performing any obligations under the Contract in part or in full, that party shall:

(i) Immediately notify the other party in writing of the force majeure events within 2 working days of the occurrence of the force majeure event

(ii) Be entitled to suspend performance of the obligation under the Contract which is affected by force majeure event for the duration of the force majeure event

(iii) Use all reasonable efforts to resume full performance of the obligation as soon as practicable

(iv) Keep the other party informed of all such efforts to resume full performance of the obligation on a regular basis.

(v) Provide prompt notice of the resumption of full performance or obligation to the other party.

27.4 Mitigation of events of force majeure:

The Contractor 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 applying other ways in which to perform 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 Company 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.

27.5 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 Contract. 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.

27.6 Terminations 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 1 (one) month during the Term of the Contract the Contract shall be terminated at the discretion of the Company and neither Party shall be liable to the other for any consequences arising on account of such termination.

36. SECRECY CLAUSE:

The technical information, drawing and other related documents forming part of work order and the information obtained during the course of investigation under this work order shall be the Company's executive property and shall not be used for any other purpose except for the execution of the work order. The technical information drawing, records and other document shall not be copied, transferred, or divulged and/ or disclosed to third party in full/part, not misused in any form whatsoever except to the extent for the execution of this work order.
This technical information, drawing and other related documents shall be returned to the Company with all approved copies and duplicates including drawing/plans as are prepared by the Bidder during the executions of this work order, if any, immediately after they have been used for agreed purpose.
In the event of any breach of this provision, the Bidder shall indemnify the Company against any loss, cost or damage or claim by any party in respect of such breach.

37. TERMINATION:

During the course of the execution, if at any time BSES observe and form an opinion that the work under the order is not being performed in accordance with the terms of this Agreement, BSES reserves its right to cancel this Agreement giving 15 days notice mentioning the reason for the termination of the agreement and BSES will recover all damages including losses occurred due to loss of time from Contractor.

38. QUALITY:

Contractor shall ensure that strict quality is maintained and execution of works under this Work Order and Works are executed in conformity with the Specification.

All tools, tackles, instruments and other equipments used in the execution of the Works shall be duly calibrated as required and Contractor shall maintain proper records of such tools, tackles, instruments and / or equipment.

39. PROGRESS REPORT INCLUDING PHOTOGRAPH:

39.1 During the various stages of erection and commissioning of the critical equipments in the pursuance of the Contract, the Contractor shall at its own cost submit periodic progress reports as may be reasonably required by the Employer (Format Attached as per Annexure-) with such materials as charts, networks, photographs, test certificates, etc. Such progress reports shall be in the form and size as may be required by the Employer and shall be submitted in adequate number of copies to be notified by the Employer
39.2 The quantitative progress report of the works by reference to the project schedule in sufficient detail should permit the Employer to assess performance, plan witness dates and evaluate forecasts, including reports on key Sub-contracts (as applicable). Within 10 days of the submission of each such report and at such other times as the Employer may reasonably request, the Contractor and the Employer shall meet to discuss progress. Contractor has to submit daily manpower, T&P, & work done report. Weekly MIS is required to be submitted by Contractor, at the end of each weekday (On Every Monday). Each monthly progress report shall be submitted not later than the 3rd day of the month following that in respect of which it is made, but may report on actual progress only up to the 25th day of the month and anticipated progress thereafter. Monthly progress reports shall include the following section
39.2.1 Executive summary

39.2.2 Description of the work and services performed and erection / commissioning activities completed during the preceding month

39.2.3 Necessary photographs of erection and commissioning activities which shall be taken when and where indicated by the Employer. Photographs shall be approximately 100 x 125 mm in size including a margin of 5 mm side for fixing. Adequate numbers of photographs shall be submitted indicating various stages of erection / commissioning. Each photograph shall contain the date, the name of the Contractor and the title of the view taken

39.2.4 Updated project schedule showing progress to the end of the month (as percentages completed of the Contractor's activities broken down into significant elements of the works), and the current schedule of activities and the targets for the next month including catch up plan, if required.

39.2.5 Identification of areas with foreseeable problems which in the opinion of the Contractor may affect the project schedule

39.2.6 Such other information and supporting documentation as the Employer may require satisfying himself about the timely erection and commissioning of equipment as per Contract.

39.2.7 The Employer shall advise the Contractor about the number of copies of progress reports and, where relevant, photographs to be submitted each month together with the names and addresses of persons to whom they are to be sent. Employer will also advise the Contractor regarding the format of the Monthly Progress report as per Annexure – VII.

39.2.8 The Contractor shall submit to the Engineer-in-Charge on a daily basis details of Contractor's and subcontractors' personnel (classified by trade), equipment and construction materials on Site; progress of Work under the Contract; and safety issues.

39.3 Monthly/Fortnightly Progress Report - Format

39.3.1 Project Overview

39.3.2 Executive Summary

i. Performance Highlights during the period
ii. Issues needing Attention

39.3.3 Schedule Analysis

i. Progress Curves: Attach – Engineering progress curve, procurement progress curve, Erection & commissioning curve and overall progress curve Schedule Analysis
ii. Brief write up on major gains and shortfall in each schedule.
iii. One page summary schedule indicating target and forecast delivery dates of major equipment.
iv. Overview of critical inputs to be provided by Contractor to Employer and vice versa.

39.3.4 Critical areas/ issues needing attention

Bring out any critical issue that needs attention/action of project team including Contractor, Employer & its Consultants. Suggest action required from concerned on the critical issues and impact of the decision on project schedule & cost (if any). Bring out specifically the previous agreed date for issue of deliverable/delivery of equipment or a decision on the issue.

39.3.5 Recovery Plan:

Bring out the areas that are delayed by over 2 weeks from the schedule or current requirement. Provide action taken for recovery of schedule and meet the delivery dates.

39.3.6 Engineering Progress

i. Major highlights during the month.
ii. Goals for next month
iii. Updated project schedule – 12 weeks rolling plan. Target Vs Actual/ Forecast
iv. Detailed schedule analysis
v. Critical areas and action taken recovery plan.
vi. List of inputs required from Contractor to Employer and vice versa – Plan Vs Actual.
vii. Plan for next month

39.3.7 Procurement Schedule

i. Major highlights during the month
ii. Updated detailed manufacturing and delivery schedule. 12 weeks rolling plan. Target Vs Actual/ Forecast
iii. Detailed delivery report – Indicate list of all material supplied and plan for next 3 months as annexure.
iv. Critical areas, Impact of delays, action taken and recovery plan

v. List of purchase orders placed, with vendor name, order no., and date
vi. Transport & logistics Plan
vii. QA & Inspection plan
viii. Plan for next month

39.3.7 Erection & Commissioning Schedule

i. Major highlights during the month
ii. Updated detailed erection schedule. 12 weeks rolling plan. Target Vs Actual/ Forecast
iii. Resource mobilization plan Vs Actual, Constraints
iv. Critical areas, Constraints, Impact of delays, action taken and recovery plan
v. QA & Inspection plan
vi. Plan for next month

39.3.8 Financial Summary

Invoice raised, Payments received

39.3.9 Fortnightly Progress Report

The fortnightly progress report shall consist of executive summary, critical areas and updated project schedule.

Vendor shall submit the progress report latest by 3rd day of every month.

39.4 Meetings At Site

i. Meetings shall be convened weekly or at other intervals as deemed necessary by the Engineer-in-Charge during the period of Work under the Contract and such meetings shall be held on Site during the period of Site work. The meetings shall be attended by the Senior Representatives of both Employer and the Contractor.

ii. The meetings shall ascertain Work progress, safety issues, any problems related to manpower, equipment or Site conditions, and provide early notice of any potential claims for Contract variations. Meetings shall be minutes by the Employer Representative / Engineer-in-Charge. Copies of the minutes shall be supplied to attendees and a standard list of addressees and the Employer.

40. REVIEW MEETING:

The contractor has to attend weekly review meeting at site level and bi-monthly review meeting at corporate level. MIS and Resources planning shall be prepared and monitored showing progress and quantity completion along with S-curve.

41. ACCEPTANCE:

Acceptance of this work order implies and includes acceptance of all terms and conditions enumerated in this work order in the technical specification and drawings made available to you consisting of general conditions, detailed scope of work, detailed technical specification & detailed equipment, drawing. Complete scope of work and the Bidder's and Company's contractual obligation are strictly limited to the terms set out in the work order. No amendments to the concluded work order shall be binding unless agreed to in writing for such amendment by both the parties.

However, during the course of the execution of the work order, if at any time the Company's representative observe and form an opinion that the work under the work order is not being performed in accordance with the terms of this work order, the company reserves its right to cancel this work order forthwith without assigning any reason and the Company will recover all damages including losses occurred due to loss of time from the Bidder.

We request you to please sign the duplicate copy of this work order as a token of your acceptance and return to us.

BSES Yamuna Power Limited

SECTION X

PRICE FORMAT – (E/T/C) (Items shown are indicative, Kindly refer BOQ, attached as Annexure)

DESCRIPTION OF SERVICES	SAC CODE	QTY	UoM	UNIT RATE	UNIT GST & CESS AS APPLICABLE (CGST & SGST/UTGST or IGST)		UNIT LANDED COST (₹)	TOTAL LANDED COST (₹)
					%	AMT		
Items as per BOQ i.e. shall be utilized to furnish price break-up.								
GRAND TOTAL LANDED COST								
In words ……								

NOTE:

1) Bidder shall include & indicate any others taxes under the applicable law(s) for supply and services to be performed in the purchaser's country.
2) Any other items not mentioned above but are required for successful completion of the substation shall be deemed to be included in the above quoted rates.

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PRICE FORMAT – CIVIL WORKS (Items shown are indicative. Kindly refer BOQ, attached as Annexure)

DESCRIPTION OF SERVICES	SAC CODE	QTY	UoM	UNIT RATE	UNIT GST & CESS AS APPLICABLE (CGST & SGST/UTGST or IGST)		UNIT LANDED COST (₹)	TOTAL LANDED COST (₹)
					%	AMT		
Items as per BOQ i.e. shall be utilized to furnish price break-up.								
GRAND TOTAL LANDED COST								
In words ……								

NOTE:

1. Kindly refer the relevant layout drawing of existing foundations in Annexure of tender document. Site visit is advisable prior to submission of quotation.

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SECTION XI

GRAND SUMMARY OF THE QUOTED PRICE

DESCRIPTION	Total price for supply F.O.R site incl all duties, taxes	Total for Erection, Testing & Comm incl all Taxes	Total for Civil Works incl all Taxes	Grand Total (₹)
Survey, design, engineering, manufacture, shop testing, inspection, packing, dispatch, loading, unloading and storage at site, transit/storage and construction insurance, assembly, erection, civil, structural, architectural work, complete pre-commissioning checks, testing & commissioning at site, obtaining statutory clearance & certification from State Electrical Inspector, and handing over to the Owner after satisfactory commissioning of new 33/11kv gis & power transformer along with allied equipments and works of system upgradation on Turnkey basis conforming to Technical Specification & SOW				
In words ……				

We declare that the following are our quoted prices in INR for the entire project.

Date: Bidders Name:

Place: Bidders Address:

Signature: ……

Printed Name: ……

Designation: ……

Common Seal: ……

BSES Yamuna Power Limited

SECTION XII

VENDOR CODE OF CONDUCT

Purchaser is committed to conducting its business in an ethical, legal and socially responsible manner. To encourage compliance with all legal requirements and ethical business practices, Purchaser has established this Vendor Code of Conduct (the "Code") for Purchaser's Vendors. For the purposes of this document, "Vendor" means any company, corporation or other entity that sells, or seeks to sell goods or services, to Purchaser, including the Vendor's employees, agents and other representatives.

Fundamental to adopting the Code is the understanding that a business, in all of its activities, must operate in full compliance with the laws, rules and regulations of the countries in which it operates. This Code encourages Vendors to go beyond legal compliance, drawing upon internationally recognized standards, in order to advance social and environmental responsibility.

I. Labour and Human Rights

Vendors must uphold the human rights of workers, and treat them with dignity and respect as understood by the international community.

. Fair Treatment - Vendors must be committed to a workplace free of harassment. Vendors shall not threaten workers with or subject them to harsh or inhumane treatment, including sexual harassment, sexual abuse, corporal punishment, mental coercion, physical coercion, verbal abuse or unreasonable restrictions on entering or exiting company provided facilities.

. Antidiscrimination - Vendors shall not discriminate against any worker based on race, colour, age,gender,sexual orientation, ethnicity, disability, religion, political affiliation, union membership, national origin, or marital status in hiring and employment practices such as applications for employment, promotions, rewards, access to training, job assignments, wages, benefits, discipline, and termination. Vendors shall not require a pregnancy test or discriminate against pregnant workers except where required by applicable laws or regulations or prudent for workplace safety. In addition, Vendors shall not require workers or potential workers to undergo medical tests that could be used in a discriminatory way except where required by applicable law or regulation or prudent for workplace safety.

. Freely Chosen Employment - Forced, bonded or indentured labour or involuntary prison labour is not to be used. All work will be voluntary, and workers should be free to leave upon reasonable notice. Workers shall not be required to hand over government-issued identification, passports or work permits as a condition of employment.

. Prevention of Under Age Labor - Child labor is strictly prohibited. Vendors shall not employ children. The minimum age for employment or work shall be 15 years of age, the minimum age for employment in that country, or the age for completing compulsory education in that country, whichever is higher. This Code does not prohibit participation in legitimate workplace apprenticeship programs that are consistent with Article 6 of ILO Minimum Age Convention No. 138 or light work consistent with Article 7 of ILO Minimum Age Convention No. 138.

.Juvenile Labor - Vendors may employ juveniles who are older than the applicable legal minimum age for employment but are younger than 18 years of age, provided they do not perform work likely to jeopardize their health, safety, or morals, consistent with ILO Minimum Age Convention No. 138.

. Minimum Wages - Compensation paid to workers shall comply with all applicable wage laws, including those relating to minimum wages, overtime hours and legally mandated benefits. Any Disciplinary wage deductions are to conform to local law. The basis on which workers are being paid is to be clearly conveyed to them in a timely manner.

. Working Hours - Studies of good manufacturing practices clearly link worker strain to reduced productivity, increased turnover and increased injury and illness. Work weeks are not to exceed

maximum set by local law. Further, a work week should not be more than 60 hours per week, including overtime, except in emergency or unusual situations. Workers should be allowed at least one day off per seven-day week.

. Freedom of Association - Open communication and direct engagement between workers and management are the most effective ways to resolve workplace and compensation issues. Vendors are to respect the rights of workers to associate freely and to communicate openly with management regarding working conditions without fear of reprisal, intimidation or harassment. Workers' rights to join labour unions seek representation and or join worker's councils in accordance with local laws should be acknowledged.

II. Health and Safety

Vendors must recognize that in addition to minimizing the incidence of work-related injury and illness, a safe and healthy work environment enhances the quality of products and services, consistency of production and worker retention and morale. Vendors must also recognize that ongoing worker input and education is essential to identifying and solving health and safety issues in the workplace.

The health and safety standards are:

. Occupational Injury and Illness - Procedures and systems are to be in place to prevent, manage, track and report occupational injury and illness, including provisions to: a) encourage worker reporting; b) classify and record injury and illness cases; c) provide necessary medical treatment; d) investigate cases and implement corrective actions to eliminate their causes; and e) facilitate return of workers to work.

. Emergency Preparedness - Emergency situations and events are to be identified and assessed, and their impact minimized by implementing emergency plans and response procedures, including: emergency reporting, employee notification and evacuation procedures, worker training and drills, appropriate fire detection and suppression equipment, adequate exit facilities and recovery plans.

. Occupational Safety - Worker exposure to potential safety hazards (e.g., electrical and other energy sources, fire, vehicles, and fall hazards) are to be controlled through proper design engineering and administrative controls, preventative maintenance and safe work procedures (including lockout/ragout), and ongoing safety training. Where hazards cannot be adequately controlled by these means, workers are to be provided with appropriate, well-maintained, personal protective equipment. Workers shall not be disciplined for raising safety concerns.

. Machine Safeguarding - Production and other machinery is to be evaluated for safety hazards. Physical guards, interlocks and barriers are to be provided and properly maintained where machinery presents an injury hazard to workers.

.Industrial Hygiene - Worker exposure to chemical, biological and physical agents is to be identified, evaluated, and controlled. Engineering or administrative controls must be used to control overexposures. When hazards cannot be adequately controlled by such means, worker health is to be protected by appropriate personal protective equipment programs.

.Sanitation, Food, and Housing - Workers are to be provided with ready access to clean toilet, facilities potable water and sanitary food preparation, storage, and eating facilities. Worker dormitories provided by the Participant or a labour agent are to be maintained clean and safe, and provided by the Participant or a labour egress, hot water for bathing and showering, and adequate heat and ventilation and reasonable personal space along with reasonable entry and exit privileges.

. Physically Demanding Work - Worker exposure to the hazards of physically demanding tasks, including manual material handling and heavy or repetitive lifting, prolonged standing and highly repetitive or forceful assembly tasks is to be identified, evaluated and controlled.

III. Environmental

Vendors should recognize that environmental responsibility is integral to producing world class products In manufacturing operations, adverse effects on the environment and natural resources are to be minimized while safeguarding the health and safety of the public.

The environmental standards are:

. Product Content Restrictions - Vendors are to adhere to applicable laws and regulations regarding prohibition or restriction of specific substances including labeling laws and regulations for recycling and disposal. In addition, Vendors are to adhere to all environmental requirements specified by Purchaser.
. Chemical and Hazardous Materials -Chemical and other materials posing a hazard if released to the environment are to be identified and managed to ensure their safe handling, movement storage, recycling or reuse and disposal.
. Air Emissions - Air emissions of volatile organic chemicals, aerosols, corrosives, particulates, ozone depleting chemicals and combustion by-products generated from operations are to be characterized, monitored, controlled and treated as required prior to discharge.
. Pollution Prevention and Resource Reduction -Waste of all types, including water and energy, are to reduced or eliminated at the source or by practices such as modifying production, maintenance and facility processes, materials substitution, conservation, recycling and re-using materials.
. Wastewater and Solid Waste - Wastewater and solid waste generated from operations industrial processes and sanitation facilities are to be monitored, controlled and treated as required prior to discharge or disposal.
. Environmental Permits and Reporting - All required environmental permits (e.g. discharge monitoring) and registrations are to be obtained, maintained and kept current and their operational and reporting requirements are to be followed.

IV. Ethics

Vendors must be committed to the highest standards of ethical conduct when dealing with workers, Vendors, and customers.
. Corruption, Extortion, or Embezzlement - Corruption, extortion, and embezzlement, in any form, are strictly prohibited. Vendors shall not engage in corruption, extortion or embezzlement in any form and violations of this prohibition may result in immediate termination as an Vendor and in legal action.
. Disclosure of Information - Vendors must disclose information regarding its business activities, structure financial situation, and performance in accordance with applicable laws and regulations and prevailing industry practices.
. No Improper Advantage - Vendors shall not offer or accept bribes or other means of obtaining undue or improper advantage.
. Fair Business, Advertising, and Competition - Vendors must uphold fair business standards in advertising, sales, and competition.
. Business Integrity - The highest standards of integrity are to be expected in all business interactions. Participants shall prohibit any and all forms of corruption, extortion and embezzlement. Monitoring and enforcement procedures shall be implemented to ensure conformance.
. Community Engagement - Vendors are encouraged to engage the community to help foster social and economic development and to contribute to the sustainability of the communities in which they operate.
. Protection of Intellectual Property - Vendors must respect intellectual property rights; safeguard customer information; and transfer of technology and know-how must be done in a manner that protects intellectual property rights.

V. Management System

Vendors shall adopt or establish a management system whose scope is related to the content of this Code. The management system shall be designed to ensure (a) compliance with applicable laws, regulations and customer requirements related to the Vendors' operations and products; (b) conformance with this Code; and (c) identification and mitigation of operational risks related to this Code. It should also facilitate continual improvement.

The management system should contain the following elements:

. Company Commitment - Corporate social and environmental responsibility statements affirming Vendor's commitment to compliance and continual improvement.

. Management Accountability and Responsibility - Clearly identified company representative[s]responsible for ensuring implementation and periodic review of the status of the management systems.

. Legal and Customer Requirements - Identification, monitoring and understanding of applicable laws, regulations and customer requirements.

. Risk Assessment and Risk Management - Process to identify the environmental, health and safety and labour practice risks associated with Vendor's operations. Determination of the relative significance for each risk and implementation of appropriate procedural and physical controls to ensure regulatory compliance to control the identified risks.

.Performance Objectives with Implementation Plan and Measures - Areas to be included in a risk assessment for health and safety are warehouse and storage facilities, plant/facilities support equipment, laboratories and test areas, sanitation facilities (bathrooms), kitchen/cafeteria and worker housing /dormitories. Written standards, performance objectives, and targets an implementation plans including a periodic assessment of Vendor's performance against those objectives.

. Training - Programs for training managers and workers to implement Vendor's policies, procedures and improvement objectives.

. Communication - Process for communicating clear and accurate information about Vendor's performance, practices and expectations to workers, Vendors and customers.

. Worker Feedback and Participation - Ongoing processes to assess employees' understanding of and obtain feedback on practices and conditions covered by this Code and to foster continuous improvement.

. Audits and Assessments - Periodic self-evaluations to ensure conformity to legal and regulatory requirements, the content of the Code and customer contractual requirements related to social and environmental responsibility.

. Corrective Action Process - Process for timely correction of deficiencies identified by internal or external assessments, inspections, investigations and reviews.

. Documentation and Records - Creation of documents and records to ensure regulatory compliance and conformity to company requirements along with appropriate confidentiality to protect privacy.

The Code is modeled on and contains language from the Recognized standards such as International Labour Organization Standards (ILO), Universal Declaration of Human Rights (UDHR), United Nations Convention against Corruption, and the Ethical Trading Initiative (ETI) were used as references in preparing this Code and may be useful sources of additional information

APPENDIX

Annexure-Contract closure document:

After completion of works, as per scope and specification of contract, process for contract closure will be initiated.

Following are major activities to be carried out for contract closure.

i. Completion of Works and issuance of Work Certificate by Employer.
ii. Closure Of Punch Points.
iii. Finalization of Measurements with certification from Engineer In Charge / Engineering.
iv. Joint Final Material reconciliation of Free Issue material (FIM) between contractor and Employer
v. Joint finalization of delay analysis & LD value if applicable between contractor and Employer.
vi. No Demand Certificate from Contractor
vii. Indemnity Bond from Contractor
viii. Contract Payment Register with accounts duly reconciled between Contractor and Employer.

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Annexure – Weekly / Monthly Progress Report: Format

Agenda	**Project Progress review of**		Meeting No	
			Date	
Time Start :		Time End:	Issue Date	
Attendees:				
	BYPL Team	**Contractor**		

S.No	**Points Discussed**	**Description**		**Action By Contractor**	**Action By Reliance**	**Remark / Status**
A	Construction					
1						
2						
3						
B	Payment					
1						
2						
3						
C	Hinderence / Issues if any like front, drawing etc					
1						
2						
3						
D	Amendment					
1						
2						
3						
E	Delay if any (& attributable to)					
F	Other points, if any					

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----------XXXXX----------

Annexure – FORMAT OF ADVANCE BANK GUARANTEE

(To be executed on a Non-Judicial Stamp Paper of appropriate value)

This Guarantee made at _____ this [___] day of [_____] 20XX

1. WHEREAS *M/s.* _____*(Pl specify the name of the Company)_,,* a Company within the meaning of the Companies Act, 1956 having its Registered Office at _____ hereinafter referred to as the " Purchaser", (which expression shall unless repugnant to the context or meaning thereof include its successors, administrators, executors and assigns).

2. AND WHEREAS the Purchaser has entered into a *contract for* _____*(Please specify the nature of contract here) vide Contract No.* _____*dated* _____(hereinafter referred to as the "Contract") with *M/s.*_____*,* (hereinafter referred to as "the Supplier", which expression shall unless repugnant to the context or meaning thereof be deemed to mean and include its successors and assigns) for providing of the Goods and/or services on the terms and conditions as more particularly detailed therein.

3. AND WHEREAS in conformity with the provisions of clause _____ *of Special conditions of Contract/GTC*, the Supplier has agreed to furnish a Bank Guarantee for an amount equivalent to the Advance Payment of Rs……. extended by the Purchaser to the Supplier for the faithful execution of the Contract.

4. AND WHEREAS the Supplier has agreed to provide the Purchaser and the Purchaser has agreed to accept the Advance Bank Guarantee for ____ percent (____%) of the total Contract Value from **[**_____**]** *(pl. specify the name of Bank)* having its head/registered office at **[**_____**]** through its branch in _____*(pl. specify the name of Branch through which B.G is issued)* hereinafter referred to as "the Bank", (which expression shall unless it be repugnant to the context or meaning thereof be deemed to include its successors and permitted assigns).

5. NOW THEREFORE, in consideration inter alia of the Purchaser granting the Suppliers the Contract, the Bank hereby unconditionally and irrevocably guarantees and undertakes, on a written demand, to immediately pay to the Purchaser any amount so demanded (by way of one or more claims) not exceeding in the aggregate [Rs.]……)*in words)* without any demur, reservation, contest or protest and/or without reference to the Supplier and without the Purchaser needing to provide or show to the Bank ,grounds or reasons or give any justification for such demand for the sum/s demanded.

6. The decision of the Purchaser as to whether the Supplier has fulfilled its obligation or not towards set-off of Advance Payment extended by the Purchaser to the Supplier shall be final and binding on the Bank and the Supplier. The Bank acknowledges that any such demand by the Purchaser of the amounts payable by the Bank to the Purchaser shall be final, binding and conclusive evidence in respect of the amounts payable by the Supplier to the Purchaser. Any such demand made by the Purchaser on the Bank shall be conclusive and binding, notwithstanding any difference between the Purchaser and the Supplier or any dispute raised, invoked, threatened or pending before any court, tribunal, arbitrator or any other authority.

7. The Bank also agrees that the Purchaser at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor without proceeding against the Supplier notwithstanding any other security or other guarantee that the Purchaser may have in relation to the Supplier's liabilities.

8. The Bank hereby waives the necessity for the Purchaser first demanding the aforesaid amounts or any part thereof from the Supplier before making payment to the Purchaser and further also waives any right the Bank may have of first requiring the Purchaser to use its legal remedies against the Supplier, before presenting any written demand to the Bank for payment under this Guarantee.

9. The Bank's obligations under this Guarantee shall not be reduced by reason of any partial performance of the Contract. The Bank's obligations shall not be reduced by any failure by the Purchaser to timely pay or perform any of its obligations under the Contract.

10. The Bank further unconditionally and unequivocally agrees with the Purchaser that the Purchaser shall be at liberty, without the Bank's consent and without affecting in any manner its rights and the Bank's obligation under this Guarantee, from time to time, to:

i. vary and/or modify any of the terms and conditions of the Contract;
ii. forebear or enforce any of the rights exercisable by the Purchaser against the Supplier under the terms and conditions of the Contract; or and the Bank shall not be relieved from its liability by reason of any such act or omission on the part of the Purchaser or any indulgence shown by the Purchaser to the Supplier or any other reason whatsoever which under the law relating to sureties would, but for this provision, have the effect of relieving the Bank of its obligations under this Guarantee.

11. This Guarantee shall not be discharged by any change in the constitution or composition of the Supplier, and this Guarantee shall not be affected or discharged by the liquidation, winding-up, bankruptcy, reorganisation, dissolution or insolvency of the Supplier or any of them or any other circumstances whatsoever.

12. This Guarantee shall be in addition to and not in substitution or in derogation of any other security held by the Purchaser to secure the obligations of the Supplier under the Contract.

13. NOTWITHSTANDING anything herein above contained, the liability of the BANK under this Guarantee shall be restricted to _____*(insert an amount equal to ___ percent (__%) of the Contract Value)* and this Guarantee shall be valid and enforceable and expire on _____*(pl. specify date)* or unless a suit or action to enforce a claim under this Guarantee is filed against the Bank on or before the date of expiry.

14. On termination of this Guarantee, all rights under the said Guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities hereunder.
15. The Bank undertakes not to revoke this Guarantee during its validity except with the prior written consent of the Purchaser and agrees that any change in the constitution of the Bank or the Supplier shall not discharge our liability hereunder.

16. Purchaser may assign this Guarantee to any Person or body whether natural, incorporated or otherwise under intimation to the Bank. The Bank shall be discharged of its obligations hereunder by performance in accordance with the terms hereof to such assignee without verifying the validity / legality / enforceability of the assignment.

17. This Guarantee shall be governed by the laws of India. Any suit, action, or other proceeding arising out of, connected with, or related to this Guarantee or the subject matter hereof shall be subject to the exclusive jurisdiction of the courts of _____ *(pl. specify the city)* , India.

Dated this ……. day of …….. …20XX at ……..

(Signature)
.....
(Name)
.....

(Designation with Bank Stamp)
Attorney as per
Power of Attorney No.....
Date.....

Annexure – FORMAT OF PERFORMANCE BANK GUARANTEE

(To be executed on a Non-Judicial Stamp Paper of appropriate value)

This Guarantee made at _____ this [___] day of [_____] 20XX

1. WHEREAS *M/s. _____(Pl specify the name of the Company)_,* a Company within the meaning of the Companies Act, 1956 having its Registered Office at _____ hereinafter referred to as the " Purchaser ", (which expression shall unless repugnant to the context or meaning thereof include its successors, administrators, executors and assigns).

2. AND WHEREAS the Purchaser has entered into a *contract for _____(Please specify the nature of contract here) vide Contract No. _____dated _____*(hereinafter referred to as the "Contract") with *M/s._____,* (hereinafter referred to as "the Supplier", which expression shall unless repugnant to the context or meaning thereof be deemed to mean and include their successors and assigns) for providing Goods and/or services on the terms and conditions as more particularly detailed therein.

3. AND WHEREAS as per clause ____ *of Special conditions of Contract/GTC*, the Supplier is obliged to provide to the Purchaser an unconditional bank guarantee for an amount equivalent to _____ percent (__%) of the total Contract Value for the timely completion and faithful and successful execution of the Contract from **[**_____**]** *pl. specify the name of Bank)* having its head/registered office at **[**_____**]** through its branch in _____*(pl. specify the name of Branch through which B.G is issued)* hereinafter referred to as "the Bank", (which expression shall unless it be repugnant to the context or meaning thereof be deemed to include its successors and permitted assigns).

4. NOW THEREFORE, in consideration inter alia of the Purchaser granting the Suppliers the Contract, the Bank hereby unconditionally and irrevocably guarantees and undertakes, on a written demand, to immediately pay to the Purchaser any amount so demanded (by way of one or more claims) not exceeding in the aggregate [Rs.]……(*in words)* without any demur, reservation, contest or protest and/or without reference to the Supplier and without the Purchaser needing to provide or show to the Bank ,grounds or reasons or give any justification for such demand for the sum/s demanded.

5. The decision of the Purchaser to invoke this Guarantee and as to whether the Supplier has not performed its obligations under the Contract shall be binding on the Bank. The Bank acknowledges that any such demand by the Purchaser of the amounts payable by the Bank to the Purchaser shall be final, binding and conclusive evidence in respect of the amounts payable by the Supplier to the Purchaser. Any such demand made by the Purchaser on the Bank shall be conclusive and binding, notwithstanding any difference between the Purchaser and the Supplier or any dispute raised, invoked, threatened or pending before any court, tribunal, arbitrator or any other authority.

6. The Bank also agrees that the Purchaser at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor without proceeding against the Supplier notwithstanding any other security or other guarantee that the Purchaser may have in relation to the Supplier's liabilities.

7. The Bank hereby waives the necessity for the Purchaser first demanding the aforesaid amounts or any part thereof from the Supplier before making payment to the Purchaser and

further also waives any right the Bank may have of first requiring the Purchaser to use its legal remedies against the Supplier, before presenting any written demand to the Bank for payment under this Guarantee.

8. The Bank's obligations under this Guarantee shall not be reduced by reason of any partial performance of the Contract. The Bank's obligations shall not be reduced by any failure by the Purchaser to timely pay or perform any of its obligations under the Contract.

9. The Bank further unconditionally and unequivocally agrees with the Purchaser that the Purchaser shall be at liberty, without the Bank's consent and without affecting in any manner its rights and the Bank's obligation under this Guarantee, from time to time, to:

(i) vary and/or modify any of the terms and conditions of the Contract;
(ii) Forebear or enforce any of the rights exercisable by the Purchaser against the Supplier under the terms and conditions of the Contract; or
(iii) Extend and/or postpone the time for performance of the obligations of the Supplier under the Contract;
and the Bank shall not be relieved from its liability by reason of any such act or omission on the part of the Purchaser or any indulgence shown by the Purchaser to the Supplier or any other reason whatsoever which under the law relating to sureties would, but for this provision, have the effect of relieving the Bank of its obligations under this Guarantee.

10. This Guarantee shall be a continuing bank guarantee and shall not be discharged by any change in the constitution or composition of the Supplier, and this Guarantee shall not be affected or discharged by the liquidation, winding-up, bankruptcy, reorganisation, dissolution or insolvency of the Supplier or any of them or any other circumstances whatsoever.

11. This Guarantee shall be in addition to and not in substitution or in derogation of any other security held by the Purchaser to secure the performance of the obligations of the Supplier under the Contract.

12. NOTWITHSTANDING anything herein above contained, the liability of the BANK under this Guarantee shall be restricted to _____*(insert an amount equal to ___ percent (__%) of the Contract Value)* and this Guarantee shall be valid and enforceable and expire on _____*(pl. specify date)* or unless a suit or action to enforce a claim under this Guarantee is filed against the Bank on or before the date of expiry.

13. On termination of this Guarantee, all rights under the said Guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities hereunder.

14. The Bank undertakes not to revoke this Guarantee during its validity except with the prior written consent of the Purchaser and agrees that any change in the constitution of the Bank or the Supplier shall not discharge its liability hereunder.

15. Purchaser may assign this Guarantee to any Person or body whether natural, incorporated or otherwise under intimation to the Bank. The Bank shall be discharged of its obligations hereunder by performance in accordance with the terms hereof to such assignee without verifying the validity / legality / enforceability of the assignment.

16. This Guarantee shall be governed by the laws of India. Any suit, action, or other proceeding arising out of, connected with, or related to this Guarantee or the subject matter hereof shall be subject to the exclusive jurisdiction of the courts of _____ *(pl. specify the city)* , India.

Dated this ……. day of …….. …20XX at ……

(Signature)
.....

(Name)
.....
(Designation with Bank Stamp)
Attorney as per
Power of Attorney No.....
Date.....

BSES Yamuna Power Limited

Beneficiary's bank detail with IFSC Code:

1. Name of the Bank: Axis Bank Limited

2. Branch Name & Full Address: C-58, Basement & Ground Floor, Preet Vihar, Main Vikas Marg, New Delhi 110092

3. Branch Code: 055

4. Bank Account No: 911020005246567

5. IFSC Code: UTIB0000055

Annexure – FORMAT OF WARRANTY/GUARANTEE CERTIFICATE-SUPPLY

BSES YAMUNA POWER LIMITED, Shaktikiran Building, Karkardooma, Delhi -110032.

Ref. Purchase Order No. :

Dear Sir,

We hereby confirm that the.....dispatched to BSES YAMUNA POWER LTD vide invoice no..... DT.....is exactly of the same nature and description as per above mentioned Purchase Order.

We further confirm that we will replace/repair our.....free of cost If found any manufacturing defect during.....months from the date of dispatch of material or.....months from the data of commissioning whichever is earlier.

Vendors Name & Signature

Annexure – WARRANTY / DEFECT LIABILITY PERIOD –SERVICE

Performance requirements of the works completed is as per detailed specifications and standards specified and to be adhered to strictly. In-case of deficiency, the same is to be rectified / redone to meet the specifications by the contractor within stipulated schedule or any extension thereof. The Contractor shall be liable to rectify all defects except those arising out of normal wear and tear, in the works done by the Contractor under this contract, or from any act or omission of the contractors for a period of 36 months will depend on individual contract period package to package from the date of Handing over the works to the Employer / Owner.

BSES Yamuna Power Limited

Annexure – NO DEMAND CERTIFICATE FORMAT

NO DEMAND CERTIFICATE BY CONTRACTOR
(To be issued on letterhead of Contractor)

To ,

BSES YAMUNA POWER LIMITED,
Shaktikiran Building, Karkardooma,
Delhi -110032.

Name of the Project:
Contract No.:
Date of Contract:
Name of the Contractor:

We, M/s _____(Contractor) do hereby acknowledge and confirm that we have claimed Rs. _____ (Rs. _____)
towards full and final settlement of our claims from BSES Yamuna Power Limited, in respect of the aforesaid WO/PO/Contract No.: #######. Dated. ####. including all amendments, if any, to the said Contract, to our entire satisfaction and we further confirm that we have no claim whatsoever pending with BSES Yamuna Power Limited under or in respect of the said Contract.

Notwithstanding any protest, note or objection recorded or raised by us in any correspondence, documents, measurement books and / or final bills etc.

(a) we confirm that BSES Yamuna Power Limited stands fully discharged of all its obligations,

(b) we shall make no claim of any nature on BSES Yamuna Power Limited or any of its affiliates or personnel, and

(c) we waive all our rights to lodge any claim or protest in future, in respect of the said Contract.

We have paid in full all applicable duties, levies, taxes and statutory and other amounts payable by us in connection with the above-mentioned Contract and amounts payable to or in relation to third parties engaged by us including our contractors, suppliers, employees and labour. No payment in this regard is pending or unpaid and we have no (and shall have no) claim against BSES Yamuna Power Limited in this regard.

No refund has been received/ is envisaged to be received or reasonably believed to be receivable on account of taxes, duties or any other payment made by us in respect of the Contract. In case any refund corresponding to any amount paid or reimbursed by BSES Yamuna Power Limited is received in the future, the same will be passed on to BSES Yamuna Power Limited promptly and without any demand from them in this regard.

We are issuing this "NO DEMAND CERTIFICATE" in favor of BSES Yamuna Power Limited with full knowledge of its contents and with our free consent without any influence, misrepresentation, coercion etc.

Date:
Place:

Signature:
Name:
Designation:
(Company Seal)

BSES Yamuna Power Limited

Annexure – FORMAT FOR LETTER OF INDEMNITY

Format for Letter of Indemnity
(Notes: Preferably shall be obtained on Stamp paper of appropriate value as applicable at the place of execution, if not, then at least on the letterhead of the Contractor)

Place:_____
Date: _____
To,

BSES Yamuna Power Limited, Shaktikiran Building, Karkardooma, Delhi -110032.

Dear Sirs,

WO/PO/Contract No. _____Dated _/__/___

For _____

Settlement of Dues
In consideration of your awarding the subject Work Order/Purchase Order/Contract to us and in further consideration of your having agreed to pay our final bill towards settlement of the dues in respect of the subject Work Order/Purchase Order/Contract, inter alia, on our assurances and representations that :
(a) We have paid in full all amounts payable by us including but not limited to duties, levies, taxes, cess, octroi, royalties, statutory payments, amounts payable to or in relation to third parties engaged by us including our contractors, suppliers, employees and labour, and
(b) we have fully complied with all requirements under applicable laws in connection with the subject Purchase Order/Work Order/Contract,
We_____,
unconditionally and irrevocably agree and undertake, to pay and/or settle entirely at our own cost and indemnify, defend and hold harmless you, your affiliates and your/your affiliates' personnel, directors and representatives, (hereinafter collectively referred to as "Indemnified Parties") from and against any and all liabilities, judgments, damages, losses, claims, costs and expenses, claimed, suffered or incurred or, likely to be claimed, suffered or incurred at any time by or against the Indemnified Parties or any of them as a result of, or arising out of, or in any way related to any failure or delay in payment of any of the amounts or compliances by us as aforesaid for any reason whatsoever.
Any notice(s) or communication(s) by you shall be sufficient proof that the Indemnified Parties have suffered or incurred loss, damages, liabilities etc. as aforesaid and we shall upon receipt of such notice(s) or communication(s) immediately, without any delay or demur or contest, make payment to you of the entire amount demanded under the said notice(s) or communication(s).
This letter of indemnity shall be in addition to and not in derogation of any other indemnity/ guarantee and/or security which we may have executed in your favor or your rights and entitlements under the contract.
This letter shall be governed by and construed and interpreted to accordance with the laws of India, and shall be subject to the exclusive jurisdiction of the courts of law at Mumbai.

Yours faithfully,

For M/s_____

Authorized Signatory

BSES Yamuna Power Limited

ANNEXURE - SCHEDULE OF DEVIATIONS

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

Unless **specifically** mentioned in this schedule, the tender shall be deemed to confirm the BYPL's specifications:

SL NO	Clause No.	Details of deviation with justifications

SCOPE OF WORK

FOR

MOTIA KHAN GRID S/S

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1.0 INTENT

- This document defines the scope for turnkey execution of system upgradation project at 33/11kV Motia Khan Grid Substation. This document shall be read in conjunction with all technical documents enclosed in the tender.
- In event of any contradiction between the tender documents, the most stringent one shall govern.

2.0 SITE DETAILS

- 33/11kV Motia Khan Grid Substation is situated Near Mangla Hospital Sadar Bazaar, New Delhi 110055. Motia Khan Grid is an air insulated (outdoor) substation having one bus with sectionaliser configuration contains (a) 4 line bays (b) 3 Transformer Bays (c) 1 Bus Sectionaliser Bay
- Bidder shall depute its representative at site to assess the condition of existing infrastructure in detail prior to submission of bid.

3.0 BIDDER'S SCOPE

- Bidder's Scope includes design, engineering, manufacture, shop testing, inspection, packing, dispatch, supply, loading, unloading, storage at site, assembly, erection, civil, structural, architectural work, complete pre-commissioning checks, testing & commissioning at site, obtaining statutory clearance & certification from Electrical Inspector and handing over of equipment covered under scope of this document to BSES Yamuna Power Ltd.
- Details are given in subsequent sections. It shall be noted that project execution shall ensure uninterrupted operation of grid.

3.1 DESIGN & ENGINEERING

- Detailed design and engineering of complete project as per tender requirements shall be in bidder's scope. General guidelines for design are given below

3.1.1 CODES AND STANDARDS

- The bidder shall comply with latest Indian/International standard and CEA regulations. Refer respective equipment specification for applicable standards.

3.1.2 SERVICE CONDITIONS

3.1.2.1	Average grade atmosphere	Heavily polluted, Dry
3.1.2.2	Maximum altitude above sea level	1000M
3.1.2.3	Ambient air temperature	Highest 50Deg C,Average 40Deg C
3.1.2.4	Minimum ambient air temperature	0 Deg C
3.1.2.5	Relative Humidity	100%
3.1.2.6	Rainfall	750mm concentrated in four months
3.1.2.7	Seismic Condition	Zone IV
3.1.2.8	Max. Relative Humidity	100%

3.1.3 SYSTEM PARAMETERS

3.1.3.1	Nominal Voltage kV	33	11
3.1.3.2	Rated voltage kV	36	12

3.1.3.3	Power Frequency (kV rms) with stand voltage	70	28
3.1.3.4	Basic Insulation Level KVp	170	75
3.1.3.5	Rated Frequency Hz	50 +/- 5 %	50 +/ - 5 %
3.1.3.6	System Neutral Earthing	Solidly Grounded	Solidly Grounded

3.2 SCOPE OF SUPPLY

S No.	Items	Remarks	UOM	Qty	Specification Number
3.2.1	33 kV GIS with Double Bus Bar Arrangement as per SLD Attached	a) For converting Outdoor Yard into Indoor Switchgear. b) Arrangement also includes Bus Riser Panel wherever applicable			SP-MVGIS-24-R3
3.2.1.1	Incomer Feeder with Line PT		Nos	4	
3.2.1.2	Transformer Feeder		Nos	4	
3.2.1.3	Bus Coupler		Nos	1	
3.2.1.4	Bus PT		Nos	2	
3.2.2	25 MVA, 33 kV/11 kV Power Transformer (Including Marshalling Box and NIFPS)		Nos	1	SP-TRPU-01-R4
3.2.3	11 kV Switchboard	Arrangement also includes Bus Riser Panel wherever applicable			SP-HTSWG-01 –R3
3.2.3.1	Incoming panel (with Line PT)		Nos	1	
3.2.3.2	Bus Coupler Panel(Having Provision for termination of 3 x 1c x 1000sqmm cable per phase)		Nos	1	
3.2.3.3	Bus PT		Nos	1	
3.2.3.4	Capacitor Panel		Nos	1	
3.2.3.5	Outgoing Panel		Nos	8	
3.2.3.6	Adaptor Panel (For coupling existing 11 kV switchboard to New 11 kV Switchboard panel. Panel shall have provision for termination of 3 x 1c x 1000sqmm cable per phase.)		Nos	1	
3.2.4	11 kV Auto Switched Capacitor Bank		Nos	1	SP-ASCB-82-R2

S No.	Items	Remarks	UOM	Qty	Specification Number
3.2.5	Straight Through Joint for 33kV 3c x 400sqmm cable	For joining power cable and extending power cable from Yard to GIS Panel Room	Nos	8	SP-HCSTJ-03-R1
3.2.6	GIS termination kit for 33kV, 3c x 400sqmm cable	For termination at 33kV GIS	Nos	16	
3.2.7	End Termination kit for 33kV, 3CX400 sqmm Cable	For connecting cable to the bushing of power Transformers	Nos	8	
3.2.8	End termination kit for 11kV, 1c x 1000sqmm cable	a) For Terminating 11 kV Cables at all 11 kv incomer end(1 New and 3 Existing Switchgears) b) For Terminating 11 kV Cables at all Transformer end(1 New and 3 Existing Power Transformers) c) For coupling bus of new 11 kV Switchboard and existing 11 kV Switchboard	Set	72	SP-HSGTK-04-R1
3.2.9	End Termination kit for 11kV, 3c x 300sqmm cable	For Terminating 11 kV Cables at 11 kV Capacitor Bank end and 11 kV Capacitor Panel end	Nos	4	
3.2.10	400 KVA Station Transformer		Nos	1	SP-TRDU-01-R6
3.2.11	Fire Resistant Coating	a) On all cable specified in “Scope of Supply” and “Free issue Items” b) Fire rating-4 hours	LOT	1	
3.2.12	Cable Sealing System	For all cables entering and exiting the Proposed Susbtation Building	LOT	1	
3.2.13	Cable Support Structure	Mounting Cable for four Power Transformers, Switchgear etc	LOT	1	
3.2.14	Clamps, Connectors & Accessories	For All four Power Transformers (One new and three Existing)	LOT	1	
3.2.15	Insulating Sleeves	For 33 kV and 11 kV side Transformer bus bars	LOT	1	
3.2.16	AC Distribution Board		Nos	1	SP-ACDB-113-R0
3.2.17	DC Distribution Board		Nos	1	SP-DCDB-129-R0
3.2.18	SMPS Battery Charger		Nos	1	SP-SMPSBC-153-R0

S No.	Items	Remarks	UOM	Qty	Specification Number
3.2.19	50 V Li Ion Battery Bank	Battery bank shall be installed at existing Battery Bank Room	Nos	1	SP-TSLBB-137-R0
3.2.20	Control Cables with proper ferruling and tagging along with glands and lugs	a) For items specified in "Scope of Supply" including interlocks with existing system b) From Marshalling Box of Existing Power Transformers to 33 KV & 11KV Switchgear Panel c) For Equipment to be shifted	LOT	1	SP-EWLP-01-R1
3.2.21	LT Power Cable	a) For items specified in "Scope of Supply" b) For Equipment to be shifted c) Battery charger to Li Ion Battery Bank	LOT	1	SP-LTPC-63-R0
3.2.22	Insulated Floor Coating	Complete Switchgear Room(Newly Built)	LOT	1	SP- INSFLR-103-R0
3.2.23	Cable Tray including bends etc with 50% spare capacity in each	a) For routing Power, LT and Control Cables b) For items specified in "Scope of Supply" and "Free Issue Items" c) 50% spare capacity in each is tray is required	LOT	1	
3.2.24	Complete Grid Earthing	a) Earthing of all Grid Substation(Including earthing of existing equipment and Newly installed Equipment) b) Complete earthing of outdoor yard c) Joining of new earthing with old one shall also be in vendor's scope d) Soil resistivity test shall also be in vendor's scope	LOT	1	SP-GES-107-R0
3.2.25	Fire protection system	For items specified in "Scope of Supply"	LOT	1	SP-TSFPMK-134-R0
3.2.26	Illumination and lighting system	a) For items specified in "Scope of Supply" b) For Proposed Substation Building c) For Outdoor Yard	LOT	1	SP-TSILS-135-R0

S No.	Items	Remarks	UOM	Qty	Specification Number
3.2.27	Exhaust and Ventilation system	For Proposed Building	LOT	1	SP-EVS-130-R0
3.2.28	Lightning Protection	For Outdoor Yard and Proposed Substation Building	LOT	1	
3.2.29	Conduits	For Lighting, Ceiling Fans, Power Sockets, Exhaust Fans, etc.	LOT	1	
3.2.30	Material for Civil Works	As specified in Scope of Work	LOT	1	SP-TSCWMK-132-R1
3.2.31	Motorized De watering Facility	For water seepage	LOT	1	
3.2.32	Associated SCADA Works		LOT	1	SP-TSSNI-136-R0
3.2.33	Painting of Feeder names (SCADA code, Asset Code, etc)	As per Engineer Incharge Guidance	LOT	1	
3.2.34	Licensed programming software and communication cord for offered numerical relays		No	1	
3.2.35	Special Tools with almirah (For Storing Spares/Tools)	a) One for Tools b) One for Recommended/Mandatory Spares	No	2	
3.2.36	SLD of Grid	Covered In Acrylic Sheet	No	1	
3.2.37	Emergency Exit Floor Marking	For Proposed Substation Building	LOT	1	
3.2.38	A-Type ladder (3 feet height) to be supplied.(For viewing and operating Relays)		No	1	
3.2.39	Recommended/Mandatory Spares as per Specification		LOT	1	

3.3 SCOPE OF WORK

- Broad scope of work is specified below. Refer respective equipment/work specifications for detailed scope of work.

S. No	Items	Remarks	Unit	Qty
3.3.1	Erection, Testing and Commissioning of all items specified in “Scope of Supply”		LOT	1
3.3.2	Erection, Testing and Commissioning of all items		LOT	1

S. No	Items	Remarks	Unit	Qty
	specified in "Free Issue Items"			
3.3.3	Training on O&M of 33 KV GIS	One day classroom training at BYPL Training Centre and one day onsite training. Training shall be provided by Domain experts only	Days	2
3.3.4	Training on application, programming, testing and commissioning of Numerical Relays	One day classroom training at BYPL Training Centre and one day onsite training. Training shall be provided by Domain experts only	Days	2
3.3.5	Training on commissioning, operations and maintenance of 11KV Switchgear	One day classroom training at BYPL Training Centre and one day onsite training. Training shall be provided by Domain experts only	Days	2
3.3.6	Training on commissioning, operations and maintenance of NIFPS	One day classroom training at BYPL Training Centre and one day onsite training. Training shall be provided by Domain experts only	Days	2
3.3.7	Civil Works	a) For details refer spec no. SP-TSCWMK-132-R1 b) For items specified in "Scope of Supply" , "Free issue Items"		
3.3.7.1	Foundation Works		LOT	1
3.3.7.2	Channel angle arrangement		LOT	1
3.3.7.3	Leveling		LOT	1
3.3.7.4	Soil Testing	For Designing Purpose	LOT	1
3.3.7.5	Designing and Drawing		LOT	1
3.3.7.6	Demolishing of Building to FGL	Demolishing of Building Consisting of Cash office and its nearby Area of Motia Khan Grid S/S. Area to be demolished is 23.5m X 5.5 mm X Height (As per Site Condition)	LOT	1
3.3.7.7	Trench		LOT	1
3.3.7.8	Checkered Plate		LOT	1
3.3.7.9	Sump Pit	a) Joining of all Power Transformer (Existing + Proposed) with Respective Soak Pit b) Capacity=20000 Litre	No	1
3.3.7.10	Soak Pit	For New Power Transformer	No	1
3.3.7.11	Fire Walls		LOT	1

S. No	Items	Remarks	Unit	Qty
3.3.7.12	Fencing		LOT	1
3.3.7.13	New Gate	For Power Transformer Entry and Exit	No	1
3.3.7.14	Road	For Power Transformer Entry and Exit	LOT	1
3.3.7.15	Yard Development	For Complete outdoor Yard Area	LOT	1
3.3.7.16	Dismantling of Old items mentioned and shifting/disposing as per Site Engineer	a) ACDB, DCDB, Station Transformer, Outdoor Yard (including Foundations, Structures, Battery Charger, BMKs, CTs, PTs, CVT,s,, LAs, Isolators, Circuit Breakers etc) CRPs, RTCC Panels, cables, Battery Bank and its structure b) It also includes disconnection and reconnection of Power and Control cable of equipment specified above	LOT	1
3.3.7.17	Shifting of Cash Office	a) Existing Cash Office has to be shifted in the same grid S/S b) It includes dismantling of Existing Cash office and Construction of cash office within Grid Premise with Dimension 3.5 m x 7m x 3.5 m c) Cash office shall have 2 Cash Counters, Computer, UPS, Almirah, Water cooler, AC, Place for customer to stand. Fans, tube lights, power points.	LOT	1
3.3.7.18	Tree Cutting	a) If required, Tree cutting shall be in vendor's scope b) Permission for the same from competent authority shall also be in vendor's scope	LOT	1
3.3.7.19	Substation Building	At the place of demolished Area	No	1
3.3.7.19.1	Foundation		LOT	1
3.3.7.19.2	Windows		LOT	1
3.3.7.19.3	Doors		LOT	1
3.3.7.19.4	Support Structure	a) For Power Cables and control cables in cable cellar room b) For Cables terminating at 11 kV and 33 kV switchgear	LOT	1

S. No	Items	Remarks	Unit	Qty
3.3.7.19.5	Staircase		LOT	1
3.3.7.19.6	Flooring		LOT	1
3.3.7.19.7	Finishing		LOT	1

3.4 SCOPE DEMARCATION

S. No	Head	BYPL	Bidder's Scope	Remarks
3.4.1	Testing Equipments	✗	✓	
3.4.2	Lighting Arrangement	✗	✓	
3.4.3	Construction Power and Construction Water	✗	✓	
3.4.4	Safety and Security of Manpower(Labor, Engineers, Supervisors etc)	✗	✓	
3.4.5	Various Tools and Tackles related to Job	✗	✓	
3.4.6	Loading, Unloading and Transportation of Material	✗	✓	It includes transportation of dismantled equipment to BYPL store in stacked manner. It also includes Free Issue Items
3.4.7	Cleanliness around work premises	✗	✓	
3.4.8	Document/Drawing Submission	✗	✓	
3.4.9	Document/Drawing Approval	✓	✗	
3.4.10	Security and Safety of material until handover	✗	✓	
3.4.11	Various Machines e.g. Crane, Hydra, JCB etc to complete the Job	✗	✓	
3.4.12	Maintenance of Equipments Until Handover to Engineer Incharge and EHV O&M	✗	✓	
3.4.13	Electrical Inspector Clearance	✗	✓	Only statutory fees will be borne by BYPL
3.4.14	Permit issuing agency for Works inside BYPL Premises	✓	✗	
3.4.15	Permit requesting Agency	✗	✓	Permit Should be applied to Engineer In charge prior to start of work. Isolation & permit of only one Feeder at a time, shall be given at a time, during final hook up. All necessary preparation

S. No	Head	BYPL	Bidder's Scope	Remarks
				works to be made, in order to minimize the Shutdown Time.
3.4.16	Temporary office near work premises	✘	✓	After handing over the equipments, contractor has to evacuate the premises within one week otherwise deemed fit action will be taken
3.4.17	Temporary store near work premises	✘	✓	
3.4.18	Yard aesthetics at work place should be maintained at the time and after the completion of Work	✘	✓	Disposal of Scrap/Debris etc from site and complete cleaning of working area till handover
3.4.19	Any damages done to the existing system, shall be repaired/ rectified/ replaced	✘	✓	
3.4.20	Clearance certificate	✘	✓	Clearance Certificate shall be taken from BYPL Departments (Quality, Safety, Protection, O&M, SCADA, EHV, Civil, etc) before Final Charging of the Systems. Any Site Observations/ Punch points, observed during execution, shall be attended.
3.4.21	Various compliances pertaining to Job	✘	✓	IE rules, CEA Regulation 2010

3.5 DOCUMENTATION

- Following drawing/document are required for all equipment specified in “Scope of Supply” (Refer equipment specification for details)
- Deficient/ improper document/ drawing submission shall be liable for rejection.
- Document check sheet compliance shall be provided at respective stage i.e. Technical bid, Drawing Approval, Pre Dispatch, Pre closure.
- No submission is acceptable without check list compliance.
- Order of documents shall be stricty as per the technical bid check list.
- Note- Any drawing not included in the above table but necessary for detailed engineering shall be deemed to be included in bidder’s scope.

S. No.	Description	Technical Bid	Drawing Approval	Pre-Dispatch	Pre-Closure
3.5.1	Tender No.	Required			
3.5.2	Communication Details				
3.5.2.1	Name of the Bidder	Required			
3.5.2.2	Name of Authorized contact	Required			

S. No.	Description	Technical Bid	Drawing Approval	Pre-Dispatch	Pre-Closure
	person				
3.5.2.3	Contact No. of Authorized contact person	Required			
3.5.2.4	E-mail id of Authorized contact person	Required			
3.5.3	Document Submission Format				
3.5.3.1	Documents shall be submitted in Box file/spiral binding. Any other format is not acceptable	Required			
3.5.3.2	Index of documents with page numbers for each document	Required			
3.5.3.3	Separator with document description shall be provided before each document	Required			
3.5.4	Qualifying Requirement Compliance				
3.5.4.1	Summary of compliance of qualifying criteria in tabular form along with summary of documentary proof provided	Required			
3.5.4.2	Detailed Documents supporting compliance of qualifying criteria	Required			
3.5.5	Drawings/ Documents as per Technical Specification.				
3.5.5.1	Signed copy of technical specification	Required			
3.5.5.2	Type Test reports of offered model/ type/ rating	Required	Required		
3.5.5.3	Deviation Sheet	Required			
3.5.5.4	Detailed Drawings	Required	Required		
3.5.5.5	Other drawing/ documents mentioned in technical specification	Required	Required		
3.5.5.6	Soft copy of complete technical bid in pen drive	Required			
3.5.5.7	Samples as per technical specification.	Required			
3.5.5.8	Design Calculation		Required		
3.5.5.9	Manufacturer's quality assurance plan		Required		
3.5.5.10	GTP		Required		
3.5.5.11	Inspection Reports			Required	
3.5.5.12	As manufacturing Drawings			Required	
3.5.5.13	Operation and Maintenance Manual			Required	

S. No.	Description	Technical Bid	Drawing Approval	Pre-Dispatch	Pre-Closure
3.5.5.14	As built Drawings				Required
3.5.6	Soft Copy				
3.5.6.1	Technical Bid in Pen drive	Required			
3.5.6.2	Through Mail		Required	Required	Required

4.0 FREE ISSUE ITEMS

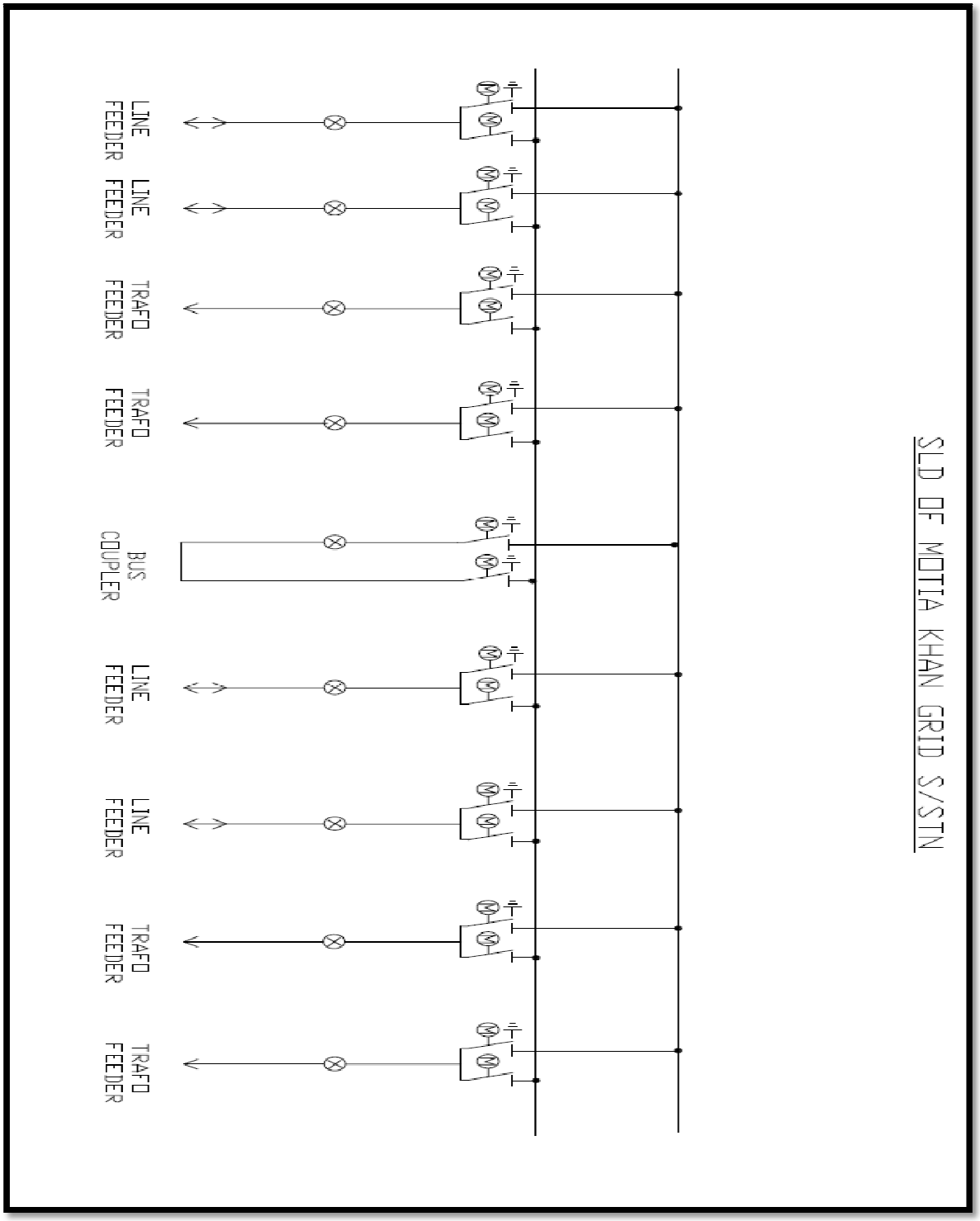
S No.	Description	UOM	Qty	Remarks
4.1	33 kV 3CX400 XLPE insulated, stranded aluminum conductor, PVC outer sheath Power cable	LOT	1	a) For extending incoming supply from outdoor yard to 33 kV incoming panels b)For connecting all four power Transformer (One new and three Existing) from 33 kV Trafo panel
4.2	11 kV 1CX1000 sqmm XLPE insulated, stranded Aluminium conductor, PVC outer sheath cable	LOT	1	a) For 11 kV Bus Coupling by Adaptor panel & Bus Coupler panel b) All four Power transformer (One new and three Existing) to 11 kV incoming Panel
4.3	11 kV 3CX300 sqmm XLPE insulated, stranded aluminum conductor, PVC outer sheath Power cable	LOT	1	For 11 kV Capacitor Bank

5.0 APPROVED MAKE LIST

- Following table contains Approved Make List. Although, Any make other than specified in table shall be subject to BSES Yamuna Power Limited Approval.

S. No	Equipment	MAKE
5.1	Power Transformer	ABB/Schneider/Siemens/Transformer & Rectifiers/ EMCO/ Bharat Bijlee/ BHEL/Toshiba/Voltamp/CGL
5.2	33 kV GIS	ABB/Siemens/Schneider
5.3	11 kV AIS	ABB/Siemens/Schneider/CGL
5.4	11 kV Auto Switched Capacitor bank	ABB/ EPCOS/Shreem
5.5	Control cable	Universal/KEI/GEMSCAB/Polycab/Torrent/Sterlite
5.6	Numerical relays	ABB (R series), Siemens (Siprotec series) and Schneider / Alstom (Micom Series)
5.7	Cable sealing system	Roxtec, MCT Brattberg
5.8	Fire retardant coating for cables	3M/Demech/Stanvac
5.9	Floor coating	3M/Demech/Stanvac

6.0 SINGLE LINE DIAGRAM OF 33kV GIS



TECHNICAL SPECIFICATION

FOR

33KV GAS INSULATED SWITCHGEAR

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1.0 REVISION RECORD

S. No	Item/ Clause No	Change/ Addition	Reason of Change/Addition
1.1	6.3.1	Introduction of Alarm and Lockout Stage in pressure indicators	Provision of two stage alert for gas pressure
1.2	6.12	Panel Dimension details specified	For standardization
1.3	7.2.2	Inclusion of provision for manual operation of three position disconnector	Operational flexibility
1.4	12.1	Current Transformer Type has been changed from cast resin to Solid insulation with class of E or better.	Inclusion of all solid insulated CTs
1.5	14.1.1	Power Cable Termination from front/rear only	For ease of Maintenance
1.6	14.1.2	Inclusion of Adaptor Plug	For ease of Maintenance
1.7	15.8	Space requirement for energy meter specified	For energy meter installation
1.8	16.0	Multifunction Meter included	Metering data integration with SCADA
1.9	21.1.6	Inclusion of IEC 61850 Communication protocol in Relays	Adoption of latest protocol for relay communication
1.10	21.2.1	Inclusion of Back up distance protection in Incomer relay if line differential relay is taken as primary protection. Provision of relay at both ends have also been included	For Backup Protection
1.11	27	Inclusion of Drawing and Data Submission Matrix	To streamline drawing/document submission
1.12	Annex A (S.no 1.7)	Inclusion of IEC 61850 Communication protocol in AVR	Adoption of latest protocol for relay communication
1.13	Annex D (S.no 23)	SCADA Spares	To meet contingency

2.0 SCOPE

a. This specification covers the design, manufacture, testing, supply, erection & commissioning of 33kV, Gas Insulated (GIS), metal-enclosed and factory assembled switchgear.

b. This specification shall be used in conjunction with all specifications, switchgear data sheets, 33kV switchgear single line diagrams, and other drawings attached to the specification / purchase requisition.

3.0 CODES & STANDARDS

Materials, equipment and methods used in the manufacture of switchboards shall conform to the latest edition of following –

3.1	Indian Electricity Rules 1956	Latest edition
3.2	Indian Electricity act 1910	Latest edition
3.3	Switchgear and control gear	IEC : 60694, IEC: 60298, IEC : 62271-200, IEC : 60529, IS: 3427, IS: 12729, IS: 12063, IS: 13947, IS: 9046
3.4	Circuit breaker	IEC 62271 - 100, IS 13118, IS 2516
3.5	Isolators & earthing switches	IEC 62271 - 102
3.6	Current transformers	IS:2705, IEC:60185
3.7	Voltage transformer	IS:3156, IEC:60186,
3.8	Indicating Instruments	IS:1248
3.9	Energy meters	IS 13010
3.10	Relays	IS:8686, IS:3231, IS:3842
3.11	Control switches and push buttons	IS 6875
3.12	HV fuses	IS 9385
3.13	Arrangement of Switchgear bus bars, main connections and auxiliary wiring	IS:375
3.14	Code of practice for phosphating iron & steel	IS 6005
3.15	Colours for ready mixed paints	IS 5
3.16	Code of practice for installation and maintenance of switchgear	IS 3072

4.0 SERVICE CONDITIONS

4.1	Location	Indoor
4.2	Average grade atmosphere	Heavily polluted, Dry
4.3	Maximum altitude above sea level	1000M
4.4	Ambient air temperature	Highest 50^0C Average 40^0 C
4.5	Minimum ambient air temperature	0^0C
4.6	Relative Humidity	100%
4.7	Rainfall	750mm concentrated in four months
4.8	Seismic Zone	IV

5.0 ELECTRICAL SYSTEM

5.1	Type	Switchgear shall be 33kV, 3 phase, 3 wire, 50Hz,
5.2	Earthing type	Solidly Earth
5.3	Fault Current	26.3 kA for 3 sec
5.4	Rating	As per Annexure –B (Technical Particulars) and Annexure-F (SLD)

6.0 PANEL CONSTRUCTION

6.1	Structural Requirements	Switchgear shall be an indoor gas insulated and metal-clad cubicle design with single/double bus bar system in accordance with tender requirement. Refer technical particulars given in Annexure-B and SLDs given in annexure-F for details. Each Panel shall be metal enclosed, free standing, floor mounting, flush fronted and arranged to form a single structure with a common bus bar assembly. Construction, including cable entry, shall be vermin proof.
6.2	Compartments	Switchgear should be completely partitioned from panel to panel. Also, each panel should have separate compartments for the following- a. Busbars b. Circuit breakers c. Incoming/Outgoing power cables d. LV compartment
6.3	High Voltage Compartments for Busbar and CB	All high voltage parts (Including bus bars, core module with built in circuit breaker etc.) shall be located in a metal enclosure filled with an insulating inert gas. Gas leakage rate for all gas filled compartments should be less than 0.5 % per annum. Bidder shall specify the type, quantity and operating pressure for all gas filled compartments or equipment. Degree of protection for HV compartment should be IP65.
6.3.1	Pressure Indicators	A pressure indicator shall be provided for each gas filled compartment and include a set of changeover contacts with two stage alert i.e alarm and lockout. Alarm stage shall be set appropriately to alert the operator of the reduction in gas pressure. Lockout stage shall be set to avoid any mal-operation in absence of gas pressure.
6.4	HV Cable compartment	Each panel shall have an air-insulated cable connection compartment. Cable connection compartment shall contain the cable sockets accessible for fitting of the power cable plugs and the test cable sockets. Cable compartment shall also include provisions for conventional VT plug in connections. Cable compartment should be IP4X compliant.
6.5	Low voltage compartment	It should contain the switch operating mechanisms and all secondary equipment including the protection and control system. All operating mechanisms shall be motorized. Manual operation switches and mechanical position indicators shall also be provided. Degree of protection for LV compartment should be IP4X.

6.6	Safety from Internal faults	The structure, including doors and panels, shall be capable of withstanding the internal pressures created by faults within the structure (equal to the maximum fault-current rating) without danger to the operating personnel. Type test reports regarding internal arc withstand performance shall be available with bids.
6.6.1	Passive Protection from internal faults	A passive safety section shall ensure that hot gases shall be guided via pressure relief disks from each compartment. The pressure relief duct ends shall be guided to open air or fitted with absorbers to cool the hot gases. Relief into a cable basement or cavity below a false floor is not acceptable. Hazards to persons or risk of fire shall be reliably prevented. An arcing fault in one compartment should not cause major damage to other compartments. Structure shall be provided with barriers to prevent the transfer of ionized gases between two adjacent compartments except bus chamber. Separate pressure relief vents shall be provided in bus bar, cable and circuit breaker compartments to release arc fault pressure quickly and safely. The orientation of pressure relief vents and gas exhaust ducts as necessary shall be coordinated with BUYER at the bid stage.
6.6.2	Internal arc classification	As per Annexure-B (Technical Particulars)
6.7	Workability	Switchgear shall be designed and constructed to facilitate inspection, cleaning, repair and maintenance and to ensure absolute safety during such work. Interlocks, busbar shutters and covers shall be provided to prevent incorrect or unsafe operation and to prevent access to live parts. It shall be possible to work safely within individual panels, such as equipping and commissioning of spare panels as well as connecting main, control and auxiliary cabling, while the remainder of the switchgear is energized.
6.8	Interchange-ability	Similar parts and components shall be interchangeable wherever practical. An interlock system shall be provided to prevent the interchange of modules with higher current rating with modules of lower current rating. Replacement of circuit breaker module shall be without interfering busbar operation and without gas work.

6.9	Doors and Covers	a. All doors, hinged covers, and hinged panels larger than 0.36 m^2 in area shall open at least 95 degrees and be equipped with doorstops to hold them in the open position. Door swing must allow withdrawable equipment to be withdrawn. All such doors and hinged covers shall be equipped with handles and secured by captive bolts, lockable with a key or pad-lockable. b. Breaker compartment door shall open and close without obstruction with and without rubber mats laid in front of the switchgear. Door of one panel should not cause hindrance for opening of adjacent panel.
6.10	Cover Plates	All cover plates that exceed 0.7 m^2 that require removal for installation or maintenance of the equipment shall be equipped with lifting handles and self-supporting lips. With the exception of the backs of panels cover plates shall not exceed 1.1 m^2 in area or 27 kg in weight, unless they are hinged and bolted or locked. Cover plates shall be secured using captive bolt fixings.
6.11	Test Facilities	Each panel shall be provided with test facilities to allow for: a. Voltage testing of the primary circuit at rated voltage with all parts connected to the facility b. Current testing of primary circuit (primary injection test) c. Protection testing suitable for continuous operation at maximum current d. Access for test devices shall be clearly identified and covers shall be secured using captive fixings that require the use of a tool for access. Provision shall be included to secure the test devices in the test position.
6.12	Panel Dimension	Maximum 2700mm, Operating height maximum 1600mm, Width-600 mm, Depth- 1800 mm
6.13	Extensibility	Switchgear shall be arranged to permit future extension at both ends. Bidder shall confirm the minimum safe operational clearances around the switchgear.
6.14	Panel Base Frame	Steel Base frame as per manufacturer's standard. Bidder shall provide facilities for bolting the switchgear to its foundation. Such facilities shall be suitable for the specified seismic service.
6.15	Non- tiered construction	Incoming and bus-section units shall be located in non-tiered separate panels.

7.0 CIRCUIT BREAKER & THREE POSITION DISCONNECTOR

7.1	Circuit Breaker	
7.1.1	Interrupting medium	Vacuum in SF6 filled compartment
7.1.2	Breaker operation	Three separate identical single pole units operated through a common shaft
7.1.3	Operating Mechanism	Re-strike free, Trip free, with electrical anti-pumping feature
7.1.4	Type	Motor wound, spring charged, stored energy type with manual charging facility
7.1.5	Operation on supply failure	One O-C-O operation possible after failure of power supply to the spring charging motor
7.1.6	Shunt Release	For closing and tripping
7.1.7	Number of Trip coils	Two
7.1.8	Push buttons	a. Manual / mechanical ON/ OFF / Emergency trip push button b. Emergency Off push button should be provided with a protective flap. c. Mechanical ON shall have padlocking facility d. Labels giving clear instructions for manual operation should be provided wherever appropriate
7.1.9	Mechanical Indications	a. On-Off b. Operation counter c. Mechanism charge/discharge
7.1.10	Position detection	Through proximity sensors/Aux Switches
7.1.11	Breaker Control	On panel front only
7.1.12	Technical particulars	As per Annexure-B
7.2	Three position disconnector	
7.2.1	Functions	Three phase, three position suitable for- a. Connecting b. Disconnecting c. Earthing
7.2.2	Type	Motorized with provision for local and remote operation. Operation of earth switch should be through local only. Provision for Manual operation shall also be there.
7.2.3	Position detection	Through proximity sensors/Aux Switches
7.2.4	Mechanical indications	Earthing switch close/open.
7.2.5	Padlocking facility	For locking the earthing device in the open and close position.
7.2.6	Rating	Continuous and Short circuit rating should be same as specified for switchgear.

8.0 FUNCTIONAL REQUIREMENTS

8.1	Mechanical and electrical interlock	a. To prevent earthing of an incoming supply which has not been isolated b. To prevent switching on an incoming supply which is earthed c. To prevent earthing of feeder circuit when the circuit breaker is in the closed position d. To prevent switching on a circuit breaker when the feeder is earthed
8.2	Breaker Operation	
8.2.1	Closing from local	Only when local/remote selector switch is in local position
8.2.2	Closing from remote	Only when local/remote selector switch is in remote position
8.2.3	Tripping from local	Only when local/remote selector switch is in local position
8.2.4	Tripping from remote	Only when local/remote selector switch is in remote position
8.2.5	Tripping from protective relays	Irrespective of position of local/remote switch
8.2.6	Trip circuit supervision	To be given for breaker close & open condition
8.2.7	Trip circuit supervision relay contact	For indication, alarm & to inhibit closing of breaker
8.2.8	Emergency trip push button contact	Wired directly to trip coil (wired to Master trip relay if second trip coil provided)
8.2.9	Emergency trip push button contact	Wired to inhibit closing of breaker
8.2.10	Master trip relay contact (if given)	Wired to inhibit closing of breaker
8.3	DC control supply bus in all panels	Fed by two DC incoming sources in Bus coupler panel with auto changeover facility
8.4	PT supply bus in all panels	Fed normally by bus PT with automatic changeover facility to incomer line PT

9.0 BUSBARS

9.1	Material	Hard drawn electrolytic copper
9.2	Cross section	Uniform throughout length of switchgear
9.3	Phase busbars	The phase busbars shall be enclosed in individual or a combined gas filled compartment. Busbars shall be silver or tin-plated at joints. Provision shall be made at the bolted connections to enable accessibility for maintenance and extension where appropriate.
9.4	Marking	All busbars and cable connections shall be marked to indicate the phase colouring, which shall be red, yellow and blue unless otherwise specified or explicitly precluded by relevant national standards.

9.5	Earth busbar	An earth busbar, sized for the earth fault rating of the electrical system and switchgear, shall be provided along the full length of the switchgear structure. The earth busbar shall have provision for earth cable connections at each end.
9.6	Supports	All phase and earth busbars and connections shall be sized, braced and supported to withstand the dynamic, dielectric stresses and thermal affects resulting from the switchgear rated short circuit current over the full length of the switchgear and carry certification from a recognized testing authority.
9.7	Rating	As per Annexure – B (Technical particulars) and Annexure-F (Single line diagram).

10.0 EARTHING

10.1	Earthing of enclosure & non -current carrying parts	All metallic non-current carrying parts of the switchgear shall be bonded together and connected to the switchgear earth busbar. The frame of each functional unit and each device requiring earthing shall be connected directly to the earth busbar. For direct connection to the station earthing grid, earthing bolts of at least 10mm shall be provided at both ends of the main earth bar.
10.2	Busbar and Feeder Earthing	Through three position switch
10.3	Circuit breaker frame earthing	Integral earthing shall be provided on feeder/incoming circuit breakers for cable earthing, and on incoming or bus coupler circuit breakers for busbar earthing.
10.4	Earthing of withdrawable parts	Withdrawable parts shall be effectively earthed until they are completely withdrawn with all power and control connections disconnected.
10.5	Cable armour Earthing	Provision shall be made, adjacent to the cable termination, for connecting earthing cable armouring to the earth busbar.
10.6	Hinged doors	Earthed through flexible copper braid
10.7	Metallic cases of relays, instruments and other LT panel mounted equipment	Connected to the earth bus by independent copper wires of size not less than 2.5 sq. mm with green colour insulation. For this purpose LT compartment should have a clear designated earth bus to which earth connections from all components are to be connected.
10.8	CT and PT neutral	Earthed at one place at the terminal blocks through links.
10.9	Instructions	Clear instructions, preferably pictorial, shall be provided showing methods of earthing wherever appropriate.

11.0 SURGE SUPPRESSOR

11.1	Provision	To be provided in all panels except bus coupler and BPT.
11.2	Type	Gapless, metal oxide type
11.3	Technical particulars	As per Annexure –B (Technical particulars)

12.0 CURRENT TRANSFORMER

12.1	Type	Solid insulation with class of E or better.
12.2	Location	Shall be located outside the gas compartment. Location shall be suitable for easy access to secondary terminals, testing and replacement.
12.3	Rating plate	Should be located at position so that the details can be easily read.
12.4	Rating	As per Annexure – B (Technical particulars) and Annexure-F (SLD)

13.0 VOLTAGE TRANSFORMER

13.1	Type	Shall be cast resin type with insulation class of E or better.
13.2	Disconnection provision	Motorised Disconnecting switch with provision for Manual operation.
13.3	Rating	As per Annexure – B (Technical particulars) and Annexure-F (SLD)

14.0 CABLE TERMINATION

14.1	Power Cable termination	
14.1.1	Cable entry	Front / rear entry only. Socket and plug assembly shall be provided for the field power cables. Facilities shall be provided for cable testing including current and voltage injection.
14.1.2	Adaptor Plug	Plug has to be provided for connecting rear cable directly on panel bushing in absence of front cable. This will enable easy energization of panel with rear cable in event the front cable is faulty. needs to be removed for energizing the panelto bushing ncomer panel in absence of front cable.
14.1.3	Cable size and nos. of runs	2 runs x 3C x 400sqmm XLPE insulated stranded aluminium cable
14.1.4	Cable supports	Cable supports shall be provided (where practicable) by bidder to avoid undue strain on the cable termination.
14.1.5	Gland plates	Termination of single core cables shall be through a non-magnetic metal panel or gland plate. Minimum air clearances shall be maintained over and above cable lugs and fixing bolts.

14.1.6	Armour Earthing	Provision should be made for bonding and earthing any armour and/or concentric earth conductors.
14.2	Control Cable termination	
14.2.1	Cable entry	Bottom and front entry
14.2.2	Gland plate	Undrilled 3mm CRCA

15.0 METERS

15.1	Mounting	Flush mounted
15.2	Voltmeter	Digital type with programmable ratio
15.3	Size	96x96 mm
15.4	Panels where to be provided	Incomer and bus PT panel
15.5	Voltmeter switch	Inbuilt in meter
15.6	Accuracy Class	1.0
15.7	Auxiliary supply	Universal type suitable for 230VAC and 50/220VDC
15.8	Energy meter provision	Energy meter is not in supplier's scope. Only space and CT/PT wiring is to be provided in all panels except bus coupler and bus PT. Dimension shall be 350(H)x200(W) mm^2.

16.0 MULTIFUNCTION METER

16.1	Model	Rish Delta Energy
16.2	Make	Rishabh
16.3	SCADA Interfacing	RS485 rear port suitable for integration on Modbus Protocol
16.4	Size	96x96 mm^2
16.5	Panels where to be provided	All panels
16.6	Accuracy Class	1
16.7	Auxiliary Supply	48 – 240VDC and AC i.e universal type.

17.0 INDICATIONS & ALARMS

17.1	Indications	Flush mounted, High intensity, clustered LED type
17.1.1	Breaker ON	Red
17.1.2	Breaker Off	Green
17.1.3	Isolator On	Red
17.1.4	Isolator Off	Green
17.1.5	Earth switch On	Red
17.1.6	Earth switch Off	Green
17.1.7	Spring Charged	Blue
17.1.8	DC control supply fail	Amber

17.1.9	AC control supply fail	Amber
17.1.10	Auto trip	Amber
17.1.11	Heater circuit healthy	Yellow (Indication with integrated push button for checking)
17.1.12	Trip circuit healthy	White
17.1.13	PT supply as applicable	R,Y B
17.2	Alarm scheme with isolation switch	a. For DC fail, TC fail and CB auto trip in 11kV panels b. For all signals wired to annunciator in 33kV panels

18.0 SELECTOR SWITCHES & PUSH BUTTONS

18.1	Selector switches	Flush mounted on LV compartment door, with shrouded terminals
18.1.1	TNC switch with pistol grip	Lockable, spring return to normal position for CB, Isolator and earth switch control
18.1.2	Local / SCADA selector switch	2 pole
18.1.3	Rotary ON/OFF switches	For heater / illumination circuit
18.1.4	Rating	16 A
18.2	Push Button	Flush mounted on LV compartment door, with shrouded terminals
18.2.1	Emergency trip push button	Red color with stay put
18.2.2	Accept push buttons	Black color – Trip alarm / DC fail alarm
18.2.3	Reset push buttons	Yellow color – Trip alarm / DC fail alarm
18.2.4	Rating	10 A

19.0 INTERNAL WIRING

19.1	Grade and type	1100 V, PVC insulated, FRLS type stranded flexible copper wire.
19.2	Size	2.5 sq mm for CT circuit, 1.5 sq mm for PT & control circuits
19.3	Colour code	
19.3.1	CT & PT	R Ph – Red Y Ph – Yellow B Ph – Blue Neutral – Black
19.3.2	Others	DC– grey, AC-black, Earth – green
19.4	Ferrules	At both ends of wire
19.5	Ferrule type	Interlocked type (one additional red colour ferrule for all wires in trip circuit)
19.6	Lugs	Tinned copper, pre-insulated, ring type, fork type and pin type as applicable. CT circuits should use ring type lugs only.

19.7	Spare contacts	Spare contacts of relays and contactors etc. should be wired upto the terminal block.
19.8	Panel wiring	Panel wiring shall be on one side of the terminal block only. No more than two wires shall be connected to a terminal.
19.9	Interpanel wiring	Interpanel wiring for AC and DC supplies, voltage transformer circuits, annunciation circuits and other common services shall be provided on the same set of terminals in all the panels with proper segregation. Wires with ferrule to be terminated in the adjacent shipping section should be supplied with one end terminated and the other end bunched and coiled.
19.10	Wiring enclosure	Plastic channels for panel wiring, PVC sleeves for Inter panel wiring. Where wiring enters or passes through compartments containing high voltage apparatus, it shall be run in earthed continuous metallic conduit/trunking without gaps, holes or joints.

20.0 TERMINAL BLOCKS

20.1	Rating and Type	1100 V grade, moulded piece, stud type screw driver operated terminals complete with insulated barriers, washers, nuts and lock nuts.
20.2	Suitability	For termination of minimum 6sqmm flexible copper conductor.
20.3	Marking and covers	White fibre markings strip with clear plastic, slip-on / clip-on terminal covers to be provided.
20.4	Disconnecting Facility	To be provided in CT and PT terminals
20.5	Shorting & Earthing Facility	To be provided in CT Terminals
20.6	Spare Terminals	20% in each TB row
20.7	TB shrouds & separators	Moulded non- inflammable plastic material
20.8	Clearance between 2 sets of TB	100 mm min
20.9	Clearance with cable gland plate	250 mm min
20.10	Clearance between AC / DC set of TB	100 mm min
20.11	Test terminal blocks	Screw driver operated stud type for metering circuit

21.0 PROTECTION AND CONTROL

21.1	Protection Relays – General Features	
21.1.1	Technology and Functionality	Numerical , microprocessor based with provision for multifunction protection, control, metering and monitoring
21.1.2	Mounting	Flush Mounting, IP5X

21.1.3	Architecture	Hardware and software architecture shall be modular and disconnectable to adapt the protection and control unit to the required level of complexity as per the application.
21.1.4	Programming and configuration	Relay shall utilize a user friendly setting and operating multi-lingual software in windows environment with menus and icons for fast access to the data required. Programming software and communication cord for offered relays should be included in scope of supply.
21.1.5	Communication module	Communication Card of Relay shall have galvanic Isolation from all other cards to prevent damage during power system transients/Faults
21.1.6	SCADA Interface port	RS485 rear port for interfacing with SCADA on IEC103 and Dual fibre optic port for interfacing with SCADA on IEC 61850 with PRP compatibility. Through these ports relays shall be connected to switches. If relays have any other rear port, hardware/software required to achieve the above said compatibility will be in supplier's scope. Ethernet switches at switchgear end shall be suitably mounted in an auxiliary compartment in switchgear panel.
21.1.7	Processing Indications	SCADA functions in monitoring direction shall be executed on SPI (Single Point Input) and DPI (Double Point Input). DPI shall only be used in case of Isolator and Circuit breaker "close" and "open" indication.
21.1.8	Command Processing	Functionality of command processing offered for SCADA interface shall include the processing of single and double commands i.e SCO (Single Command Output) and DCO (Double object command Output). DCO shall only be used in case of Isolator and Circuit Breaker close" and "open" command.
21.1.9	PC Interface port	Front port (preferably serial) for configuration/data download using PC. Licensed software and communication cord, required for programming of offered protection relays shall be provided with the switchgear.
21.1.10	User Interface	An alphanumeric key pad and graphical LCD display with backlight indicating measurement values and operating messages. It should be possible to access and change all settings and parameters without the use of PC.
21.1.11	Relay Characteristics	Relay shall integrate all necessary protections for different applications in accordance with IS and IEC. Relay shall provide wide setting ranges and choice of all IEC, IEEE and other tripping curves through a minimum of two setting groups.

21.1.12	Event and Fault records	Relay shall have the facility of recording of various parameters during event/fault with option to set the duration of record through settable pre fault and post fault time. Relay shall store records for last 10 events and 10 faults (minimum). It should be possible to download and access all records locally from PC and remotely from SCADA.
21.1.13	Self diagnosis	Relay shall be able to detect internal failures. A watchdog relay with changeover contact shall provide information about the failure.
21.1.14	Time synchronization	All relays shall be capable of being synchronized with the system clock using SCADA interface and PC.
21.1.15	Operation Indicators	LEDs with push button for resetting.
21.1.16	Test Facility	Inbuilt with necessary test plugs.
21.1.17	Auxiliary supply	50/220 VDC. Relays should be suitable for continuous operation at 15% overvoltage
21.2	Protection Relays for 33KV Incomer	
21.2.1	Relay 1 (If Distance protection is considered as primary protection)	Distance Protection
		Sync check function
		PT supervision
		Power swing blocking
	Relay 1 (If Line differential protection is considered as primary protection)	Line differential protection with Backup distance protection
		Sync check function
		PT supervision
		Power swing blocking
		Software based CT ratio correction
		Dedicated port for communication with remote end relay through optical fibre. This port should be in addition to PC interface and SCADA interface ports.
	Selection of Relay 1	Selection of Relay-1 (primary protection) will depend on site requirements. In case of Line differential as primary protection, Relays at both ends shall be provided.
21.2.2	Relay 2	3-phase Directional Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics.
		Sync check function, if not provided in relay 1.
		Circuit Breaker failure protection
		PT supervision, if not provided in relay 1
21.2.3	DIs and DOs	Relay-1 and Relay-2 should have a total of 32DIs and 16DOs exclusively for SCADA interfacing. DIs and DOs for tripping and interlocking shall be additional as per scheme requirement. If DIs and DOs for tripping and interlocking are integrated with DIs and DOs meant for SCADA (may be done to optimize DI/DO configuration), atleast 4 DIs and 4 DOs (atleast 2DIs and 2DOs per relay) should be available as spare in each panel for future use.

21.2.4	Note	Combining functions of Relay-1 and Relay-2 in single relay is not acceptable.
21.2.5	SLD	Refer annexure – F1/F5
21.3	Protection Relays for 33KV Transformer Feeder Panel	
21.3.1	Relay 1	Biased differential protection
		REF protection
		Software based ratio and vector correction feature (without ICT)
		H2 and H5 harmonic restraint
21.3.2	Relay 2	3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		Circuit Breaker failure protection
21.3.3	DIs and DOs	Relay-1 and Relay-2 should have a total of 32DIs and 16DOs exclusively for SCADA interfacing. DIs and DOs for tripping and interlocking shall be additional as per scheme requirement. If DIs and DOs for tripping and interlocking are integrated with DIs and DOs meant for SCADA (may be done to optimize DI/DO configuration), atleast 4 DIs and 4 DOs (atleast 2DIs and 2DOs per relay) should be available as spare in each panel for future use.
21.3.4	Note	Combining functions of Relay-1 and Relay-2 in single relay is not acceptable.
21.3.5	SLD	Refer annexure – F2/F6
21.4	Protection Relays for 33KV Bus-coupler/Bus-sectionalizer Panel	
21.4.1	Relay 1	3-phase Overcurrent and earthfault protection with IDMT, Definite time and instantaneous characteristics.
		Sync check function
		Circuit Breaker failure protection
		PT supervision (fuse failure monitoring) for Bus PT-1
		Relay should have a total of 32DIs and 16DOs exclusively for SCADA interfacing. DIs and DOs for tripping and interlocking shall be additional as per scheme requirement. If DIs and DOs for tripping and interlocking are integrated with DIs and DOs meant for SCADA (may be done to optimize DI/DO configuration), atleast 4 DIs and 4 DOs (atleast 2DIs and 2DOs per relay) should be available as spare in each panel for future use.
21.4.2	Relay 2	PT supervision (fuse failure monitoring) for Bus PT-2
21.4.3	SLD	Refer annexure – F3/F4
21.4.4	Note	One Bus PT should be provided for each bus section
21.5	Protection Relays – SCADA Interfacing Philosophy for all panels	
21.5.1	Configuration and wiring of DIs in Protection Relays for routing status and alarm signals to SCADA through SCADA interface port	DI-1 – TC unhealthy DI-2 – CB Autotrip (contact from lockout relay) DI-3 – CB Open DI-4 – CB Close DI-5 – Spring Charged

		DI-6 – L/R switch in Remote DI-7 – L/R switch in Local DI-8 - DC fail DI-9 - AC Fail DI-10 – Gas pressure low in CB Compartment DI-11 –Gas pressure low in busbar compartment DI-12 – PT MCB trip (metering and protection, for incomer and bus coupler panel only) DI-13 – Isolator Open DI-14 – Isolator Close DI-15 – Earth Switch Open DI-16 – Earth Switch Close DI-17 – Isolator-2 Open (bus coupler panel only) DI-18 – Isolator -2 Close (bus coupler panel only) DI-19 – Earth switch -2 Open(bus coupler panel only) DI-20 – Earth switch -2 Close(bus coupler panel only) Sequence of DIs should be strictly as mentioned above.
21.5.2	Configuration and wiring of DOs in Protection relays for execution of SCADA commands through SCADA interface port	DOs should be wired for operation of CB and three position disconnectors. Sequence of DO assignment should be same in all panels.
21.5.3	Looping of protection relays	All relays in the switchboard have to be looped to form a common bus for interfacing with SCADA.
21.5.4	Spare DIs and DOs	Should be wired upto terminal block for future use.
21.6	Transformer Monitoring cum AVR Relay	
21.6.1	Features	As per annexure –A
21.6.2	Requirement	To be provided in 33KV Transformer feeder panel
21.7	Auxiliary Relays – General Features	
21.7.1	Relays for auxiliary, supervision, trip and timer relays	Static or electromechanical type.
21.7.2	Reset mechanism for auxiliary relays	Self reset contacts except for lock-out relays.
21.7.3	Reset mechanism for lockout relays	Hand reset type.
21.7.4	Operation indicators	With hand-reset operation indicators (flags) or LEDs with pushbuttons for resetting.
21.7.5	Auxiliary supply	50/220VDC. Relays should be suitable for continuous operation at 15% overvoltage
21.8	Auxiliary relays – Requirement	
21.8.1	Anti pumping (94), lockout (86) and trip circuit supervision (74) relays	For each breaker
21.8.2	PT selection relays	To be provided for selection between Bus PT and Line PT of respective sections.
21.8.3	Switchgear with two incomer & bus coupler	Lockout relay (86) contact of each incoming breakers to be wired in series in closing circuit of other incoming

		breakers & bus coupler.
21.8.4	Auxiliary Relays, contact multiplication relays etc.	To effect interlocks and to exchange signals of status & control
21.8.5	Transformer trouble relays (For Transformer feeder panel only)	Auxiliary relays with indicating flags should be provided for the following trip and alarm commands – a. Buchholz trip b. OSR trip c. PRV trip d. SPR trip e. WTI Trip f. OTI Trip g. Buchholz Alarm h. Low oil level alarm i. OTI Alarm j. WTI Alarm.
21.9	MCBs	
21.9.1	Incoming auxiliary supplies	Shall be protected by MCB at the point of entry to the switchboard
21.9.2	Panel auxiliary supplies	a. All auxiliary supplies (DC, AC, PT supply etc.) shall be protected by MCB of appropriate rating. b. Separate MCBs shall be provided for control, indication and protection circuits of each breaker. For shunt trip circuits the protection shall be rated atleast 300 % of the load.

22.0 SPACE HEATERS, SOCKETS & ILLUMINATION LAMPS

22.1	Space Heaters	
22.1.1	Type	Thermostat controlled with switch for isolation
22.1.2	Location	In Breaker & HV cable compartment, mounted on an insulator. Heater position in cable compartment should be easily accessible after cable termination.
22.2	Illumination lamp with switch	For LV & cable chamber
22.3	Universal type (5/15 A) Socket with Switch	In LV chamber

23.0 NAMEPLATES AND MARKING

23.1	Nameplates	To be provided as per the following description
23.1.1	Equipment Nameplates	a. All equipment mounted on front as well as inside the panels shall be provided with individual name plates with equipment designation/description engraved. b. All front mounted equipment shall be also provided at the rear with individual name plates engraved with tag numbers corresponding to the one shown in the panel internal wiring to facilitate easy

		tracing of the wiring.
23.1.2	Feeder Nameplates	Large and bold name plate carrying feeder identification/ feeder number shall be provided on the top of each panel on front as well as rear side. On rear side, nameplate should be provided on frame.
23.1.3	Panel Rating Plate	Following details are to be provided on Panel rating plate: a. Manufacturers name or trade mark b. Switchgear designation c. Rated system voltage, phases, wires and frequency d. Rated fault current e. Busbar rating f. Insulation Gas Type and rated filling pressure for insulation g. Alarm pressure for insulation h. Minimum functional pressure for insulation i. Minimum functional pressure for operation j. Design pressure of gas filled compartment k. Year of manufacture l. Warranty Period m. Purchasers name n. Serial no o. Customer – BSES p. PO No. & Date – As per respective PO. q. CT rating details r. PT rating details
23.1.4	CB Rating Plate	a. Type / Model No. b. Month /Year of Manufacturing c. Current and voltage rating. d. Rated fault making and breaking current.
23.1.5	Material	Non-rusting metal or 3 ply lamicoid. Nameplates shall be black with white engraved lettering. Stickers are not allowed.
23.1.6	Fixing of rating plates and external nameplates	Shall be riveted to the panels at all four corners. Bolting/screwing is not acceptable.
23.1.7	Fixing of internal nameplates	Internal labels may make use of a durable proprietary labeling system unless specifically indicated otherwise.
23.2	Markings	Each switch shall bear clear inscription identifying its function. Similar inscription shall also be provided on each device whose function is not otherwise

		identified. If any switch or device does not bear this inscription separate nameplate giving its function shall be provided for it. Switch shall also have clear inscription for each position indicating e.g. Trip-Neutral close, ON-OFF etc.

24.0 FINISH

24.1	Finish	The colour and finish may be in accordance with the Manufacturer standards for the service conditions specified, subject to BUYER's approval. The switchgear shall be fully tropicalized.

25.0 APPROVED MAKES OF COMPONENTS

25.1	Numerical Relays	R series of ABB, Siprotec series of Siemens, Micom series of Schneider/Alstom. Numerical relays used in complete switchboard should be of same make. Use of two different makes of relays in a switchboard is not acceptable.
25.2	Transformer monitoring cum AVR relay	A-eberle/Easun-MR
25.3	Electromechanical Relays	Alstom/Schneider/Siemens/ABB
25.4	Contact Multiplication Relays	Alstom/Schneider/Siemens/ABB
25.5	Contactors	ABB/Siemens/Schneider/ Telemechanique
25.6	MCBs	Siemens/Schneider/Legrand/ABB
25.7	Control switches	Switron/Kaycee
25.8	Test terminal blocks	IMP/Schneider/Alstom
25.9	Terminal blocks	Elmex/Connectwell
25.10	Indicating lamps	Siemens/Teknic/ Binay
25.11	Surge Suppressors	Oblum/Tyco
25.12	Cable termination	Pfisterer/Sudkabel/ NKT/ Euromold
25.13	Multifunction Meter	Rishabh

26.0 INSPECTION AND TESTING

26.1	Type Tests	The product must be of type tested quality as per applicable Indian standards / IEC
26.2	Type test report validity period	Last five years from date of bid submission. Bidder with type test report more than 5 years old needs to re-conduct the tests without any commercial implication to BSES
26.3	Pressure relief device operation	Test certificate for panel to be submitted

26.4	Acceptance & Routine tests	To be done as per this specification and relevant standards. Charges for all these tests shall be deemed to be included in the equipment price. In addition to these tests, following tests have to be carried out as acceptance tests -
26.5	Primary injection test	To be carried out on panels selected for testing
26.6	Temperature rise test	One panel per Purchase order (PO with minimum 10 panels) without any commercial implication to BSES. In-house testing is acceptable.
26.7	Paint Thickness/ Peel off	To be carried out on panels selected for testing
26.8	Inspection	The purchaser/owner reserves the right to witness all the acceptance/routine tests during inspection.
26.9	Notice to purchaser for conducting type tests	At least three weeks in advance
26.10	Test reports before dispatch for approval	Six (6) copies of acceptance and routine test reports
26.11	Vendor quality plan	To be submitted for purchaser approval
26.12	Inspection points	To be mutually identified & agreed in quality plan

27.0 DRAWINGS & DATA SUBMISSION MATRIX

Drawing submission shall be as per the matrix given below. All documents/ drawing shall be provided on A3/A4 sheet in box file with separators for each section. PDF shall also be provided of all documents via USB. Language of the documents shall be English only. Deficient/ improper document/ drawing submission may liable for rejection.

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
27.1	Contact Person Name, Email ID and Mobile Number	Required	Required		
27.2	Consolidated Deviation Sheet	Required	Required		
27.3	GTP	Required	Required		
27.4	Relevant Type Test as per IS/IEC (including internal arc withstand performance)	Required			
27.5	Power Cable and control cable Philosophy and Schedule		Required		
27.6	Manufacturer's quality assurance plan and certification for quality standards		Required		

27.7	Sizing Calculation of Associated Equipment		Required		
27.8	Recommended Spares Apart from spares stated in Spec(for five years of operation)		Required		
27.9	**33 kV Switchgear drawing**				
27.9.1	General Arrangement	Required	Required		
27.9.2	Sectional Layout				
27.9.3	Door Layout		Required		
27.9.4	LV Box Internal Layout		Required		
27.9.5	Gas Pressure Diagram		Required		
27.9.6	SLD	Required	Required		
27.9.7	Schematic Circuit diagram and Scheme of Each type of Panel		Required		
27.9.8	Communication Architecture		Required		
27.9.9	Bus Bar Arrangement		Required		
27.9.10	QAP		Required		
27.9.11	Panel wise BOQ		Required		
27.9.12	Logic Operation Diagram		Required		
27.9.13	Plan		Required		
27.9.14	Synch Logic Diagram		Required		
27.9.15	Foundation Diagram		Required		
27.9.16	DI sheet		Required		
27.9.17	DO Sheet		Required		
27.9.18	TB Details		Required		
27.9.19	Make of all Component as per specification		Required		
27.10	Drawing of Substation Room		Required		
27.11	Ventilation detail requirement of GIS Room		Required		
27.12	Installation, erection and commissioning manual for switchgear		Required		
27.13	Inspection Reports			Required	
27.14	As manufacturing Drawings			Required	
27.15	Operation and Maintenance Manual			Required	
27.16	Trouble shooting manual			Required	

27.17	As built Drawings				Required
27.18	Test Report				Required

28.0 PACKING

28.1	Packing Protection	Against corrosion, dampness, heavy rains, breakage and vibration. During transportation/ transit and storage, panels may be subjected to outdoor conditions. Hence, packing of each panel shall be weatherproof.
28.2	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection & identification Label
28.3	Packing Identification Label to be provided on each packing case with the following details	
28.3.1	Individual serial number	
28.3.2	Purchaser's name	
28.3.3	PO number (along with SAP item code, if any) & date	
28.3.4	Equipment Tag no. (if any)	
28.3.5	Destination	
28.3.6	Project Details	
28.3.7	Manufacturer / Supplier's name	
28.3.8	Address of Manufacturer / Supplier / it's agent	
28.3.9	Description and Quantity	
28.3.10	Country of origin	
28.3.11	Month & year of Manufacturing	
28.3.12	Case measurements	
28.3.13	Gross and net weights in kilograms	
28.3.14	All necessary slinging and stacking instructions	

29.0 SHIPPING

29.1	Shipping	The bidder shall ascertain at an early date and definitely before the commencement of manufacture, any transport limitations such as weights, dimensions, road culverts, Overhead lines, free access etc. from the Manufacturing plant to the project site. Bidder shall furnish the confirmation that the proposed Packages can be safely transported, as normal or oversize packages, up to the site. Any modifications required in the infrastructure and cost thereof in this connection shall be brought to the notice of the Purchaser.
		The Bidder shall be responsible for all transit damage due to improper packing.

30.0 HANDLING AND STORAGE

30.1	Handling and Storage	Manufacturer instruction shall be followed. Detail handling & storage instruction sheet / manual needs to be furnished before commencement of supply.

31.0 PROGRESS REPORTING

31.1	Outline Document	To be submitted for purchaser approval for outline of production, inspection, testing, inspection, packing, dispatch, documentation programme
31.2	Detailed Progress report	To be submitted to Purchaser once a month containing: a. Progress on material procurement b. Progress on fabrication (As applicable) c. Progress on assembly (As applicable) d. Progress on internal stage inspection e. Reason for any delay in total programme f. Details of test failures if any in manufacturing stages g. Progress on final box up h. Constraints / Forward path

32.0 DEVIATION

32.1	Deviation	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. No deviation will be acceptable post order.

33.0 ACCESSORIES & SPARES

33.1	Accessories	Should be supplied alongwith the switchgear in accordance with annexure-C
33.2	Spares	Should be supplied alongwith the switchgear in accordance with annexure- D

ANNEXURE – A – TRANSFORMER MONITORING CUM AVR RELAY

1	General features	
1.1	Technology and Functionality	Microprocessor based with provision for multifunction control and monitoring.
1.2	Mounting	Flush Mounting
1.3	Architecture	Hardware and software architecture shall be modular and disconnectable to adapt the control unit to the required level of complexity as per the application.
1.4	Programming and configuration	AVR shall utilize a user friendly setting and operating multi-lingual software in windows environment with menus and icons for fast access to the data required.
1.5	User Machine Interface	UMI with an alphanumeric key pad and graphical LCD display with backlight indicating measurement values and operating messages. Capability to access and change all settings and parameters.
1.6	PC Interface port	Front port (preferably serial) for configuration using PC. Cost of licensed software and communication cord, required for programming of offered protection relays using PC, shall be mentioned separately in the bid.
1.7	SCADA Interface port	RS485 rear port for interfacing with SCADA on IEC103 and dual fibre optic port for interfacing with SCADA on IEC 61850 & PRP compatible. Through these ports relays shall be connected to switches. Protocol shall be selectable at site. If relays have any other rear port, hardware/software required to achieve the above said compatibility will be in supplier's scope. Ethernet switches at switchgear end shall be suitably mounted in an auxiliary compartment in switchgear panel.
1.8	Self diagnosis	Shall be able to detect internal failures. A watchdog relay with changeover contact shall provide information about the failure.
1.9	Auxiliary supply	220VDC or 48VDC
2	Inputs and Outputs	
2.1	CT Input	1/5A selectable through programming
2.2	PT Input	110VAC

2.3	Binary Inputs	Sixteen programmable binary inputs should be provided
2.4	Analog Inputs (4-20mA)	One input to be provided
2.5	PT-100 direct input	Two inputs to be provided
2.6	Direct Resistance Input	For tap position indication (18 steps)
2.7	Binary Outputs	Ten programmable binary outputs should be provided
3	Control	
3.1	Control Tasks	Ability to implement control functions through programmable logics
3.2	Voltage setting	Programmable Voltage set point
3.3	Voltage Regulation	Raise/Lower tap position to maintain the preset value of voltage.
3.4	Voltage Regulation modes	Automatic and Manual
3.5	Operation Modes	Local and Remote
3.6	Fan and Pump control	To be provided
3.7	Transformer Paralleling	Capability to parallel transformers whose AVRs are interconnected via a communication network.
4	SCADA Interfacing	
4.1	Configuration of DIs for routing alarm/trip signals to SCADA.	DI-1 – Buchholz trip DI-2 – OSR Trip DI-3 – PRV trip DI-4 – SPR trip DI-5 – OTI trip DI-6 – WTI trip DI-7 – Buchholz alarm DI-8 – Oil Level low larm (MOG alarm) DI-9 – WTI alarm DI-10 – OTI alarm DI-11 – Tap changer trouble/stuck/out of step DI-12 – Tap changer motor supply fail DI-13 – Tap changer in local control All signals from DI-1 to DI-10 are to be wired up from transformer trouble auxiliary relays.
4.2	Configuration of Dos for executing commands from SCADA through interface port/CRP	DO-1 – Tap raise DO-2 – Tap lower DO-3 – Fan group 1 control DO-4 – Fan group 2 control
4.3	Spare Dis and Dos	To be wired upto the terminal block.
5	Measurement, Event Recording and Monitoring	
5.1	Measured Quantities (optional)	Voltage, Current, Active Power, Reactive Power, Apparent Power, Power factor, frequency
5.2	Event Recording	Facility for recording parameters during various events such as tap change, change in binary input status etc.
5.3	Monitoring	Capability to monitor important transformer parameters such as Oil temperature, Winding Temperature etc and give indication/alarm when the value of a particular parameter exceeds the preset value.

ANNEXURE – B – TECHNICAL PARTICULARS (DATA BY PURCHASER)

1.0	**SWITCHGEAR**		
1.1	Type	Metal clad, SF6 gas insulated with VCB type circuit breaker	
1.2	Service	Indoor	
1.3	Mounting	Free standing, floor mounted	
1.4	System Voltage	33kV	
1.5	Voltage variation	+/- 10%	
1.6	Frequency	50 Hz +/- 5%	
1.7	Phase	3	
1.8	Rated voltage	36 kV	
1.9	Rated current	As per Single line diagram	
1.10	Short time rating for 3 sec.	25kA	
1.11	Internal arc classification and rating		
1.11.1	Classification	IAC – A – FLR	
1.11.2	Rating	25kA for 1 second.	
1.12	Insulation level (PF rms / Impulse peak)	70 kV/ 170 kV	
1.13	System ground	Effectively earthed	Effectively earthed
1.14	Enclosure degree of protection	IP – 65 for gas filled compartments IP – 4X for Cable and LV compartment	
1.15	Bus bar – Main	Rating as per SLD, Short time rating as per clause 1.10.	
1.15.1	Material	Copper	
1.15.2	Bus bar joint plating	As per manufacturer's standard. Tape on joints is not acceptable.	
1.15.3	Bus identification	Colour coded	
1.15.4	Temperature rise	40 deg. C for conventional joints. 55 deg. C for silver plated joints	
1.16	Auxiliary bus bar	Electrolytic grade tinned copper	
1.17	Auxiliary DC Supply	220 V DC / 50 V DC	
1.18	Auxiliary AC supply	240 V AC 50 Hz	
1.19	Hardware	Stainless steel.	
1.20	Earth bus	Aluminium	
1.21	Power cable entry	From bottom and rear	
1.22	Control cable entry	From bottom and front (i.e breaker compartment)	
1.23	Gas leakage rate	Less than 0.5% per annum	
2.0	**CIRCUIT BREAKER**		
2.1	Voltage class, insulation level, short time rating	As specified for switchgear	

2.2	Rated current	As per SLD.
2.3	Duty cycle	O – 0.3 sec – CO – 3min – CO
2.4	Short circuit rating	
2.4.1	A.C sym. Breaking current	25kA
2.4.2	Short circuit making current	62.5kA
2.5	Operation time	
2.5.1	Break time	Not more than 4 cycles
2.5.2	Make time	Not more than 5 cycles
2.6	Range of Auxiliary Voltage	
2.6.1	Closing	85% - 110%
2.6.2	Tripping	70% - 110%
2.6.3	Spring Charging	85% - 110%
2.7	No. of spare aux. Contacts of Breaker, for Owner's use.	Minimum 4 NO + 4 NC
2.8	Nos. of spare auxiliary contacts of disconnector	Minimum 2 NO + 2 NC
2.9	Nos. of spare auxiliary contacts of earth switch	Minimum 2 NO + 2 NC
3.0	**CURRENT TRANSFORMERS**	
3.1	Voltage class, insulation level and short time rating	As specified for switchgear
3.2	Type	Solid Insulation
3.3	Class of insulation	Class E or better
3.4	Ratio	As per SLD
3.5	Number of secondaries	As per SLD
3.6	Accuracy class	
3.6.1	Protection core	5P20
3.6.2	Protection (Diff. / REF)	PS
3.6.3	Metering	0.2s
3.7	Burden (VA)	Adequate for the protection & instruments offered i.e atleast 1.5 times the connected burden.
3.8	Excitation current of PS Class CTs	30 mA at Vk/4
4.0	**VOLTAGE TRANSFORMERS**	
4.1	Type	Cast resin, single phase unit
4.2	Rated Voltage	
4.2.1	Primary	33000/sq.rt.3
4.2.2	Secondary	110V/sq.rt.3
4.3	No. of phases	3
4.4	No. of secondary windings	2

4.5	Method of connection	Star/Star
4.6	Rated voltage factor	1.2 continuous, 1.9 for 30 seconds
4.7	Class of insulation	Class E or better
4.8	Accuracy class	
4.8.1	Protection	3P
4.8.2	Metering	0.2
5.0	**HV FUSES**	
5.1	Voltage class	36kV
5.2	Rupturing capacity	50kA
5.3	Rated current	As per application
6.0	**SURGE ARRESTORS**	
6.1	Rated Voltage	30kV
6.2	Maximum continuous operating voltage (MCOV)	25kV
6.3	Discharge current	10kA
6.4	Discharge class	3

ANNEXURE – C – MANDATORY ACCESSORIES FOR EACH SWITCHBOARD SET

S No.	Description	Qty
1	Current test plug/ adapter	2
2	Voltage test plug/ adapter	2
3	Operating Handles	2 sets
4	Adaptor Plug as per clause 14.1.2.	2 sets
5	Gas leak detector – DILO make	1
6	Cable dummy plugs (if required, depending on type of cable termination)	1 set per Incomer/Trafo panel
7	Special tools and tackles required for erection, testing, commissioning and maintenance of the switchboard should be supplied with the switchboard.	1 set
8	Other accessories required for trouble free operation of switchgear as per manufacturer recommendation.	1 set

ANNEXURE – D – SPARES REQUIREMENT

S No.	Description	Qty
1	Numerical relay of each type	1
2	Auxiliary Relay of each type	5
3	Contactors of each type	5
4	Contact Multiplication Relay of each type	5
5	Line voltage transformer	3 (1 set)
6	Bus voltage transformer	3 (1 set)
7	GIS End Termination Kit	2

9	Current transformers suitable for incomer panel	3 (1 set)
10	Current transformers suitable for transformer panel	3 (1 set)
11	Current transformers suitable for bus coupler panel	3 (1 set)
12	Trip Coil	4
13	Closing Coil	4
14	CB Spring charging motor	2
15	Auxiliary switch	2 sets (2 Nos. each type)
16	Disconnector motor for isolator	1
17	Disconnector motor for earthswitch	1
18	Gas density switch	2
19	Bursting disc / pressure relief plate complete	2
20	Capacitive voltage indicator	6 (2 sets)
21	Mobile gas filling and evacuation device -DILO make	1
22	SF6 Gas cylinders	4
23	SCADA Spares	20% of Supplied Items
24	Other spares recommended by manufacturer may be added to this list	

Unit price for all the spares should be indicated in price bid.

ANNEXURE – E– GUARANTEED TECHNICAL PARTICULARS (DATA BY BIDDER)

S No.	DESCRIPTION	UNITS	DATA SPECIFIED BY PURCHASER	DATA PROVIDED BY BIDDER
1.00	**SITE CONDITIONS**			
1.01	Altitude	meters	1 -50	
1.02	Maximum Ambient Temperature	°C	45	
1.03	Minimum Ambient Temperature	°C	0	
1.04	Design Ambient Temperature	°C	50	
1.05	Relative Humidity	%	100	
2.00	**PARAMETERS**			
2.01	Voltage	kV	33	
2.02	Phases	-	3	
2.03	Frequency	Hz	50	
2.04	Short Time Rating for 3 Sec	kA	31.5 / 26.3	
2.05	Voltage Class	kV	36	
2.06	Insulation level (PF rms / Impulse peak)	kVrms / kVpeak	70/170	
2.07	Internal arc test			
a	Rated current and duration	kA, sec		
b	Classification			
3.00	**ENCLOSURE TYPE**		IP65 / IP4X	

S No.	DESCRIPTION	UNITS	DATA SPECIFIED BY PURCHASER	DATA PROVIDED BY BIDDER
3.01	Rear Doors	-	Manufacturers Standard	
3.02	Indoor / Outdoor	-	Indoor	
3.03	Arc Resistant	-	YES	
3.04	Tamperproof Category		YES	
3.05	Dust resistant (gasketed)	-	YES	
4.00	**PANEL CONSTRUCTION**			
4.01	Gas pressure – busbar compartment		Bar / MPa	
a	Normal gas pressure		Bar / MPa	
b	Permitted range of Gas pressure for safe operation		Bar / MPa	
c	Alarm level		Bar / MPa	
d	Gas pressure for operation of PRD		Bar / MPa	
e	Withstand gas pressure of enclosure		Bar / MPa	
f	Number of aux.contacts /stages provided for the gas density meter			
4.02	Gas pressure – breaker compartment		Bar / MPa	
a	Normal gas pressure		Bar / MPa	
b	Permitted range of Gas pressure for safe operation		Bar / MPa	
c	Alarm level		Bar / MPa	
d	Gas pressure for operation of PRD		Bar / MPa	
e	Withstand gas pressure of enclosure		Bar / MPa	
f	Number of aux. contacts /stages provided for the gas density meter			
4.03	Material and thickness of gas enclosure			
4.04	Total no. of Gas compartments per panel		No.	
4.05	Number of Gas Density meters provided per panel		No.	
4.06	Rating of Isolator (A)		Same as CB rating	
4.07	Rating of earthing switch (A)		Same as CB rating	
4.07	Guaranteed Gas leakage Rate		< 0.5 %	
4.08	Rodent damage protection		YES	
4.09	Ground and test device		YES	

S No.	DESCRIPTION	UNITS	DATA SPECIFIED BY PURCHASER	DATA PROVIDED BY BIDDER
4.10	Equipment Labeling		Anodized aluminium	
4.11	Lift truck		If required	
4.12	Testing facility			
a	For Cable		Required	
b	For CT		Required	
c	For PT		Required	
5.00	**BUS INFORMATION**			
5.01	Material		Copper	
5.02	Bus Joint Plating		Manufacturers Standard	
5.03	Rated Continuous Current	A rms	1250A	
5.04	Short time Withstand Current	A rms	31.5kA/ 26.3kA for 3 Sec	
6.00	**BUS SUPPORTS AND INSULATION**			
6.01	Manufacturer's Standard & Type		Manufacturers Standard	
6.02	Material		Manufacturers Standard	
7.00	**POWER CABLE ACCOMMODATION**			
7.01	Power Cable entry		Bottom	
7.02	Terminal lug type		Socket & Plug for SF6	
7.03	Qty of power cables per phase per compartment	qty	As per specification and SLD	
7.04	Make of termination			
8.00	**CIRCUIT BREAKER INFORMATION**			
8.01	Manufacturer / Model No.			
8.02	Type (SF6/Vacuum)		Manufacturers Standard	
8.03	Rated Short-Circuit Current	kA	31.5 kA / 26.3kA	
8.04	Short circuit-Current Withstand Time	sec	3	
8.05	Rated Maximum Voltage	kV rms	36	
8.06	Rated Voltage Range Factor, K		1.1	
8.07	Power Frequency Withstand Voltage	kV rms	70	
8.08	Lightning Impulse Withstand Voltage	kV crest	170	

S No.	DESCRIPTION	UNITS	DATA SPECIFIED BY PURCHASER	DATA PROVIDED BY BIDDER
8.09	Rated Continuous Current	A rms	As per single line drawing.	
8.10	Rated Transient Recovery Voltage Time to Peak (T2)	microsec	Manufacturers Standard	
8.11	Switching duty/capability			
a	Power Transformers (oil filled)	Capacity		
b	Cables	Length		
c	Over head lines	Length		
8.12	Rated Interrupting Time	ms	60	
8.13	Time for Opening Operation	cycles	3	
8.14	Time for Closing Operation	cycles	4	
8.15	Closing and latching capability (peak)	kA	Manufacturers Standard	
8.16	Control Power Voltage Range, Trip Coil	V dc	220/50	
8.17	Control Power Voltage Range, Closing Coil	V dc	220/50	
8.18	Auxiliary Contacts Total	qty	12	
8.19	Min. Auxiliary Contacts for Customer use	qty	6	
8.20	Auxiliary Contact voltage rating	V dc	220 / 50	
8.21	Auxiliary Contact current rating	Amps	10	
8.22	Stored Energy System Minimum Voltage	V dc	187	
8.23	Stored Energy Spring Charging Motor Current	Amps	MS	
8.24	Stored Energy Spring Charging Motor Inrush	Amps	MS	
8.25	Stored Energy Time to Fully Recharge Spring:	seconds	MS	
8.26	Rated Operating duty cycle		O – 0.3Sec – CO -3min -CO	
8.27	Rated out of phase switching capability to IEC 56			
8.28	Operating Power Consumption			
a	Trip Coil	Watt		
b	Closing Coil	Watt		
c	Operating Motor	Watt		
8.29	Number of trip coils	Nos.	2	
8.30	Quantity of Gas in CB			
a	Mass			
b	Volume at Normal Pressure	CuM		

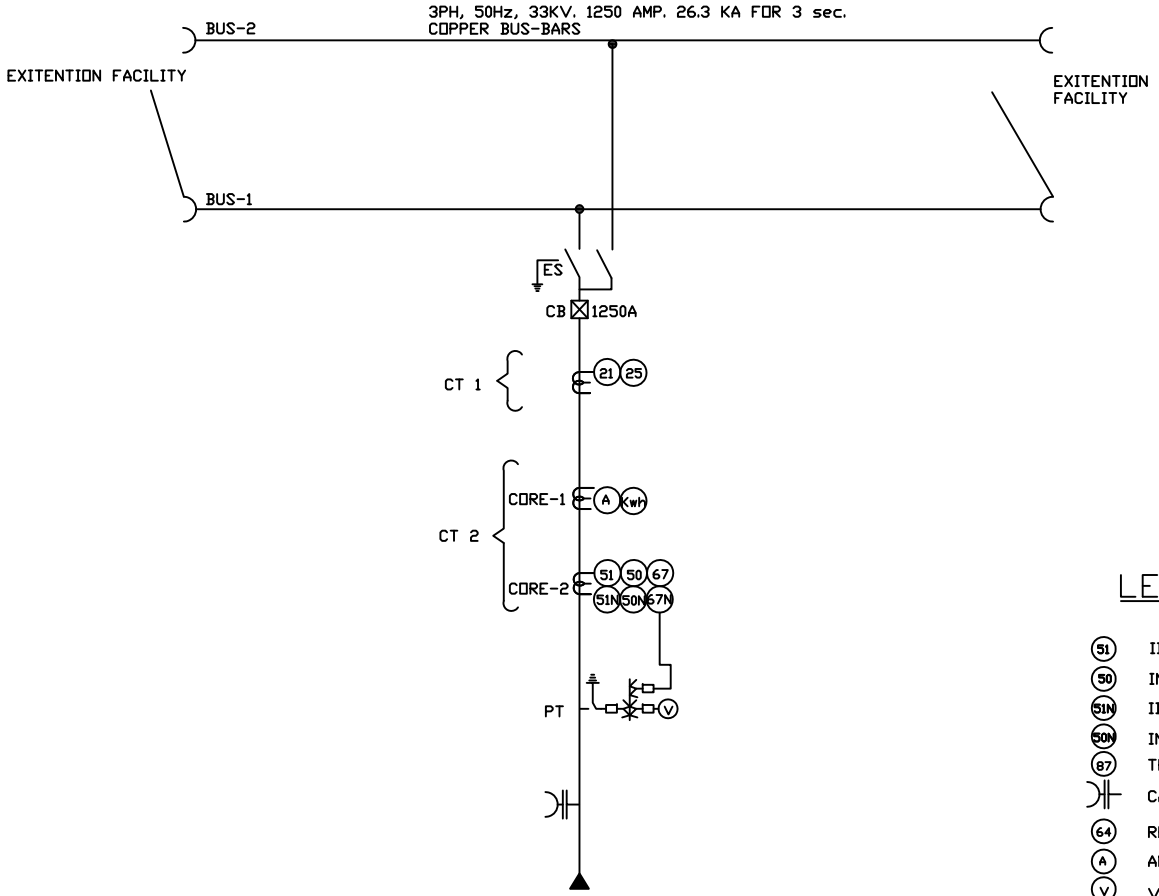
S No.	DESCRIPTION	UNITS	DATA SPECIFIED BY PURCHASER	DATA PROVIDED BY BIDDER
8.31	Interrupting Gas Pressure Maximum / Normal / Minimum	Bar (Absolute)		
8.32	Number of Close / Open Operation possible without re-charging	No.		
8.33	Number of operations possible before interrupter maintenance required			
a	At rated S.C. current	Nos.		
b	At full load current	Nos.		
c	At no load	Nos.		
8.34	Method used to relieve internal overpressure due to short circuit (Bursting disc / relief valve / none. Etc.)			
8.35	Operating pressure of pressure relief device			
9.00	**PROTECTIVE RELAYS**			
9.01	Manufacturer		By Seller	
9.02	Model no. of each relay			
9.03	Relay functions		As per specification	
9.04	Relay Communication		IEC 103 & IEC 61850	
10.00	**MULTI FUNCTION METER**			
10.01	Model		Rish Delta Energy	
10.02	Make		Rishabh	
10.03	SCADA Interfacing		RS485 rear port suitable for integration on Modbus Protocol	
10.04	Size	mm^2	96x96	
10.05	Panels where to be provided		All panels	
10.06	Accuracy Class		1	
10.07	Auxiliary Supply		48 – 240VDC and AC i.e universal type.	
11.00	**CONTROL WIRING**		See Specification	
11.01	Type		XLPE or PVC	
11.02	Control wire Size minimum:		1.5 mm	
11.03	Voltage Rating:	Vac	600/1000V	
11.04	FRLS type		Yes	

S No.	DESCRIPTION	UNITS	DATA SPECIFIED BY PURCHASER	DATA PROVIDED BY BIDDER
12.00	**CURRENT TRANSFORMERS**		As per SLD	
	(Details to be furnished for each type of CT)			
12.01	Manufacturer/Model Number:			
12.02	Accuracy Class		As per SLD	
12.03	Ratio		As per SLD	
12.04	Burden		As per SLD	
12.05	Knee point voltage		As per SLD	
12.06	Rct			
12.07	Excitation current		As per SLD	
13.00	**VOLTAGE TRANSFORMERS**			
13.01	Manufacturer			
13.02	Model Number			
13.03	Accuracy		As per SLD	
13.04	Primary Fuse		Required	
13.05	Secondary Fuse/min-breaker:		Required	
13.06	Burden		As per SLD	
13.07	Disconnecting switch for VT		Required	
14.00	**PANEL ACCESSORIES**			
14.01	Indications		LED type	
14.02	Control switches			
a	Make			
b	Type			
c	Rating			
14.03	L/R switch			
a	Make			
b	Type			
c	Rating			
14.04	CT & PT Terminal blocks			
a	Make			
b	Type		Disconnecting	
c	Size			
d	Rating			
14.05	Terminal blocks			
a	Make			
b	Type		Non-Disconnecting	
c	Size			
d	Rating			
15.00	**HEAT LOSS**			
15.01	Bus Losses	Watts		
15.02	Heat loss at rated breaker current –1250A	W/bkr		

S No.	DESCRIPTION	UNITS	DATA SPECIFIED BY PURCHASER	DATA PROVIDED BY BIDDER
15.03	Heat loss of space heater per vertical section	W/vrtl		
16.00	**INSTALLATION INFORMATION**			
16.01	Mass of heaviest piece to be shipped as a unit	kg		
16.02	Largest section to be shipped a unit -Length:	mm		
16.03	Largest section to be shipped a unit -Width:	mm		
16.04	Largest section to be shipped a unit -Height:	mm		
16.05	Total Mass of assembly to be shipped	kg		
16.06	Total assembly (breaker line-up only) -Length	mm		
16.07	Total assembly (breaker line-up only) -Width	mm		
16.08	Total assembly (breaker line-up only) -Height	mm		
16.09	Transition section (breaker line-up only) -Mass	kg		
16.10	Transition section (breaker line-up only) -Length	mm		
16.11	Transition section (breaker line-up only) -Width	mm		
16.12	Transition section (breaker line-up only) -Height	mm		
16.13	Total Number of shipping sections per line up:	qty		
17.00	**PANEL DIMENSIONS**			
17.01	Incomer (Width x Depth x Height)	mm		
17.02	Bus-coupler (Width x Depth x Height)	mm		
17.03	Outgoing (Width x Depth x Height)	mm		
17.04	Overall length of Complete board	mm		
18.00	**CONTROL AND AUXILIARY SUPPLY**			
18.01	Buyer Control power supply (Volts)		220 V / 50V , +15% & -15%V DC	
18.02	Buyer Control power current		15 A	

S No.	DESCRIPTION	UNITS	DATA SPECIFIED BY PURCHASER	DATA PROVIDED BY BIDDER
	rating (A)			
18.03	Buyer control power supply short circuit level		30 kA	
18.04	Buyer AC power supply (Volts)		240 V + 10%	
18.05	Buyer AC power supply current rating (A)		20A	
18.06	Buyer AC power supply short circuit rating (kA)		50 kA	
19.00	**PAINTING / FINISHING**			
19.01	Manufacturer's Standard		Manufacturer's Paint Spec doc. No.	
19.02	Color		RAL7032	
20.00	**MODULE REPLACEMENT**			
20.01	Complete panel replacement duration (at site)	Hours		
20.02	CB Module replacement duration (at site)	Hours		
20.03	Bushing Replacement duration (at site)	Hours		

ANNEXURE-F1



CT-1
800-400/1A
ACCURACY-PS
Ie<-30mA at VK/4
Vk>40(Rct+4)V

CT-2
CORE1-800-400/1A
ACCURACY-0.2S
BURDEN-7.5VA
ISF>=10

CORE2-800-400/1A
ACCURACY-5P20
BURDEN-15VA

PT
WINDING 1-33KV/√3/110/√3
CL-0.2
BURDEN-25VA
WINDING 2-33KV/√3/110/√3
CL-3P
BURDEN-25VA

LEGEND:

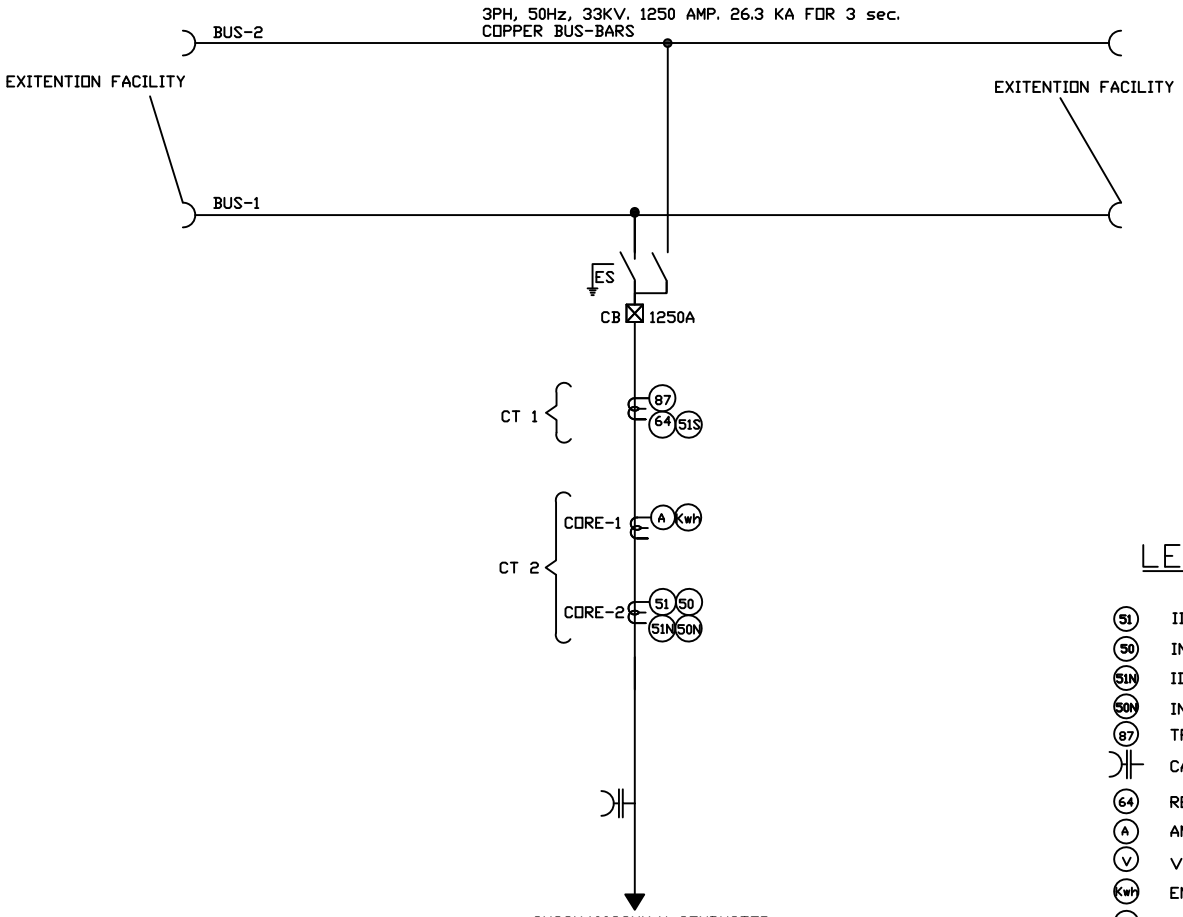
51	IDMT PHASE OVER CURRENT RELAY
50	INSTANTANEOUS PHASE OVER CURRENT RELAY
51N	IDMT EARTH FAULT RELAY
50N	INSTANTANEOUS EARTH FAULT RELAY
87	TRANSFORMER DIFFERNTIAL RELAY
	CAPACITIVE VOLTAGE INDICATOR
64	RESTRICTED EARTH FAULT RELAY (33 KV OF TRANSFORMER)
A	AMMETER WITH SELECTOR SWITCH
V	VOLTMETER WITH SELECTOR SWITCH
Kwh	ENERGY METER
21	DISTANCE RELAY
67	DIRECTIONAL OVER CURRENT RELAY
67N	DIRECTIONAL EARTH FAULT RELAY
25	SYNCHRO CHECK RELAY

NOTE

1. BURDENS ARE INDICATIVE AND MAY CHANGE SUBJECT TO CALCULATIONS DURING DETAILED ENGINEERING.
2. REFER CLAUSE 19 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENT OF RELAYS.

DRAWN	RAJESH	TITLE:-	BSES Yamuna Power Limited
CHECKED	G.S	STANDARD SLD FOR 33KV INCOMER	SPECIFICATION NO. SP-MVGIS-24-R3
APPD.	A.A		SLD-GIS-33KV-01
DATE	26.09.18		
SCALE	NTS		

ANNEXURE-F2



LEGEND:

- (51) IDMT PHASE OVER CURRENT RELAY
- (50) INSTANTANEOUS PHASE OVER CURRENT RELAY
- (51N) IDMT EARTH FAULT RELAY
- (50N) INSTANTANEOUS EARTH FAULT RELAY
- (87) TRANSFORMER DIFFERNTIAL RELAY
- CAPACITIVE VOLTAGE INDICATOR
- (64) RESTRICTED EARTH FAULT RELAY (33 KV OF TRANSFORMER)
- (A) AMMETER WITH SELECTOR SWITCH
- (V) VOLTMETER WITH SELECTOR SWITCH
- (Kwh) ENERGY METER
- (21) DISTANCE RELAY
- (67) DIRECTIONAL OVER CURRENT RELAY
- (67N) DIRECTIONAL EARTH FAULT RELAY
- (25) SYNCHRO CHECK RELAY

NOTE

1. BURDENS ARE INDICATIVE AND MAY CHANGE SUBJECT TO CALCULATIONS DURING DETAILED ENGINEERING.
2. REFER CLAUSE 19 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENT OF RELAYS.

DRAWN	RAJESH
CHECKED	G.S
APPD.	A.A
DATE	26.09.18
SCALE	NTS

TITLE:-

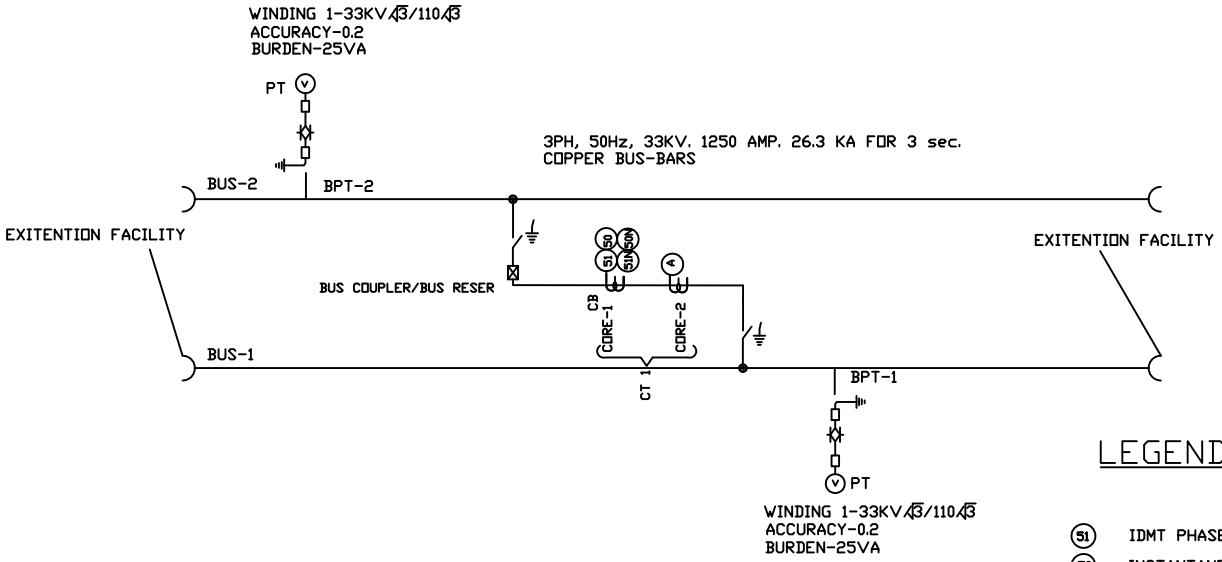
STANDARD SLD FOR 33KV TRANSFORMER FEEDER

BSES Yamuna Power Limited

SPECIFICATION NO. SP-MVGIS-24-R3

SLD-GIS-33KV-02

ANNEXURE-F3



CT-1

CORE1-800-400/1A
ACCURACY-5P20
BURDEN-15VA

CORE2-800-400/1A
ACCURACY-0.5
BURDEN-7.5VA

LEGEND:

51	IDMT PHASE OVER CURRENT RELAY
50	INSTANTANEOUS PHASE OVER CURRENT RELAY
51N	IDMT EARTH FAULT RELAY
50N	INSTANTANEOUS EARTH FAULT RELAY
87	TRANSFORMER DIFFERNTIAL RELAY
	CAPACITIVE VOLTAGE INDICATOR
64	RESTRICTED EARTH FAULT RELAY (33 KV OF TRANSFORMER)
A	AMMETER WITH SELECTOR SWITCH
V	VOLTMETER WITH SELECTOR SWITCH
kWh	ENERGY METER
21	DISTANCE RELAY
67	DIRECTIONAL OVER CURRENT RELAY
67N	DIRECTIONAL EARTH FAULT RELAY
25	SYNCHRO CHECK RELAY

NOTE

1. BURDENS ARE INDICATIVE AND MAY CHANGE SUBJECT TO CALCULATIONS DURING DETAILED ENGINEERING.
2. REFER CLAUSE 19 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENT OF RELAYS.
3. ONE BPT TO BE PROVIDED FOR EACH BUS SECTION.

DRAWN	RAJESH
CHECKED	G.S
APPD.	A.A
DATE	26.09.18
SCALE	NTS

TITLE:-

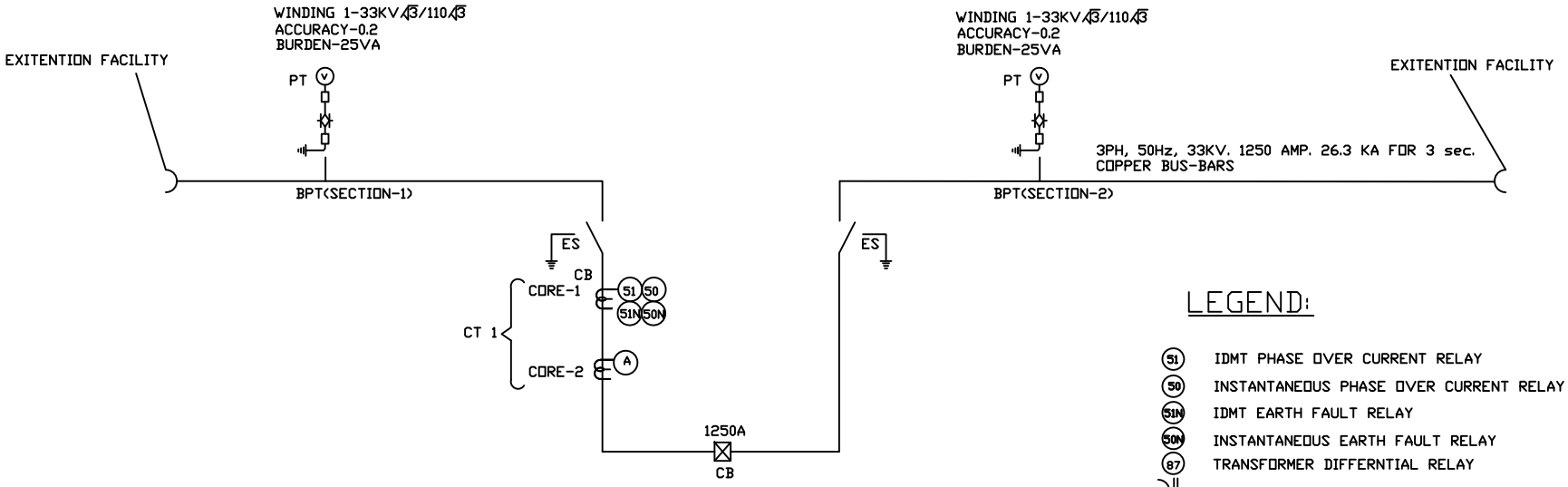
STANDARD SLD FOR 33KV BUS COUPLER CUM BUS PT

BSES Yamuna Power Limited

SPECIFICATION NO. SP-MVGIS-24-R3

SLD-GIS-33KV-03

ANNEXURE-F4



LEGEND:

51	IDMT PHASE OVER CURRENT RELAY
50	INSTANTANEOUS PHASE OVER CURRENT RELAY
51N	IDMT EARTH FAULT RELAY
50N	INSTANTANEOUS EARTH FAULT RELAY
87	TRANSFORMER DIFFERNTIAL RELAY
	CAPACITIVE VOLTAGE INDICATOR
64	RESTRICTED EARTH FAULT RELAY (33 KV OF TRANSFORMER)
A	AMMETER WITH SELECTOR SWITCH
V	VOLTMETER WITH SELECTOR SWITCH
kwh	ENERGY METER
21	DISTANCE RELAY
67	DIRECTIONAL OVER CURRENT RELAY
67N	DIRECTIONAL EARTH FAULT RELAY
25	SYNCHRO CHECK RELAY

CT-1

CORE1-800-400/1A
ACCURACY-5P20
BURDEN-15VA

CORE2-800-400/1A
ACCURACY-0.5
BURDEN-7.5VA

NOTE

1. BURDENS ARE INDICATIVE AND MAY CHANGE SUBJECT TO CALCULATIONS DURING DETAILED ENGINEERING.
2. REFER CLAUSE 19 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENT OF RELAYS.
3. ONE BPT TO BE PROVIDED FOR EACH BUS SECTION.

DRAWN	RAJESH
CHECKED	G.S
APPD.	A.A
DATE	26.09.18
SCALE	NTS

TITLE:-

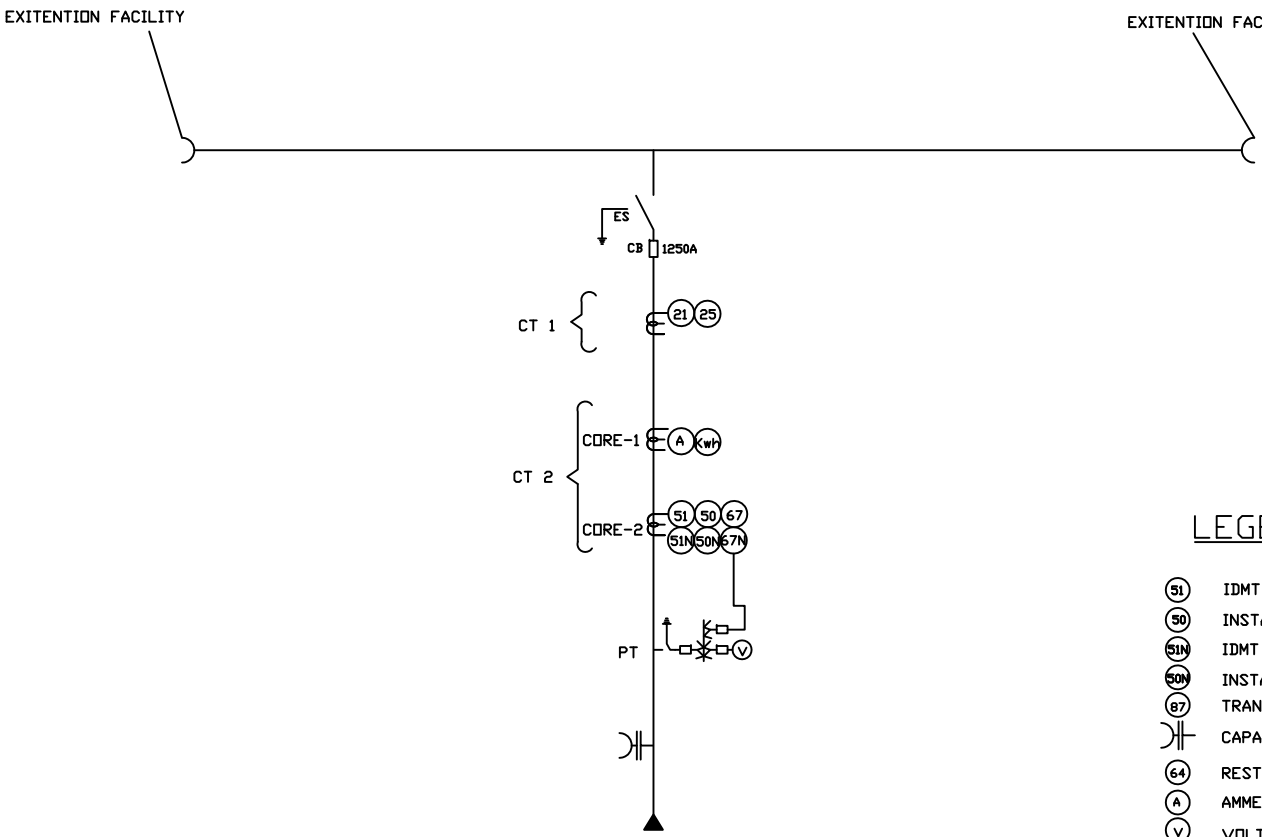
STANDARD SLD FOR
33KV BUS SECTIONALIZER
CUM RISER
CUM BUS PT

BSES Yamuna Power Limited

SPECIFICATION NO. SP-MVGIS-24-R3

SLD-GIS-33KV-04

ANNEXURE-F5



CT-1
800-400/1A
ACCURACY-PS
Ie<-30mA at VK/4
Vk>40(Rct+4)V

CT-2
CORE1-800-400/1A
ACCURACY-0.2S
BURDEN-7.5VA
ISF>=10

CORE2-800-400/1A
ACCURACY-5P20
BURDEN-15VA

PT
WINDING 1-33KV/√3/110/√3
CL-0.2
BURDEN-25VA
WINDING 2-33KV/√3/110/√3
CL-3P
BURDEN-25VA

LEGEND:

51	IDMT PHASE OVER CURRENT RELAY
50	INSTANTANEOUS PHASE OVER CURRENT RELAY
51N	IDMT EARTH FAULT RELAY
50N	INSTANTANEOUS EARTH FAULT RELAY
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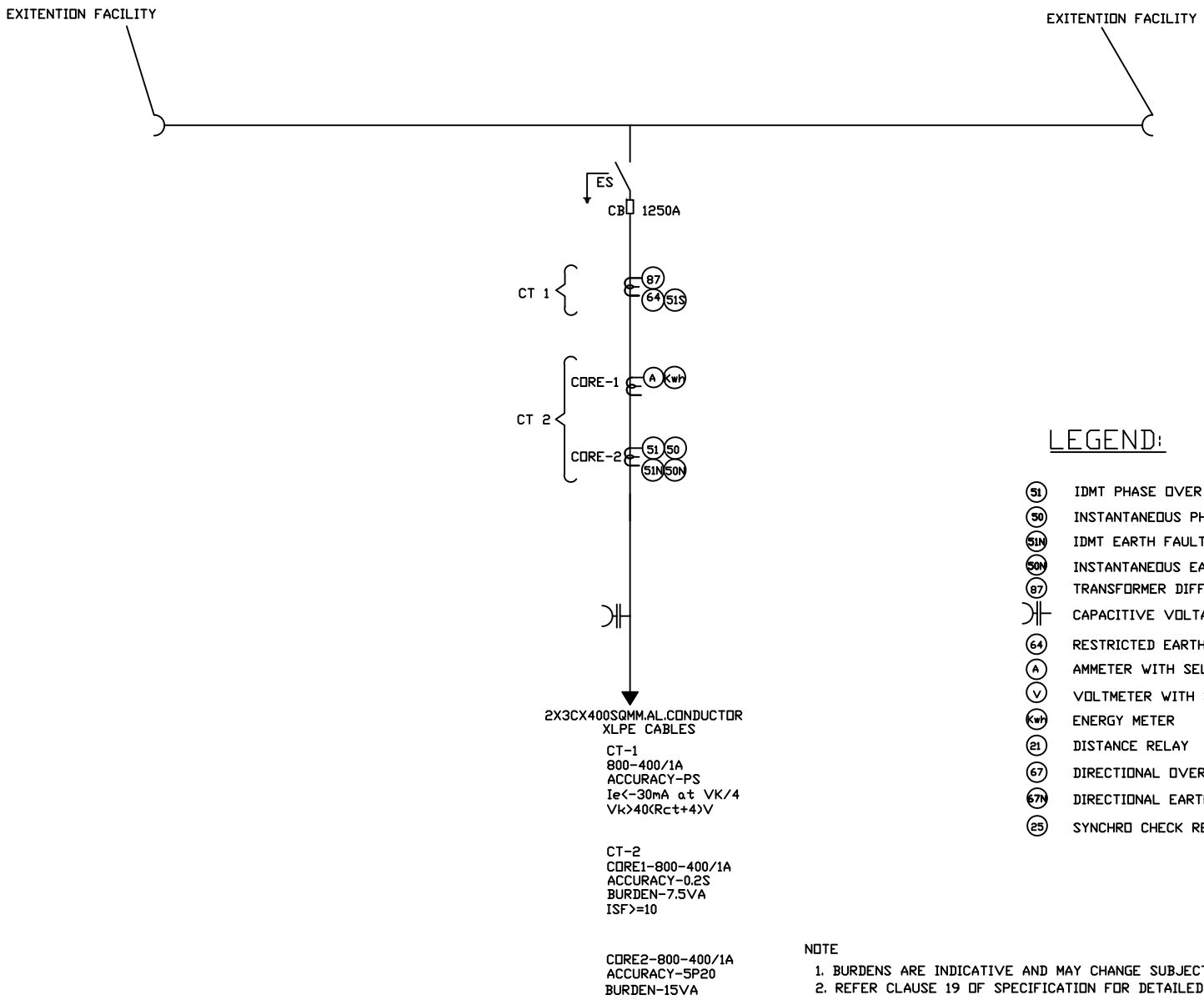
V	VOLTMETER WITH SELECTOR SWITCH
Kwh	ENERGY METER
21	DISTANCE RELAY
67	DIRECTIONAL OVER CURRENT RELAY
67N	DIRECTIONAL EARTH FAULT RELAY
25	SYNCHRO CHECK RELAY

NOTE

1. BURDENS ARE INDICATIVE AND MAY CHANGE SUBJECT TO CALCULATIONS DURING DETAILED ENGINEERING.
2. REFER CLAUSE 19 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENT OF RELAYS.

DRAWN	RAJESH	TITLE:-	BSES Yamuna Power Limited
CHECKED	G.S	STANDARD SLD FOR 33KV INCOMER	SPECIFICATION NO. SP-MVGIS-24-R3
APPD.	A.A		SLD-GIS-33KV-05
DATE	26.09.18		
SCALE	NTS		

ANNEXURE-F6



LEGEND:

- (51) IDMT PHASE OVER CURRENT RELAY
- (50) INSTANTANEOUS PHASE OVER CURRENT RELAY
- (51N) IDMT EARTH FAULT RELAY
- (50N) INSTANTANEOUS EARTH FAULT RELAY
- (87) TRANSFORMER DIFFERNTIAL RELAY
- CAPACITIVE VOLTAGE INDICATOR
- (64) RESTRICTED EARTH FAULT RELAY (33 KV OF TRANSFORMER)
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- (V) VOLTMETER WITH SELECTOR SWITCH
- (Kwh) ENERGY METER
- (21) DISTANCE RELAY
- (67) DIRECTIONAL OVER CURRENT RELAY
- (67N) DIRECTIONAL EARTH FAULT RELAY
- (25) SYNCHRO CHECK RELAY

NOTE

1. BURDENS ARE INDICATIVE AND MAY CHANGE SUBJECT TO CALCULATIONS DURING DETAILED ENGINEERING.
2. REFER CLAUSE 19 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENT OF RELAYS.

DRAWN	RAJESH
CHECKED	G.S
APPD.	A.A
DATE	26.09.18
SCALE	NTS

TITLE:-

STANDARD SLD FOR 33KV TRANSFORMER FEEDER

BSES Yamuna Power Limited

SPECIFICATION NO. SP-MVGIS-24-R3

SLD-GIS-33KV-06

TECHNICAL SPECIFICATION

FOR

POWER TRANSFORMER

PREPARED BY	REVIEWED BY	APPROVED BY	REV	00
SG	GS	DS	DATE	22nd JULY 2014
			PAGE	1 OF 54

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1.0 SCOPE OF SUPPLY

For scope of supply,refer Annexure A

2.0 CODES & STANDARDS

Material, equipment and methods used in the manufacture of power transformer shall conform to the latest edition of following:

IEC 34	Rotating Electrical Machines. (E.g. For Cooler Fan Motors.)
IEC 38	Standard Voltages.
IEC 71	Co-ordination of Insulation.
IEC 76	Power transformers
IEC 156	Method for Determination of the Electric Strength for Insulating Oils.
IEC 44	Current Transformers.
IEC 214	On-Load Tap- Chargers
IEC 242	Standard Frequencies for Centralized Network Control Installations.
IEC 296	Specification for Unused Mineral Insulating Oils for Transformer and switchgear.
IEC 354	Loading Guide for Oil-Immersed Power Transformers.
IEC 445	Identification of Equipment Terminals and of Terminations of Certain Designated Conductors, Including General Rules for an Alphanumeric System.
IEC 529	Degrees of Protection Provided by Enclosures (IP Code)
IEC 542	Application Guide for On-Load Tap- changers.
IEC 551	Determination of Transformer and Reactor Sound Levels.
IEC 606	Application Guide for Power Transformer.
IEC 616	Terminal and Tapping Markings for Power Transformers.
IEC 947	Low- Voltage Switchgear and Control gear.
IEC 60127	Bushing fo alternating voltages above 1000V
BS 148	Unused Mineral Insulation Oils for Transformers and Switchgear.
BS 223	Bushings for alternating Voltages above 1000 V.
BS 2562	Cable Boxes for Transformers and Reactors.
IS 335	Insulating oil
IS 1271	Thermal evaluation and classification of electrical insulation
IS 2099	Bushing for Alternating voltage above 1000V
IS 2705	Current Transformers
IS 3347	Dimensions for porcelain Transformer bushing
IS 3637	Gas operated relays
IS 3639	Fitting & Accessories for power transformers
IS 4201	Application guide for CT's
IS 6600	Guide for loading of oil immersed transformers
IS 8478	Application guide for On-load tap changer
IS 8468	On-load tap charger
IS 10028	Code of practice for selection, installation & maintenance of transformers
IS 13947	LV switchgear and control gear part-1
IS 2026	Power transformers
IS 5	Colours for ready mix paints
IS 6272	Industrial Cooling Fans
IS5561	Electrical power connectors
IS 325	Three phase induction motors.
	Indian electricity rules
	Indian electricity act

	CBIP manual

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

a. Guaranteed Technical Particulars (GTP)
b. This Specification
c. Referenced Standards
d. Approved Vendor Drawings
e. Other documents

3.0 MAJOR DESIGN CRITERIA & PARAMETERS OF THE TRANSFORMER

3.1	Major design criteria	
3.1.1.	Voltage variation on supply side	+ / - 10%
3.1.2	Frequency variation on supply side	+ / - 5%
3.1.2	Transient condition	- 20% or + 10% combined variation of voltage and frequency
3.1.4	Service condition	Refer Project data
3.1.5	Insulation level	Refer Schedule A
3.1.6	Short circuit withstand level	Refer Schedule A
3.1.7	Overload capability	Refer Schedule A
3.1.8	Noise level	Refer Schedule A
3.1.9	Radio influence voltage	Refer Schedule A
3.1.10	Harmonic currents	Refer Schedule A
	Partial discharge	Refer Schedule A
	Parallel operation	Shall be designed to operate in parallel with transformer.
	Major parameters	
	Rating	Refer Schedule A
	Voltage ratio	Refer Schedule A
3.2.3	Vector group	Refer Schedule A
3.2.4	Impedance	Refer Schedule A
3.2.5	Losses	Refer Schedule A
3..2.5.1	No load loss	Refer Schedule A
.3..2.5.2	Load losses at principal tap	Refer Schedule A
3.2.6	Temperature rise top oil	Refer Schedule A
3.2.7	Temperature rise winding	Refer Schedule A
3.2.8	Flux density	Refer Schedule A
3.2.9	Current density	Refer Schedule A
3.2.10	Tappings on HV winding	Refer Schedule A
3.2.11	Design clearances	Refer Schedule A

4.0 CONSTRUCTION & DESIGN

4.1	Type	ONAN/ONAF, Copper wound, three phase, oil immersed with on load tap changer
4.1.1	Essential provision for ONAF cooling	See note 1 of Annexure C

4.1.2	Provision of mounting cooling fan at site in future at service condition.	Required
4.1.3	Provision of replacement of cooling fan at site in future at service condition	Required
4.1.4	Fan guard if fans mounted in future.	Required
4.2	Major parts	
4.2.1	Tank	
4.2.1.1	Material of construction	As per GTP
4.2.1.2	Plate thickness	Adequate for meeting the requirements of pressure and vacuum type tests as per CBIP. Test will be conducted on each transformer tank for design validation.
4.2.1.3	Welding features	1) All seams and joints shall be double welded 2) All welding shall be stress relieved for sheet thickness greater than 35 mm 3) All pipes, radiators, stiffeners, welded to the tank shall be welded externally
4.2.1.4	Tank feature	1) Adequate space at bottom for collection of sediments 2) Stiffeners provided for rigidity and Designed to prevent accumulation of water 3) No internal pockets in which gas / air can accumulate 4) No external pockets in which water can lodge 5) Tank bottom with welded skid base 6) Tank cover sloped to prevent Retention of rain water 7) Minimum disconnection of pipe work and accessories for cover lifting 8) Tanks shall be of a strength to prevent permanent deformation during lifting, jacking, transportation with oil filled 9) Tank to be designed for oil filling under vacuum 10) Fitted with lifting lug to lift the tank cover only 11) Manhole of sufficient size required for inspection of core and winding 12) Oil level indicator for transportation
4.2.1.5	Flanged type adequately sized inspection cover rectangular in shape required for	1) HV line bushing 2) LV line bushing 3) LV neutral bushing and NCT connection 4) OLTC to winding connection from both sides 5) Core assembly ear thing Inspection covers should be provided with jacking screws & handle and shall not weigh more than 25 KG . Overall design shall be in such a way that

		there shall not be any hindrance/overlapping of some other component, in front of any of the inspection covers.
4.2.1.6	Fittings and accessories on main tank	See under fittings and accessories
4.2.2	Conservator for the main tank	
4.2.2.1	Capacity	Adequate between highest and lowest visible levels to meet the requirement of expansion of oil volume in the transformer and cooling equipment from minimum ambient temperature to 100 °C
4.2.2.2	Conservator oil preservation system	By flexible rubber bag (air cell) placed inside conservator
4.2.2.3	Air cell material	Special type of fabric coated with special grade nitrile rubber, outer surface oil resistant and inner surface ozone resistant
4.2.2.4	Conservator features	1) Conservator shall be bolted into position so that it can be removed for cleaning / other maintenance purposes 2) Main pipe from tank shall project about 20 mm above conservator bottom for creating a sump for collection of impurities 3) Conservator minimum oil level corresponding to minimum temperature shall be well above the sump level 4) It shall be possible to remove and Replace the air cell if required 5) Conservator to main tank piping shall be supported at minimum two points.
4.2.2.5	Fittings and accessories on main tank conservator	1) Prismatic oil gauge with NORMAL and MINIMUM marking. 2) End cover. 3) Oil filling hole with cap 4) Magnetic oil gauge with LOW LEVEL Alarm contact. 5) Silica Gel dehydrating breather with Oil seal and dust filter with clear acrylic single piece clearly transparent cover resistant to UV rays. 6) Drain cum filling valve (gate valve) with locking rod and position Indicator made of Brass, 25 mm with Cover plate. 7) Shut off valve (gate valve) with position indicator made of Brass Located before and after Buccholz relay, 80 mm. 8) Flange for breather connection. 9) Air release valve on conservator (gate valve) made of Brass, 25 mm with cover plate 10) Air release plug as required
4.2.2.6	Essential provision for mounting of conservator	Conservator to be mounted in such a manner that the top cover of the transformer can be lifted without disturbing the conservator
4.2.2.7	Essential provision for	1) Breather body should be Aluminum

	breather	pressure die casted, shot blasted and power coated. 2) Container and oil cup should be 143R grade UV resistant polycarbonate. 3) All gaskets should be of nitrile cork (RC 70C) rubber. 4) Breather should be flanged type not threaded type 5) Breather piping shall not have any Valve placed in between 6) Breather shall be removable type mounted at a height of 1400 mm from ground level. 7) Silica Gel used in breather should be of ROUND BALL type & 2.5 mm dia. 8) Breather shall be tested for 0.35 kg/cm for all joints
4.2.3	Conservator for OLTC & Diverter Chamber	
4.2.3.1	Capacity	Adequate between highest and lowest visible levels to meet the requirement of expansion of oil volume in the OLTC from minimum ambient temperature to 100 deg cent. Conservator for OLTC & Diverter chamber shall be single with partition inside & with clear visible indication separately for both OLTC & Diverter chamber.
4.2.3.2	Conservator oil preservation system	Conventional
4.2.3.3	OLTC conservator features	Same as 4.2.2.4 except air cell features
4.2.3.4	Fittings and accessories on OLTC conservator	1) Prismatic oil gauge with NORMAL and MINIMUM marking 2) End cover 3) Oil filling hole with cap 4) Magnetic oil gauge with LOW LEVEL Alarm contact 5) Silica gel dehydrating breather with oil seal and dust filter with clear acrylic single piece clearly transparent cover resistant to UV rays 6) Drain valve (gate valve)With locking rod and position Indicator made of Brass, 25 mm with cover plate 7) Shut off valve (gate valve) with Position indicator made of Brass ocated before oil surge relay, 25 mm 8) Flange for breather connection 9) Air release plug as required
4.2.3.5	Essential provision for mounting of OLTC conservator	OLTC conservator to be mounted in such a way that the OLTC can be inspected / maintained without disturbing the OLTC conservator
4.2.3.6	Essential provision for OLTC breather	1) Breather piping shall not have any valve placed in between 2) Breather piping from conservator shall be supported in such a manner that the maximum

		unsupported length of the of the breather piping shall not be more than 3 meters 3) Breathers shall be removable type mounted at suitable height from ground so that it can be attended to easily for inspection / maintenance
4.2.4	Radiators	
4.2.4.1	Material	Pressed Steel
4.2.4.2	Thickness	Minimum 1.2 mm
4.2.4.3	Features	Detachable type with lifting lugs, air release plug, drain plug, isolating valve top and bottom in each radiator, Radiator support from ground if required
4.2.4.4	Essential provision if radiators mounted separately	Expansion bellow to be provided in the pipes between main tank and radiator headers
4.2.4.5	Essential provision for all type of radiators provided	Radiator header pipes shall not originate from tank top cover to make the tank top cover removable at site with minimum manpower.
4.2.5	Core	
4.2.5.1	Material	High grade, non ageing, low loss, high permeability, grain oriented, cold rolled silicon steel lamination
4.2.5.2	Grade	As per GTP
4.2.5.3	Lamination thickness	As per GTP
4.2.5.4	Design flux density at rated conditions at principal tap	As per manufacturers design.
4.2.5.5	Maximum flux density at 10% over excitation / overfluxing	As per GTP
4.2.5.6	Core design features	1) Magnetic circuit designed to avoid short circuit paths within core or to the earthed clamping structure 2) Magnetic circuit shall not produce flux components at right angles to the plane of lamination to avoid local heating 3) Least possible air gap and rigid clamping for minimum core loss and noise generation 4) Adequately braced to withstand bolted faults on secondary terminals without mechanical damage and damage / dis-placement during transportation and positioning 5) Percentage harmonic potential with the maximum flux density under any condition limited to avoid capacitor overloading in the system 6) All steel sections used for supporting the core shall be thoroughly sand blasted after cutting, drilling, welding 7) Provision of lifting lugs for core coil assembly 8) Supporting framework designed not to obstruct complete drainage of oil from transformer

		9) The insulation of core to bolts and core to clamps plates shall be able to withstand a voltage of 2 Kvrms for one minute, however boltless construction shall be preferred to avoid generation of hot spots and decomposition of oil as well as to reduce noise level.
4.2.6	Winding	
4.2.6.1	Material	Electrolytic Copper
4.2.6.2	Maximum current density allowed	As per GTP
4.2.6.3	Winding Insulating material	Class A, non catalytic, inert to transformer oil, free from compounds liable to ooze out, shrink or collapse
4.2.6.4	Winding Insulation	Uniform
4.2.6.5	Design features	1) Stacks of winding to receive adequate shrinkage treatment before final assembly 2) Connection braced to withstand shock during transport, switching, short circuit, or other transients. 3) Minimum out of balance force in the transformer winding at all voltage ratios. 4) Conductor width on edge exceeding six times its thickness 5) Transposed at sufficient intervals. 6) Threaded connection with locking facility 7) Winding leads rigidly supported, using guide tubes if practicable 8) Winding structure and major insulation not to obstruct free flow of oil through ducts 9) Provision of taps as indicated in the technical particulars
4.2.6.6	Essential provision for core coil assembly	Core coil assembly shall be mounted on bottom of the tank. Earthing of core clamping structure and earthing of magnetic circuit shall be in line with CBIP reference manuals.
4.2.7	Transformer Oil	
		Should be in accordance with specification as per Annex D of this document. One sample of oil drawn from every lot of transformer offered for inspection should be tested at NABL accredited lab for tests as listed under table 1 of IS 1866(2000).The cost of this testing should be included within the cost of transformer.
4.2.8	Bushings and terminations	
4.2.8.1	For 33 kV side (20/25 MVA)	33kV Plug In Type bushings with T –Type screened connectors (Nexans/ Euromold make) Bushings: **M 400AR – 4/J** Connector: - **3x(M 484 TBP2 - 43 - 400.630-14-5)**

		Other make equivalent to product specified can be consider subject to approval from BSES.
4.2.8.2	Type 52kv and above	Oil filled porcelin condenser & non oil communicating type with oil level gauge, oil filling plug and drain valve if not hermetically sealed, tap for capacitance and loss factor measurement, removable without disturbing bushing CT'S.
4.2.8.3	Arcing horns.	Not required.
4.2.8.4	Termination on HV side bushing	By bimetallic connectors suitable for ACSR/AAAC conductor, cable connection through cable box with disconnecting link as per annexure A Scope of Supply.
4.2.8.5	Termination on LV side bushing	Cable connection through cable box with disconnecting link as per annexure A, scope supply.
4.2.8.6	Minimum creepage distance of bushing	As per annexure C cl 38.0
4.2.8.7	Continuous current rating	Minimum 20 % higher than the current corresponding to the minimum tap of the transformer.
4.2.8.8	Rated thermal short time current	As per annexure C Cl 38.0
4.2.8.1.	Atmospheric protection for clamp and fitting of iron and steel.	Hot dip galvanizing as per IS 2633
4.2.8.11	Bushing terminal lugs in oil and air.	Tinner copper.
4.2.8.12	Sealing washers /gasket ring.	RC 70C Nitrile Cork
4.2.9	HV LV, LV Neutral cable box	Required /Not required as annexure A Scope of supply.
4.2.9.1	Material of construction	Sheet steel min 4.0 mm thick. Inspection covers shall be min 3mm thick.
4.2.9.2	Cable entry	At bottom through detachable gland plate with cable clamps of non magnetic material
4.2.9..3	Cable size for HV	As pe annexure C Cl 15.4
4.2.9.4	Cable size for LV	As per Annexure C Cl 15.5
4.2.9.5	Cable size for LV neutral	As per Annexure C
4.2.9.6	Detachable gland plate material for HV, LV, LV Neutral box	As per annexure C
4.2.9.7	Gland plate thickness for HV, LV, LV Neutral box	As per GTP
4.2.9.7	Cable gland for HV, LV, LV Neutral cables	As per GTP
4.2.9.8	Cable lug for LV Neutral cables	As per CL 4.9 of this spec and suitable for cable size as per GTP
4.2.9.10	Essential parts	1) Disconnecting chamber 2) Flexible disconnecting link of tinned copper 3) Tinned copper busbar for Owner's cable termination with busbar supports 4) Detachable gland plate as per Annexure D

		GTP Cl. 24.4, 24.5, 25.4, 25.5, 26.4, 26.5 5) Earthing boss for the cable box 6) Earthing link for the gasketted joints at two points for each joint 7) Earthing provision for cable armour / screen 8) Flange type Inspection cover with handle for Inspecting bushing and busbars on top as well as on front cover 9) Removable front cover with handle 10) Drain plug 11) Rainhood on gasketted vertical joint 12) Danger plate made of Anodized aluminum with white letters on red background on HV and LV side fixed by rivets. 13) Phase marking plate inside cable box near termination as well as on front cover of cable box made of anodized aluminum with black letters on satin silver background on HV and LV side fixed by rivets 14) Support insulators for the busbars shall be epoxy resin cast type.
4.2.9.11	Terminal Clearances	As per Annexure C technical particulars
4.2.9.12	Termination height required for cable termination	Minimum 1000 mm
4.2.9.13	Essential provision for LV neutral cable box	1) Neutral shall be outdoor bushing type suitable for connecting 2*75x10 mm size GS strip and brought down to the bottom of the transformer supported by suitable support insulator made of epoxy resin cast(For Delhi Discom) 2) Neutral shall be provided with cable box suitable for connecting 2 runs of 1C * 500 Sq mm.,1.1Kv Aluminum armored XLPE cable(For Mumbai discom) 3) Box shall have adequately sized inspection cover suitable for inspection of bushings/replacement/maintenance of neutral CT.
4.2.10	Current Transformers	
4.2.10.1	WTI CT	As per GTP
4.2.10.1.1	Rating	As per GTP
4.2.10.1.2	Mounting	In the turret of the bushing
4.2.10.1.3	Essential provision	1) CT mounting shall be such that CT can be replaced without removing tank cover 2) CT secondaries shall be wired upto TB with TB spec. as per Cl. of this specification
4.2.10.2	Neutral CT	
4.2.10.2.1	Type	Cast resin
4.2.10.2.2	Rating	As per Annexure GTP
4.2.10.2.3	Location of NCT	Separate box with TB arrangement for secondary Bushing type not acceptable.

4.2.10.2.4	Essential provision	1) CT mounting shall be such that CT can be replaced without removing the neutral cable box. 2) CT secondaries shall be wired upto TB
4.2.10.2.5	Size of NCT Box	Overal size of NCT box shall not exceed 1200x600x1000 mm including canopy on top.
4.2.11	Marshalling Box Cubicle	
4.2.11.1	Material of construction	Construction of Marshalling Box should be stainless steel more than 314 grade with powder coating of specified colour shed
4.2.11.2	Door hinges of marshalling box should be from inner side and should not be exposed to rain.	Required
4.2.11.3	Gland plate mounting should be from inside only.	Required
4.2.11.4	Digital Temp scanner	Not Required
4.2.11.5	TTB with LED for all TRIP & ALARM signals.	Not Required
4.2.11.6	Major equipments in Marshalling box	1) Mechanical gauge for WTI -2 No's 2) Mechanical gauge for OTI 3) Control & Protection Equipment for Fan Control 4) Other panel accessories listed elsewhere
4.2.11.7	Gland plate	Min. 3 mm thick detachable with knockout
4.2.11.8	Contacts wired to terminal block Connect Well TTB with LED shall be used for all TRIP & ALARM terminals (TTB No.: - DDFL4ULR)	WTI alarm and trip OTI alarm and trip Buchholz relay alarm and trip OSR trip contacts MOG low level alarm MOG on OLTC low level alarm PRV main tank trip PRV OLTC trip Sudden pressure relay trip
4.2.11.9	Signals to be wired to terminal block	WTI CT NCT Capillaries for WTI and OTI 4 to 20 mA signals for WTI and OTI repeater located elsewhere
4.2.11.10	Ingress protection	IP 55 plus additional rain canopy to be provided
4.2.11.11	Welding	Continuous welding on joints, welding at regular intervals on joints and filling of gaps with use of M seal not accepted
4.2.11.12	Cable entry	Bottom for all cables
4.2.11.13	Panel internal Access	Front only through front door double leaf with antitheft hinges
4.2.11.14	Pane back access	None
4.2.11.15	Mounting of marshalling box	Tank / separately mounted as per GTP
4.2.11.16	Panel supply	240 V AC, single phase, 50 Hz
4.2.11.17	Panel accessories	1) Cubicle lamp with door switch and separate fuse / MCB 2) Approved space heaters controlled by

		thermostat and separate fuse / MCB 3) Incoming fuse switch / MCB for the incoming supply 4) Panel wiring diagram fixed on back of panel door on Aluminum plate engraved fixed by rivet 5) Stainless steel door handle with lock & additional facility for padlock 6) Earthing boss for the marshaling box 7) Single phase power plug industrial type 15/5 Amp. With MCB 8) TTB for all TRIP Commands
4.2.11.18	Fan motors control installed in marshalling box or separate fan control cubicle	1) 2 x 50% fans 2) Complete fan control with fuse switch, contactor, Bimetallic relay, in starter circuit with type 2 coordinated rating as per IS 3) Automatic control from WTI contact 4) Provision for manual control both from local/ remote. 5) Fan Control Cubicle should be separately mounted. 6) 2RC/2RS type bearings shall be used instead of ball bearings. 7) Fan enclosure shall be perforated sheet with holes at motor side with ground support.
4.3	Hardware	
4.3.1	External	M16 size & below Stainless Steel & above M16 Hot Dip galvanized steel.
4.3.2	Internal	Cadmium plated except special hardware for frame parts and core assembly as per manufacturer's design
4.3.3	Provision of fully enclosed Aluminium hoods/Canopy for following accessories of power transformer for protection against water ingress.	All Oil Surge Relays, Buchholz Relay, Pressure release Valve.
4.4	Gasket	
4.4.1	For transformer, OLTC chamber, PT chamber, surfaces interfacing with oil like inspection cover etc.	RC 70C Nitrile Cork
4.4.2	For cable boxes, marshalling box, OLTC drive mechanism etc.	RC 70C Nitrile Cork
4.4.3	Tank top cover gasket	It shall be double O ring type sealing arrangement seating over a double groove made in transformer tank & top cover.
4.5	Valves	
4.5.1	Material of construction	Brass
4.5.2	Type	Both end flanged gate valve / butterfly valve depending on application

4.5.3	Size	As per manufacture's standard
4.5.4	Essential provision	Position indicator, locking rod, padlocking facility, valve guard, cover plate.
4.6	Cable routing on Transformer	Control cable for accessories on transformer tank to marshalling box and WTI, OTI Capillaries shall be routed through perforated Covered GI trays
4.6.1	Control cable specification	PVC insulated, extruded PVC inner sheathed, 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
4.6.2	Specification of wires to be used inside marshalling box, OLTC drive mechanism.	PVC insulated multistrand flexible copper wires of minimum 2.5 sqmm size, 1100 V grade as per latest edition of relevant IS
4.6.3	Essential provision for Capillary routing from transformer to marshalling box	Routing shall be done in such a way that adequate protection is available from mechanical and fire damage.
4.7	Terminal Blocks to be used by the vendor	Nylon 66 material, minimum 6 sqmm screw driver operated stud type for control wiring and potential circuit. Terminal blocks to be located in such a way to achieve the termination height as min 250 mm from grand plate.
4.7.1	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
4.8	Cable glands to used by the vendor	Nickel plated brass double compression weatherproof cable gland
4.9	Cable lugs to be used by the vendor	
4.9.1	For power cables	Long barrel medium duty bi-mettalic lug with knurling on inside surface
4.9.2	For control cable	Tinned copper preinsulated Pin Ring, Fork type as applicable. For CT connection ring type lug shall be used.
4.10	Painting of transformer, conservator, OLTC, Radiator, cable boxes marshalling box.	
4.10.1	Surface preparation	By 7 tank pretreatment process or shot blasting method
4.10.2	Finish on internal surfaces of the transformer interfacing with oil	Bright Yellow heat resistance and oil resistant paint two coats. Paint shall neither react nor dissolve in hot transformer insulating oil.
4.10.3	Frame parts	Bright Yellow heat resistance and oil resistant paint two coats. Paint shall neither react nor dissolve in hot transformer insulating oil.
4.10.4	Finish on inner surface of the marshalling boxl	White Polyurethane paint anticondensation type two costs, minimum dry film thickness 80 microns
4.10.5	Finish on outer surface of the	Siemens Grey (RAL 7032) polyurethane paint

	transformer, conservator, radiator, cable boxes, marshalling box	two coats, minimum dry film thickness 80 micros

5.0 MINIMUM PROTECTIVE DEVICES ON TRANSFORMER

5.1	Spring loaded with detachable diaphragm type pressure relief valve with two trip contacts for the main tank of LSM model with limit switch design IP 65 with additional rain hood.	Required
5.2	Spring loaded with detachable diaphragm type pressure relief valve with two trip contacts for OLTC of LSM model with limit switch design IP 65 with additional rain hood.	Required
5.3	Double float bucchholz relay with alarm and trip contacts, service and test position, with test cock for the main tank, terminal box shall be IP 65 with drain plug for rainwater draining. Additional rain hood shall be provided.	Reed Switch Type shall be required
5.4	Oil surge relay with two contacts, services and test position, with test cock for OLTC tank, terminal box shall be IP 65 with drain plug for rainwater draining. Additional rain hood shall be provided.	Required
5.5	Sudden pressure relay with trip contact for the main tank	Required
5.6	Oil temperature indicator metallic bulb type 150 mm diameter with maximum reading pointer, potential free independent adjustable alarm and trip contacts, resetting device with temperature sensing element	Required
5.7	Winding temperature indicator 150 mm diameter with maximum reading pointer, two sets of potential free independent adjustable alarm and trip contacts, resetting device with temperature sensing element, thermal image coil	Required
5.8	2 No's PT 100 sensors/RTDs for winding emperature indication wired upto TB's in marshalling box for external connection.	required

6.0 FITTINGS AND ACCESSORIES ON TRANSFORMER

6.1	Rating and diagram plate	Required
6.1.1	Material	Anodized aluminum 16SWG
6.1.2	Background	SATIN SILVER
6.1.3	Letters, diagram & boder	Black
6.1.4	Process	Etching
6.1.5	Name plate details	Following details shall be provided on rating and diagram plate as a minimum 1) Type / kind of transformer with winding material 2) Standard to which it is manufactured 3) Manufacture's name 4) Transformer serial number 5) Month and year manufacture 6) Rated frequency in Hz 7) Rated voltages in kv 8) Number of phases 9) Rated power in kVA 10) Type of cooling (ONAN) 11) Rated currents in A 12) Vector group symbol 13) 1.2/50□s wave impulse voltage withstand level in kV 14) Power frequency withstand voltage in kV 15) Impedance voltage at rated current and frequency in percentage at principal, minimum and maximum tap 16) Load loss at rated current 17) No load loss at rated voltage and frequency 18) Auxiliary loss 19) Continuous ambient temperature at which ratings apply in □ C 20) Top oil and winding temperature rise at rated load in deg C 21) Temperature gradient of HV and LV winding 22) Winding connection diagram 23) Weight of radiator 24) Volume and weight of oil in radiator 25) Transport weight of transformer 26) Weight of core and frame 27) Weight of winding 28) Weight of core and winding 29) Weight of tank and fittings 30) Total weight 31) Volume of oil 32) Weight of oil 33) NCT, WCT, details 34) Type of OLTC

		35) Tapping details 36) Name of the purchaser 37) PO no and date 38) Guarantee period
6.2	Instruction plate for OLTC anodized aluminum black lettering on satin silver background fixed by rivet	Required
6.3	Oil filling instruction plate anodized aluminum black lettering on satin silver background fixed by rivet	Required
6.4	Valve schedule plate anodized aluminum black lettering on satin silver background fixed by rivet	Required
6.5	Instruction plate anodized aluminum black lettering on satin silver background for flexible air cell for oil conservator	Required
6.6	Terminal marking plate for bushing WTI, OTI & RTD anodized aluminum black lettering on satin silver background fixed by rivet	Required
6.7	Company monogram plate	Required
6.8	Lifting lugs / bollards with antiskid head to lift complete transformer with oil	Required
6.9	Lashing lug	Required
6.10	Jacking pad with Haulage hole to raise or lower complete transformer with oil	Required
6.10.1	Essential provision for jacking pads	Designed in such a way that jacking of complete transformer with oil shall be possible with 3 nos jacking pads out of 4 nos jacking pads provided as minimum
6.11	Detachable bi-directional roller assembly with corrosion resistant bearing, fitting / nipple for lubrication or with permanently lubricated bearing, anti earthquake locking device. The wheels shall be capable of swiveling when transformer is lifted with provision for locking the swivel movement. Roller shall be suitable for 90 lb rail. Suitable antirolling clamp for 90 lb rail minimum 4 nos. shall be provided	Required
6.12	Pockets for OTI, WTI, & RTD on tank	Required (with one spare pocket for future use)
6.13	Pockets for ordinary thermometer on tank cover, top and bottom header of radiator, top of each radiator	Required
6.14	Ordinary thermometer 4 nos.	Required

6..15	Drain valve (gate valve) for the main tank, 80 mm	Required
6.16	Drain valve (gate valve) for OLTC, 50 mm	Required
6.17	Drain valve (gate valve) for all headers, 50 mm	Required
6.18	Filter valve (gate valve) at top and bottom of the main tank, 50 mm	Required
6.19	Sampling valve (gate valve) at top and bottom of the main tank, 15 mm	Required
6.20	Vacuum breaking valve (gate valve), 25 mm	Required
6.21	Drain plug on tank base	Required
6.22	Air release plug on various fitting and accessories	Required
6.23	Earthing pad on tank for transformer earthing complete with non ferrous nut, bolt, washers, spring washers etc.	Required
6.24	Vacuum pulling pipe with blanking plate on main conservator pipe work	Required
6.25	Rainhood (canopy) for Buccholz relay, PRV on main transformer and OLTC, OSR relay of OLTC	Required
6.26	Rainhood for vertical gasketted joints, in cable boxes	Required
6.27	Oil level gauge on tank for transformer shipment	Required
6.28	Earthing bridge by copper strip jumpers on all gasketted joints at least two points for electrical continuity	Required
6.29	Aluminium ladder with anticlimbing device and safety flap, with lockable hinged plate for at least 1.5 m from ground level. Ladder shall be located in such a way that it avoids any hindrance to operation of nearby electrical/mechanical accessories etc.	Required
6.30	Transformer and OLTC monitoring Relay (Digital RTCC relay)	Not in bidder's scope (Digital and analog signals shall be provided on transformer by bidder)
6.31	Skid base welded type	Required
6.32	Core, frame to tank earthing	Required
6.33	Danger plate made of anodized aluminium white lettering on red background fixed by rivet	Required
6.34	Identification plate for all accessories, protective devices, instruments, thermometer / RTD pockets, earthing terminals, all	Required

	inspection covers, cable boxes, marshalling boxes etc.made of anodized aluminium black lettering on silver background fixed by rivet	

7.0 OLTC

.7.1	Requirement	Required CTR make or equivalent subject to purchasers approval for 33 kv. For 66 kv the type and rating shall be finalized based on discussion with the vendor. No in-tank OLTC acceptable. "For selected locations where space is a constraint, BSES may accept in tank OLTC".
7.2	OLTC gear location	Side mounted on conservator side not in front of HV bushing
7.3	Type of OLTC gear	The tapings shall be controlled by a high speed resistor transition type gear in which tap change is carried out virtually under 'no volt' 'no ampere' condition and the selector switches do not make and break any current, main current is never interrupted and a resistor is provided to limit the arching at diverter contacts to a minimum suitable for outdoor mounting and continuously rated for operating at all position including positions in the middle of tap change. In particulars, the tap change gear shall be suitable when delivering the full output plus permissible overload and operating the lowest voltage tap on the HV side. The value of the transition resistor shall be indicated on the rating plate of the OLTC with continuous current rating with reference to design ambient temperature specified.
7.4	Tappings	As per GTP
7.5	Operation of OLTC gear	Selection of local / remote operation by selector switch on OLTC drive mechanism
7.5.1	local operation	From OLTC drive mechanism through pistol grip rotary switch as well as emergency mechanical hand operation.
7.5.2	Remote operation	From digital RTCC provided by customer /SCADA depending on the selection of control on digital RTCC panel.
7.6	Safety interlocks in OLTC	Following safety interlock to be provided in OLTC as minimum 1) Positive completion of tap changing step once initiated 2) Blocking of reverse tap change command during a forward tap change already in progress until the mechanism resets and vice - versa 3) Cutting of electrical circuits during

		mechanical operation 4) Mechanical stops to prevent overrunning of the mechanism at the end taps 5) Interlock to avoid continuous tap change which will cut off motor supply in such events 6) Raise / lower command in OLTC and Digital relay shall be positively interlocked
7.7	Feature of OLTC	1) OLTC mechanism and associated controls shall be housed in an outdoor, IP 55, weatherproof, vermin proof and dust proof cabinet 2) It shall be ensured that oil in compartments containing contacts making and breaking current compartments containing contacts not making and breaking current and main transformer tank does not mix 3) The hand cranking arrangement shall be such that it can be operated at standing height from ground level 4) Mechanical indicator to indicate completion of tap change operation shall be provided with suitable (Green & Red) colour code to confirm correct method of completion of tap change operation 5) Contractors shall be placed in the OLTC driving mechanism in such a way that the name-plate shall be visible on opening of door. 6) Protective cover shall be provided for raise and lower push buttons, external ON-OFF switch, which are mounted on OLTC driving mechanism door. This is required to prevent unauthorized person operating these buttons. 7) It shall be possible to remove the top cover of the OLTC tank without difficulty. The OLTC conservator, piping & oil surge relay shall be placed accordingly. 8) The tap change equipment shall be so designed that if the mechanism is struck in an intermediate position, the transformer shall be capable of delivering full load without any damage. 9) Limit switches may be connected in the control circuit of the operating motor provided that a mechanical de-clutching mechanism is incorporated. Otherwise it shall be directly connected to the operating motor circuit and mechanical stop. 10) Thermal devices or other means shall be provided to protect the motor and control circuits 11) The tap changer shall be capable of

		permitting parallel operation with other transformer for which necessary wiring and accessories, if any, shall be provided 12) The control scheme for the tap changer shall be provided for independent control of the tap changers when the transformers are in Independent service. In addition provision shall be made to enable parallel operation control also at times so that the tap changer will be operated simultaneously when one unit is in parallel with another it will not become out of step and this will eliminate circulating current. Additional features like master /follower and visual indication during the operation of motor shall also be incorporated. 13) OLTC shall be suitable for bi- directional power flow in transformer 14) Mechanical indicator and operation counter shall be visible through glass window OLTC drive mechanism door 15) External ON /OFF switch in addition to door switch 16) All HRC fuses shall be located in such a way that they are easily replaceable. 17) Motor protection relay shall be provided with single phasing prevent for both current and voltage unbalance. 18) All accessories inside drive mechanism shall be provided with metallic label, no sticker permitted.
7.8	Essential BOM for OLTC drive mechanism (indicative only, bidder to provide all necessary components to complete the function of the OLTC)	1) Control circuit transformer 415/55-0-55 V, adequate capacity 2) Local remote selector switch 1 pole, 2 way, 6A, pistol grip 3) Retaining switch raise / lower 4) Handle interlock switch 5) Raise / lower switch 1 pole, 2way, 6A, pistol grip 6) Lower limit switch 7) Raise limit switch 8) Tap changer motor, 415 V AC, 3 phase, adequate rating 9) Motor protection relay with single phasing preventor 10) Motor control contactors raise / lower 11) Stepping relay 12) Out of step switch 13) Tap position indicator 14) Operation counter 15) Emergency stop push button 16) Tap change incomplete scheme with timer

		17) Required indication lamp
7.9	Essential provision of accessories on OLTC	1) Pressure relief valve 2) Oil surge relay
7.10	Drive mechanism accessories	1) Cubical lamp with door switch and separate fuse / MCB with external ON /OFF switch on front cover of OLTC drive mechanism 2) Approved space heaters controlled by thermostat and separate fuse / MCB 3) Incoming fuse switch / MCB for the incoming supply 4) Panel wiring diagram fixed on back of panel door aluminium engraved fixed by rivet 5) Nylon 66 terminal block min 4 sqmm screw type, with 10% spare terminals 6) Stainless steel door handle with lock & additional facility for padlock 7) Earthing boss
7.11	Hardware, Gasket, Cables and Wires, Terminal blocks, Cable gland, Cable lugs of OLTC drive mechanism	As per Cl. 4.3, 4.4, 4.6, 4.7, 4.8, 4.9 of the specification respectively.
7.12	OLTC and drive mechanism painting	As per Cl. 4.10 of the specification
7.13	RTCC panel	Not in the scope of supply.

8.0 APPROVED MAKE OF COMPONENTS

8.1	Magnetic oil level indicator	Sukrut /Yogya/ATVUS
8.2	Pressure relief valve	Sukrut / Qualitrol
8.3	Buccholz relay	Proyog / ATVUS/ /Yogya
8.4	Oil surge relay	Proyog / ATVUS/ EASUN - MR
8.5	Winding Temperature Indicator	Precimeasure/perfect controls /pradeep sales.
8.6	Oil Temperature Indicator	Precimeasure/perfect controls/pradeep sales.
8.7	Sudden pressure relay.	Sukrut / Qualitrol
8.8	Aircell	Sukrut / pronol / Rubber product.
8.9	Neutral CT	Pragati/ECS /KAPPA/ Reputed equivalent.
8.10	WCT	Pragati / ECS /KAPPA/ Reputed equivalent
8.11	Switch	L & T (Salzer) / Siemens
8.12	HRC fuse links	Siemens / L & T / GE
8.13	Fuse base	Siemens / L & T / GE
8.14	AC contractors & O / L relay	L & T / Siemens / Schneider
8.15	Terminals	Connectwell/Elmex
8.16	Push buttons / Actuator	L & T / Siemens
8.17	Thermostat	Velco
8.18	Heater	Velco
8.19	Voltmeter Selector Switch	Siemens
8.20	Control selector switch	Siemens
8..21	Auxiliary relays	Jyoti / Easun Rayrole
8.22	Timers	L & T / Siemens
8.23	Tap position indicator	Accord
8.24	Annunciator	Accord

8.25	Digital tap change counter	Selectron
8.26	LED cluster type indication lamp	MIMIC / Siemens / binay
8.27	33kV Plug In Type bushings	Nexans/ Euromold

Note – Any other make of component to be approved by Owner

9.0 QUALITY ASSURANCE

9.1	Quality assurance	To be submitted before contract award Program shall contain following 1) The structure of the organization. 2) The duties and responsibilities assigned to staff ensuring quality of work. 3) the system for purchasing, taking delivery and verification of materials. 4) The system for ensuring quality of workmanship 5) the system for control of documentation 6) the arrangements for the suppliers internal auditing 7) the system for retention of records. 8)A list of the administration and work procedures required to achieve and verify contracts quality requirements. These procedures shall be made readily available to the purchaser for inspection on request.
9.2	Quality plan Packing protection	To be submitted by the successful bidder for approval. Plan shall contain following as a minimum 1) An outline of the proposed work and programme sequence 2) the structure of the suppliers organization for the contract. 3) The duties and responsibilities assigned to staff ensuring quality of work for he contract. 4) hold and notification points. 5)submission of engineering documents required by the specification. 6)the inspection of materials and components on receipt 7)reference to the suppliers work procedures appropriate to each activity 8)inspection during fabrication /construction. 9) final inspection and test. 10)Successful bidders shall include submittal of Mills invoice,Bill of lading,Mills test certificate for grade,physical tests,dimension,specific watt loss per KG for the core material to the purchaser for verification in the quality plan suitably.

10.0 PROGRESS REPORTING

10.1	Online document	To be submitted for purchaser approval for outline of producton , inspection,testing,packing dispatch ,documentation programme
10.2	Detailed progress report	To be submitted to the purchaser once a month containing 1)Progress on material procurement 2)progress on fabrication 3)progress on assembly 4) progress on internal stage inspection 5) Reason for any delay in total programme. 6) Details of test failures if any in manufacturing stages. 7) Progress on final box up. 8)Constraints 9) Forward path.

11.0 SUBMITTALS

11.1	Submittals required with bid.	1) Completed technical data schedule. 2) Descriptive literature giving full technical details of equipment offered : 3) Outine dimension drawing for each major component, general arrangement drawing showing component layout an general schematic diagrams. 4) Type test certificates ,where available, and sample routine test reports 5) Detailed reference list of customers already using equipment offered during the last 5 years with particular emphasis on units of similar design and rating 6) Details of manufacturers quality assurance standard and programme and ISO 9000 series or equivalent national certification. 7) Deviations from this specification. Only deviations approved in writing before award of contract shall be accepted. 8)Recommended spare parts and consumable items for the five years of operation with prices and spare parts catalogue with price list for future requirements. 9) Transport / shipping dimension and weights, space required for handling parts for mai11.3ntenance 10) write up on oil preservation system. 11) Write up on OLTC. 12) Quality assurance program.
11.2	Submittals required after award for approval (A), (R) Reference and subsequent	1)Programme for production and testing (A) 2) Guaranteed technical particulars (A) 3) General description of the equipment and all components ,including brochures(R) 4)Calculations to substantiate choice of electrical

	distribution.	,structural,mechanical component size,ratings(A) 5)Detailed dimension drawing for all components ,general arrangement drawing showing detailed component layout and detailed schematic nd wiring drawings for all components like marshalling box and OLTC drive mechanism box. 6) Detailed loading drawing to enable the purchaser to design and construct foundations for the transformer. 7)Transport /shipping dimension with weights ,wheel base details ,untanking height etc.(R) 8) Terminal arrangements and cable box details (A) 9) Flow diagram of cooling system showing no. of cooling banks.(A) 10) Drawings of major components like bushing ,CT etc(A) 11) Valve schedule diagram plate(A) 12)Instruction plate for flexible separator (A) 13)Rating and diagram plate with OLTC connection details. 14) Lists of makes of all fittings and accessories (A) 15)Statement drawing attention to all exposed points in the equipment at which contact with or in close proximity to other metals and stating clearly what protection is employed to prevent corrosion at each point (A). 16) Detailed installation and commissioning instructions . 17) Quality Plan.
11.3	Submittals required at the final hold point prior to dispatch.	1) Inspection and test reports carried out in manufacturers works (A) 2) Test certificates of all bought out items. 3) Operation and maintenance instructions as well as trouble shooting charts.
11.4	Drawing and document sizes	Standard paper A0 ,A1 ,A2 ,A3 , A4
11.5	No of drawings /documents required at different stages.	As per Annexure A Scope of Supply.

12.0 INSPECTION & TESTING

12.1	Inspection and Testing during manufacture	
12.1.1	Tank and conservator	1) Check correct dimension between wheels demonstrate turning of wheels through 90 deg and further Dimensional check. 2) Check for physical properties of material for lifting lugs, jacking pads etc. all load bearing welds, including lifting lug welds shall be subjected to required load tests

		3) Leakage test of the conservator as per CBIP 4) Certification of all test results 5) Oil leakage test on all tanks at normal head of oil plus 35 kn / sqm at the base of the tank for 24 hrs 6) Vacuum and pressure test on tank as type test as per CBIP 7) Leakage test of radiators as per CBIP.
12.1.2	Core	1) Vendor to submit the documentary evidence for procurement of CRGO laminations and prove that they have procured/used new core material..During in process inspection at lamination subvendor, customer shall randomly select/seal lamination for testing at ERDA/CPRI(Accredited NABL labs) for specific core loss,accelerated geing test ,surface insulation resistivity,AC permeability and magnetization, stacking factor,ductility etc.this testing shall be in the scope of vendor. 2) Check on the quality of varnish if used on the stampings. a) Measurement of thickness and hardness of varnish on stampings b) Solvent resistance test to check that varnish does not react in hot oil c) Check over all quality of varnish by sampling to ensure uniform hipping color, no bare spot. No ever burnt varnish layer and no bubbles on varnished surface 3) Check on the amount of burrs 4) Bow check on stamping 5) Check for the overlapping of tampings. Corners of the sheet are to be apart 6) Visual and dimensional check during assembly stage. 7) Check on complete core for measurements of iron-loss and check for any hot spot by exciting the core so to include the designed value of flux density in the core 8) Check for inter laminar insulation between core sectors before and after pressing 9) Visual and dimensional check for straightness and roundness of core, thickness of limbs and suitability of clamps 10) High voltage test (2KV for one minute) between core and clamps 11) Certification of all test results
12.1.3	Insulating material	1) Sample check for physical properties of material 2) Check for dielectric strength 3) Visual and dimensional checks 4) Check for the reaction of hot oil on insulating materials 5) Certification of all test results
12.1.4	Windings	1) Sample check on winding conductor for mechanical properties and

		electrical conductivity 2) Visual and dimensional check on conductor for scratches, dept. mark etc. 3) Sample check on insulating paper for PE value, bursting strength, electric strength 4) Check for the reaction of hot oil on insulating paper 5) Check for the binding of the insulating paper on conductor 6) Check and ensure that physical condition of all materials taken for winding is satisfactory and free of dust 7) Check for absence of short circuit between parallel strands 8) Check for Brazed joints wherever applicable 9) Measurement of voltage ratio to be carried out when core / yoke is completely restocked and all connections are ready 10) Certification of all test results
12.1.4.1	Checks before drying process	1) Check conditions of insulation on the conductor and between the windings 2) Check insulation distance between high voltage connection cables and earthed and other live parts 3) Check insulation distance between low voltage connection cables and earthed and other parts 4) Insulation test of core earthing 5) Check for proper cleanliness 6) Check tightness of coils i.e. no free movements 7) Certification of all test results
12.1.4.2	Checks during drying process	1) Measurement and recording of temperature and drying time during vacuum treatment. 2) Check for completeness of drying 3) Certification of all test result.
12.1.5	Oil	As per IS 335 and annexure-I
12.1.6	Test on fittings and accessories	As per manufacturer's standard
12.2	Routine tests/Acceptance tests	The sequence of routine testing shall be as follows 1) Visual and dimension check for completely assembled transformer 2) Measurements of voltage ratio 3) Measurements of winding resistance at principal tap and two extreme taps. 4) Vector group and polarity test 5) Measurements of insulation resistance and polarization index. 6) Separate source voltage withstand test. 7) Measurements of iron losses and exciting current at rated frequency and 90%, 100% and 110% rated voltage. 8) Induced voltage withstand test. 9) Load losses measurement.

		10) Impedance measurement at principal tap (HV and LV) of the transformer. 11) Routine test of tanks 12) Induced voltage withstand test (to be Repeated if type tests are conducted). 13) Measurement of iron loss (to be repeated if type tests are conducted). 14) Measurement of capacitance and Tan Delta for transformer oil (for all transformers). 15) Phase relation test, polarity, angular displacement and phase sequence. 16) Ratio of HV WTI CT, LV WTI CT and neutral CT 17) Excitation and knee point voltage test on class PS core of neutral CT. 18) Routine test on on–load tap changer. 19) Oil leakage test on assembled transformer 20) Magnetic balance test 21) Power frequency voltage withstand test on all auxiliary circuits 22) Temperature rise test. 23) Impulse test on one sample randomly selected. 23) Certification of all test result a) Insulation resistance measurement shall be carried out at 5 kv. Value of IR should not be less than 1000M ohms. Polarization index (PI = IR10min/IR1min). should not be less than 1.5 (if one minute IR value is above 5000Mohms 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.) b) Temperature rise test may be necessary to be carried out on 100% of the order quantity at the manufacturer's works or third party lab.
12.3	Type tests	On one transformer of each rating and type (In Govt. recognized independent test laboratory / Internationally accredited test lab or at manufacturer's facility if it is approved by component authority. 1) Impulse withstand test on all three HV and LV limbs of the transformers for chopped wave as per standard 2) Temperature rise test as per IS 3) Dissolved gas analysis before and after Temperature Rise test 4) Pressure relief device test 5) Pressure and Vacuum test on tank(stage inspection)
12.4	Special tests	On one transformer of each rating and type 1) Dynamic & Thermal short circuit test short circuit test as per IS 2) Measure of zero seq. impedance (Cl.16.10 IS 2026 part-1)

		3) measurement of acoustic noise level (Cl.16.12 IS 2026 part-1) 4) measurement of harmonic level on no load current 5) High voltage withstand test shall be performed on the auxiliary equipment and wiring after complete assembly. Cost of such tests, if extra, shall be quoted separately by the bidder.
12.5	Note for special tests and type test	Cost of the above tests, if extra, shall be quoted separately by the bidder which shall be considered in the price evaluation.
12.6	Notification to biders	The product offered must be of type tested design with valid type test report of not more than 5 years. In case the product offered is never type tested for tests as per above list,type tests to be conducted by bidder at his own cost at Govt. recognized independent test laboratory / Internationally accredited test lab or at manufacturer's facility if it is approved by component authority. Valid type test reports for dynamic short circuit test as per IS may be forwarded for customer's review and approval. In case the product offered is never tested for dynamic short circuit the same to be conducted by bidder at his own cost at Govt. recoganised independent test laboratory/internationally accredited test lab.

13.0 PACKING, SHIPPING, HANDLING AND STORAGE

13.1	Packing	For 3 secs.
13.1.1	Packing protection	Against corrosion, dampness, heavy rains, breakage and vibration.
13.1.2	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection
13.1.3	Packing details	On each packing case details required as follows 1) Individual serial number: 2) Purchaser's name: 3) PO Number: 4) Destination: 5 Suppliers name: 6) Name and address of suppliers agent 7) Description and numbers of contents: 8) Manufacturers name: 9) Country of origin;: 10) Case measurements: 11) Gross and net weights in kilograms 12) All necessary slinging and stacking instructions.
13.2	Shipping	The bidder shall ascertain at an early date and definitely

		before the commencement of manufacture, any transport limitations such as weights, dimensions, roads culverts, overhead lines, free access etc. from the manufacturing plant to project site :and furnish to the purchaser confirmation that the proposed packages can be safely transported, as normal or oversize packages up to the plant site. Any modifications required in the infrastructure and cost thereof in this connection shall be brought to the notice of the purchaser.
13.3	Handling and storage	As per manufacturers instruction.

14.0 DRAWINGS AND DOCUMENTS

		Along with offer	For approval after award of work	Final after approval /*After completion of delivery.	Remarks
14.1	Drawings	3 Copies (Typical drgs)	4 copies	12 copies + 1 soft copy in CD	See clause 11 for various drawings required.
14.2	Calculations	3 Copies (Typical)	4 copies	6 copies + 1 soft copy in CD	See clause 11 for details
14.3	Catalogues	1 copy		12 copies + 1 soft copy in CD	
14.4	Instruction manual for the transformer	1 copy		12 copies + 1 soft copy in CD	
14.5	Type test report & Routine test report.	2 Copies (Type test and sample Routine Test)		12 copies + 1 soft copy in CD Routine Test Report.	

15.0 DEVIATIONS

15.1	Deviation	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. No deviation will be acceptable post order.

ANNEXURE – A – SCOPE OF SUPPLY

Design, manufacture, assembly, testing at stages of manufacture as per Cl. 12 of this specification, final testing at manufacturer works on completely assembled transformer before dispatch, packing, transportation, delivery and submission of all documentation for the Power transformer with all accessories as below and ratings & requirements as specified in Annex C.

Sr No	Description	Scope Of Supply
1.0	Fully assembled transformer with all major parts like conservator, Radiators, Marshalling box, Protective devices as per Clause 5.0 of this specification, Fittings and accessories as per Clause 6.0 of this specification	YES
1.1	OLTC as per this specification	YES
1.2	RTCC panel as per this specification	No
1.3	HV, LV ,LV NEUTRAL cable boxes	YES
1.4	Support steel material for support of cable boxes from ground	YES
1.5	Foundation Bolts for complete transformer	YES
1.6	Nickel Plated brass double compression weather proof glands for HV and LV cable	No
1.7	Long barrel medium duty Aluminum lugs for power cables	YES
1.8	Nickel Plated brass double compression weatherproof glands and tinned copper lugs for control cable termination in Marshalling box for vendor's cables	YES
1.9	Cables and wires for transformer accessories and internal wiring of marshalling box.	YES
1.10	Touch up paint, minimum 5 liters.	YES
1.11	Extra Transformer oil 10 % in non returnable drums	YES
1.12	One spare complete set of gaskets.	YES
1.13	One set (4 Nos in a set) of anti rolling clamp for 90 lb rail.	YES
1.14	Ordinary thermometers 4 Nos'	YES
1.15	Recommended spares as per manufacturer	YES
2.0	Routine testing as per Clause 12 of this specification	YES
3.0	Type testing as per Clause 12 of this specification	YES
4.0	Special testing as per Clause 12 of this specification	YES
5.0	Submission of Documentation as per clause 14 of this specification	YES

ANNEXURE – B – SERVICE CONDITIONS

1.0	Delhi Atmospheric condition	
1.1	Average grade atmosphere	Heavily polluted, dry
1.2	Maximum altitude above sea level	1000M
1.3	Ambient air temperature	40 deg C
1.4	Relative humidity	90% Max
1.5	Seismic zone	4
1.6	Rainfall	750 mm concentrated in four months

ANNEXURE – C – TECHNICAL PARTICULARS (DATA BY OWNER)

Sr No	Description	Data by Owner			
1.0	Location of equipment	OUTDOOR			
2.0	Reference design ambient temperature	40 deg C			
3.0	Type	Oil immersed, core type, step down			
4.0	Type of cooling	ONAN / ONAF			
5.0	Reference standard	IS: 2026			
6.0	No. of phases	3			
7.0	No. of winding per phase	2			
8.0	Rated frequency (Hz)	50 Hz			
9.0	Rated voltage (kV)				
9.1	HV winding	33	66		
9.2	LV winding	11	11		
10.0	Vector group reference	Dyn11	Dyn11		
11.0	Nominal continuous rating, KVA				
11.1	For 20/25 MVA				
	ONAN	20	20		
	ONAF	25	25		
11.2	For 25/31.5 MVA				
	ONAN		25		
	ONAF		31.5		
12.0	Impedance at principal tap at rated frequency with IS tolerance	12%	12%		
13.0	Maximum no load loss at rated condition allowed without any positive tolerance kW	12kw (for 25 MVA),	12kw (for 25 MVA), 14 kw (for 31.5 MVA)		
14.0	Maximum load loss at rated condition @ 75 deg C and principal tap allowed without any positive tolerance, kW	85 kw (for 25MVA),	85 kw (for 25MVA), 115 kw (for 31.5 MVA)		
15.0	Terminal connection / cable / conductor size				
15.1	HV side	33kv	66 kv		
		By 2 runs of 3C X400sq mm A2XFY ,33kv(E) grade cable for 20/25 MVA.	By single /Double ACSR “ZEBRA” conductor per phase		
15.2	LV side	By 3 runs of	By 3 runs of		

		1 C X1000sq mm per phase unarmored A2XY ,11 kv (E) grade cable	1C X1000sq mm A2XY unarmored per phase ,11kv (E) grade cable		
15.3	LV neutral	By G .S. strip mim 2x75x10 mm size	By G.S. strip min 2x75x10 mm size		
16.0	Highest system voltage HV side, kV	36	72.5		
17.0	Highest system voltage LV side, kV	12	12		
18.0	Lightning impulse withstand voltage, kV peak				
18.1	For nominal system voltage of 11 kV	75			
18.2	For nominal system voltage of 33 kV	170			
18.3	For nominal system voltage of 66 kV	325			
19.0	Power frequency withstand voltage kV rms				
19.1	For nominal system voltage of 11 kV	28			
19.2	For nominal system voltage of 22 kV	50			
19.3	For nominal system voltage of 33 kV	70			
19.4	For nominal system voltage of 66 kV	140			
20.0	Clearances phase to phase, mm				
20.1	For nominal system voltage of 11 kV	280			
20.2	For nominal system voltage of 22 kV	330			
	For nominal system voltage of 33 kV	350			
	For nominal system voltage of 66 kV	700			
21.0	Clearances phase to earth, mm				
	For nominal system voltage of 11 kV	140			
	For nominal system voltage of 22 kV	230			
	For nominal system	320			

	voltage of 33 kV	
	For nominal system voltage of 66 kV	660
22.0	System fault level, HV side	1000 MVA for 22kV 1500 MVA for 33 kV 3600 MVA for 66 kV
23.0	System fault level, LV side	500 MVA for 11 kV
24.0	Short circuit withstand capacity of the transformer	
24.1	Three phases dead short circuit at secondary terminal with rated voltage maintained on the other side	For 3 secs.
24.2	Single phase short circuit at secondary terminal with rated voltage maintained on the other side	For 3 secs.
25.0	System earthing	
25.1	HV	Solidly earthed
25.2	LV	Solidly earthed
26.0	Overload capability	As per IS 6600
27.0	Noise level	Shall not exceed limit as per NEMA TR- 1 with all accessories running measured as per IEC 551 / NEMA standard
28.0	Radio influence voltage	Maximum 250 microvolt
29.0	Harmonic suppression	Transformer to be designed for suppression of 3^{rd}, 5^{th}, 7^{th} harmonic voltage and high frequency disturbances
30.0	Partial discharge	10 Pico C
31.0	Loss capitalization formulae	As per CBIP manual (see note2)
31.1	No load loss capitalization figure	Rs. 4,09,979 per KW
31.2	Load loss capitalization figure	Rs. 2,26,718 per KW
32.0	Temperature rise of top oil by thermometer	40 deg C
33.0	Temperature rise of winding by resistance	45 deg C
34.0	Note for the bidders	(left blank)
35.0	Tapping to be provided on HV winding for OLTC	For 33/11 kv & 66/11kvTransformer +5% to -15% @step of 1.25 % 16 taps, 17 tap positions, Tap no. 5 is principal tap.
36.0	Maximum flux density allowed in the core extreme over excitation /over fluxing,	1.9 Tesla

	Tesla	
37.0	Maximum current density allowed	3.0 Amperes per sqmm @ lowest tap.
38.0	AVR input voltage/ Auxiliary supply	Not applicable
39.0	Bushing parameters	
	Rated Current for 20/25 MVA Xmer	1250 A for 33 kv bushing 2000 A for 11kv bushing
39.1	Creepage factor for all bushing mm /KV	31 mm / kV minimum
39.2	Rated thermal short time current for all bushing	25 times rated current for 2 secs
39.2.1	Angle of mounting	0 to 90 degree
39.2.2	Cantilever withstand load	for 33 kv bushing- as per std. vendor 2000N for 11kv bushing
	Overall Length (Approx)	for 33 kv bushing- as per std. vendor 503 mm for 11 kv bushing
	Diameter of base	100 mm

Note 1: For ONAN and ONAF rating the temperature rise of the transformer shall be within the values specified at sl .no. 31.0 and 32.0 above. Under ONAF cooling 20 % spare cooling fans shall be provided .Design of cooling equipment and control shall comply to CBIP clause no. 2.1.3 of Section A (general)

Note 2: The transformers will be evaluated against no load and load losses guaranteed by the bidders with capitalization of losses as per figures indicated under sl no. 30.1, 30.2 and 30.6 above. However the maximum loss figure acceptable are as per cl 13.0 14.0 of Annexure C. In case of deviation in loss figure on higher side, the technical offer won't be considered for evaluation. In the event of measured loss figures during testing exceeding the guaranteed loss figures of the successful bidder penalty shall be levied at a rate of 1.25 times the figures mentioned above for both no load and load losses.

ANNEXURE – D – TECHNICAL SPECIFICATION FOR TRANSFORMER OIL

1.0 Codes and standards

Latest revision of following codes and standards with all amendments-

Cl no.	Standard no	Title
1.1	IS 335	New insulating oils
1.2	IS1783	Drums for oils

2.0 Properties

2.1	Appearance	Clear, transparent and free from suspended matter or sediments
2.2	Density at 29.5 C	0.89G/CM^3
2.3	Kinematics viscosity Max	16 cSt at 27 C
		11cSt at 40 C
2.4	Interfacial tension at 27^0C, min	0.04N/m
2.5	Flash point Pensky-Marten (Closed),140^0C Min.	140 C
2.6	Pour point Max	-15 C
	Neutalization value	
	1) Total acidity ,Max	0.03 mg KOH/ g
	ii) Inorganic acidity/ Alkalinity	Nil
2.7	Corrosive sulfur	Non corrosive
2.8	Electric strength breakdown voltage	Average vaue of six samples
	1) New unfiltered oil Min	30 Kv rms min
	2)After filtration Min	60 Kv rms
2.9	Dieelectric dissipation factor(tan delta)	0.002 at 90 CMax.
		0.0005 at 27 C Max
2.10	Specific resistance (resistivity)	
	1) At 90 C Min	150 x 10^ 12ohm-cm
	2) At 27 C Min	3000 x 10^12 ohm-cm
2.11	Oxidatioon stability	
	1)Neutralization value after oxidation,Max.	0.15mg KOH/g
	2)Total sludge ,after oxidation ,Max	0.03%by weight
	3) Max Tan Delta at 70 deg C	0.1
2.12	Ageing characterstics after accelerated ageing	(open breaker method with copper catalyst)
	1) Specific resistance (resistivity)	
	a) at 27 DEG C Min	27x 10^12 ohm-cm
	b) at 90 deg C Min	2 x 10^12 ohm-cm
	2) Dielectric dissipation factor (tan delta)at 90 deg C Max	0.1
	3) total acidity,Max	0.05mg KOH /g
	4) Total sludge ,Max	0.05% by weight

2.13	Presence of oxidation inhibitor	No antioxidant additives
2.14	Water content ,Max	40 ppm
2.15	Max PCA (Poly cyclic aromatics)	3 %
2.16	PCB(Poly chlorinated biphenyl content	Not detectable
2.17	Tests	As per IS335

ANNEXURE – E – SPECIFICATION FOR NITROGEN INJECTION FIRE PROTECTION SYSTEM

1.1 General

Nitrogen Injection Fire Protection System (NIFPS) shall use nitrogen as fire quenching medium. The protective system shall prevent transformer/Reactor oil tank explosion and possible fire in case of internal faults. In the event of fire by external causes such as bushing fire. OLTC fires, fire from surrounding equipment etc, it shall act as a fast and effective fire fighter. It shall accomplish its role as fire preventer and extinguisher without employing water and / or carbon dioxide. Fire shall be extinguished within 3 minutes (Maximum) of system activation and within 30 seconds (maximum) of commencement of nitrogen injection.

1.2 Codes & Standards

The design and installation of the complete fire protection system shall comply with the latest applicable Indian standards. Wherever Indian standards are not available relevant British / I.E.C. Codes shall be followed. The following standards / codes shall be followed in particular.

a. Approval certificate from Loss Prevention Association (LPA)
b. National fire Codes 1993 of National Fire Protection Association (NFPA) USA.

The entire fire protection system shall be designed, erected and commissioned in accordance with the regulation of Tariff Advisory Committee (TAC). In the absence of TAC regulations NFPA regulation shall be adhered to.

1.3 Activation of the fire protective system

Mal-functioning of fire prevention/ extinguishing system could lead to interruption in power supply. The supplier shall ensure that the probability of chances of malfunctioning of the fire protective system is practically zero. To achieve this objective, the supplier shall plan out his scheme of activating signals which should not be too complicated to make the fire protective system inoperative in case of actual need. The system shall be provided with automatic control for fire prevention and fire extinction. Besides automatic control, remote electrical push button control at Control box and local manual control in the fire extinguishing cubicle shall also be provided. The following electrical-signals shall be required for activating the fire protective system under prevention mode / fire extinguishing mode.

1.3.1 Auto Mode

1.3.1.1 For prevention of fire

a. Differential relay operation
b. Buchholz relay paralleled with pressure relief valve or RPRR (Rapid Pressure Rise Relay)
c. Tripping of all circuit breakers (on HV &LV/IV side) associated with transformer / reactor is the is the pre-requisite for activation of system.

1.3.1.2 For extinguishing fire

a. Fire detector
b. Buchholz relay paralleled with pressure relief valve (PRV) or sudden pressure relay (SPR).
c. Tripping of all circuit breakers (on HV &LV/IV side) associated with transformer / reactor is the pre-requisite for activation of system.

1.3.2 Manual Mode (Local / Remote)

Tripping of all circuit breakers (on HV &LV/IV side) associated with transformer / reactor is the pre-requisite for activation of system.

1.3.3 Manual Mode (Mechanical)

Tripping of all circuit breakers (on HV &LV/IV side) associated with transformer / reactor is the pre-requisite for activation of system.

The system shall be designed to be operated manually in case of failure of power supply to fire protection system.

1.4 General description

Nitrogen injection fire protection system should be a dedicated system for each oil filled transformer / reactor. It should have a Fire Extinguishing Cubicle (FEC) placed on a plinth at suitable distance away from transformer / reactor. The FEC shall be connected to the top of transformer / reactor oil tank for depressurization of tank and to the oil pit (capacity approximately equal to 10% of total volume of oil in transformer/reactor tank) from its bottom through oil pipes. The fire extinguishing cubicle should house a pressurized nitrogen cylinder(s) which is connected to the oil tank of transformer/reactor oil tank at bottom. The Transformer conservator Isolation Valve (TCIV) is fitted between the conservator tank and Buchholz relay.

Cable connections are to be provided from signal box to the control box in the control room, from control box to fire extinguishing cubicle and from TCIV to signal box. Fire detectors placed on the top of transformer/reactor tank are to be connected in parallel to the signal box by Fire survival cables. Control box is also to be connected to relay panel in control room for receiving system activation signals.

1.5 Operation

On receipt of all activating signals, the system shall drain pre-determined volume of hot oil from the top of tank (i.e top oil layer), through outlet valve, to reduce tank pressure by removing top oil and simultaneously injecting nitrogen gas at high pressure for stirring the oil at pre-fixed rate and thus bringing the temperature of top oil layer down. Transformer conservator isolation valve blocks the flow of oil from conservator tank in case of tank rupture / explosion or bushing bursting. Nitrogen occupies the space created by oil drained out and acts as an insulating layer over oil in the tank and thus preventing aggravation of fire.

1.6 System components

Nitrogen injection fire protection system shall broadly consist of the following components. However, all other components which are necessary for fast reliable and effective working of the fire protective system shall deemed to be included in the scope of supply.

1.6.1 Fire Extinguishing Cubicle (FEC)

The FEC shall be made of CRCA sheet of 3 mm (minimum) thick complete with the base frame,

painted inside and outside with post office red colour (shade 538 of IS-5). It shall have hinged split doors fitted with high quality tamper proof lock. The degree of protection shall be IP55. The following items shall be provided in the FEC.

a. Nitrogen gas cylinder with regulator and falling pressure electrical contact
b. manometer.
c. Oil drain pipe with mechanical quick drain valve.
d. Control equipment for draining of oil of pre-determined volume and injecting regulated volume of nitrogen gas
e. Pressure monitoring switch for back-up protection for nitrogen release
f. Limit switches for monitoring of the system
g. Butterfly valve with flanges on the top of panel for connecting oil drain pipe and nitrogen injection pipes for transformer/reactors
h. Panel lighting (CFL Type)
i. Oil drain pipe extension of suitable sizes for connecting pipes to oil pit.

1.6.2 Control box

Control box is to be placed in the control room for monitoring system operation, automatic control and remote operation. The following alarms, indications, switches, push buttons, audio signal etc. shall be provided.

a. System on
b. TCIV open
c. Oil drain valve closed
d. Gas inlet valve closed
e. TCIV closed*
f. Fire detector trip *
g. Buchholz relay trip
h. Oil drain valve open*
i. Extinction in progress *
j. Cylinder pressure low *
k. Differential relay trip
l. PRV / SPR trip
m. Transformer/reactor trip
n. System out of service *
o. Fault in cable connecting fault fire detector
p. Fault in cable connecting differential relay
q. Fault in cable connecting Buchholz relay
r. Fault in cable connecting PRV / SPR
s. Fault in cable connecting transformer /reactor trip
t. Fault in cable connecting TCIV
u. Auto/ Manual / Off
v. Extinction release on / off
w. Lamp test
x. Visual/ Audio alarm*
y. Visual/ Audio alarm for DC supply fail *

*** Suitable provision shall be made in the control box, for monitoring of the system from remote substation using the substation automation system.**

1.6.3 Transformer Conservator Isolation Valve

Transformer conservator isolation valve (TCIV) to be fitted in the conservator pipe line, between conservator and buchholz relay which shall operate for isolating the conservator during abnormal

flow of oil due to rupture / explosion of tank or bursting of bushing. The valve shall not isolate conservator during normal flow of oil during filtration or filling or refilling, locking plates to be provided with handle for pad locking. It shall have proximity switch for remote alarm, indication with visual position indicator.

The TCIV should be of the best quality as malfunctioning of TCIV could lead to serious consequence. The closing of TCIV means stoppage of breathing of transformer/reactor.

Locking plates shall be provided for pad locking.

1.6.4 Fire detectors

The system shall be complete with adequate number of fire detectors (quartz bulb) fitted on the top cover of the transformer / reactor oil tank.

1.6.5 Signal box

It shall be mounted away from transformer / reactor main tank, preferably near the transformer marshalling box, for terminating cable connections from TCIV & fire detectors and for further connection to the control box. The degree of protection shall be IP55.

1.6.6 Cables

Fire survival cables (capable to withstand 750° C.) of 4 core x 1.5 sq. mm size for connection of fire detectors in parallel shall be used. The fire survival cable shall conform to BS 7629-1,BS 8434-1, BS 7629-1 and BS 5839-1,BS EN 50267-2-1 or relevant Indian standards.

Fire Retardant Low Smoke (FRLS) cable of 12 core x 1.5 sq. mm size shall be used for connection of signal box / marshalling box near transformer/reactor and FEC mounted near transformer/reactor with control box mounted in control room.

Fire Retardant Low Smoke (FRLS) cable of 4 core x 1.5 sq. mm size shall be used for connection between control box to DC and AC supply source, fire extinguishing cubicle to AC supply source, signal box/ marshalling box to transformer conservator isolation valve connection on transformer/reactor.

1.6.7 Pipes

Pipes, complete with connections, flanges, bends and tees etc. shall be supplied along with the system.

1.7 Other items

a. Oil drain and nitrogen injection openings with gate valves on transformer / reactor tank at suitable locations.
b. Flanges with dummy piece in conservator pipe between Buchholz relay and conservator Tank for fixing TCIV.
c. Fire detector brackets on transformer / reactor tank top cover.Spare potential free contacts for activating the system i.e. in differential relay, Buchholz
d. relay, Pressure Relief Device / RPRR, Circuit Breaker of transformer/reactorPipe connections between transformer / reactor and FEC and between FEC and oil pit required for collecting top oil.
e. Cabling for fire detectors mounted on transformer /reactor top cover
f. Inter cabling between signal box, control box and Fire Extinguishing Cubicle (FEC).
g. All external cables from / to the system i.e. signal box to control box and control box to FEC shall be provided by the purchaser. All internal cables within the system i.e.

between detectors / signal box / marshalling box / FEC / TCIV shall be in the scope of NIFPS supplier.

h. Butterfly valves /Gate valves on oil drain pipe and nitrogen injection pipe which should be able to withstand full vacuum.
i. Supports, signal box etc. which are to be painted with enameled paint.

1.8 Technical Particulars

Fire extinction period from commencement of nitrogen injection.	30 secs Max
Fire extinction period from the moment of system activation	3 Minutes maximum
Fire detectors' heat sensing temperature	Vendor to specify
Heat sensing area per detector	Vendor to specify
Transformer Conservator Isolation valve setting -min	Vendor to specify
Capacity of nitrogen cylinder	Vendor to specify
Power supply For Control For service / lighting	 220 V DC, variation -15 %, +10 % 230 AV AC variation + - 10 %

The doors, removable covers and panels shall be gasketted all round with neoprene gaskets.

1.9 Mandatory Spares

Cylinder filled with Nitrogen of required capacity per substation	1 No.
Fire Detectors per transformer	3 No's.
Regulator assembly per sub-station	1 No.

1.10 Tests

Reports of all type test conducted as per relevant IS/IEC standards in respect of various bought out items including test reports for degree of protection for FEC / control box / signal box shall be submitted by the supplier. The supplier shall demonstrate the functional test associated with the following:

a. Fire Extinguishing Cubicle, Control Box.
b. Fire Detector.
c. Transformer Conservator Isolation Valve

The performance test of the complete system shall be carried out after erection of the system with transformer at site.

1.11 Documentation

1.11.1 To be submitted along with offer

a. General outline of the system.
b. Detailed write-up on operation of the offered protection system including maintenance and testing aspects / schedules.
c. Technical Data particulars (GTP)
d. Data regarding previous supplies, date of commissioning, performance feedback etc.

1.11.2 To be submitted after award of contract:

Detailed dimensional layout drawing of the system with complete bill of materials, clearances from ground and other live points, details of detectors, equipment layout drawings, detailed drawings pertaining to signal box, control box, FEC equipment, wiring and schemes, 4 sets of testing, commissioning, Operation and Maintenance manual along with soft copies (in CDs) shall be submitted by the supplier.

ANNEXURE – F – SPECIFICATION FOR SILICAL GEL BREATHER

This specification is intended to cover the manufacturing, testing at manufacturer's works, supply and delivery of "Silica Gel Breather" to the purchaser.

1.0 Scope of Supply

Silica Gel Breather shall be as per REL specification suitable for use in Power Transformer (Main
Tank conservator & OLTC conservator) & for Distribution Transformer (Tank Conservator)

2.0 General

Silica Gel Breather offered by seller shall be suitable for continuous operation of prevailing climatic conditions as mentioned in Annexure –B

3.0 Specific Requirement

3.1 Breather

A	Body	Aluminium pressure die caste Short Blasted & Powder Coated
B	Container	Polycarbonate : 143R grade
C	Oil Cup	Polycarbonate : 143R grade
D	Gasket	Nitrile Cork (RC70C) for main body & oil cup gasket
E	Silica Gel	Round ball type of size 2-5 mm (deep Blue)
F	Paint	Powder Coated
G	Mounting	Threaded for existing Transformers. Flanged type for New Transformers
H	Hardware	Stainless Steel
I	Flange Type, Size & hardware	Flange should be of circular shape with diameter of & with hardware of M10 bolts.

3.2 The indicating grade of Silica Gel, which shall be filled in the breather, is hard Blue Round Ball with considerable absorption power of moisture & hence signaling the saturation degree by changing colour (from Blue to Pink).

3.3 The breather shall have clear visibility of Gel colour & of oil level with dust particles in the oil cup from distance.

3.4 Breather should breathe only from the inlet holes provided for breathing. Air should not enter anywhere from the body of breather.

3.5 Silica Seal shall be applied on gasket for better air tightening.

3.6 Gel removing & refilling method is specially designed to avoid skilled labour requirement at site & consequent air leakages.

3.7 Oil filling indicator on oil cup.

3.8 Application

Transformer Size	Rating	Silica Gel Quantity in KG	
		Main Tank Conservator	OLTC Conservator
Power Transformer	20 & 31.5 MVA	5.0 Kg	1.0 Kg

3.9 Silica Gel

Sl. no	Properties	Requirement
1	Particle Size	Round ball type of size 2.5 mm (deep Blue)
2	Bulk Density	570-700 g/l
3	Moisture Adsorption Capacity 1. R.H. = 100% 2. R.H. = 50% 3. R.H. = 40% 4. R.H. = 20%	25 % (min)
4	Appearance	99.5% (min)
5	Friability	99.5% (min)
6	Chlorides percent by mass (max)	0.04%
7	Sulphates percent by mass (max)	0.5%
8	Cobalt percent by mass (max)	0.5%
9	Ammonium Compounds by mass (max)	0.001%
10	Loss on drying	4% (max)
11	pH of Aqueous extract	5-6.5%
12	Loss on Attrition	< 2.5 %

4.0 Marking

A Sticker label Indicating manufacturer's Name, Sr. No. Gel capacity etc. shall be provided at suitable place. Container may also marked with the Standard mark.

5.0 Testing

Breather container shall be suitably blanked & pressure tested with air at 0.35 Kg/cm for 30 minutes. There shall not be any leakages from gasketted joints. Test certificates from accredited laboratory shall be submitted.

6.0 Prototype

Before starting manufacture of the quantity ordered, the successful bidder shall submit a prototype for approval. Unless the prototype is inspected and approved, manufacturing shall not be started. The necessity of submitting prototype shall be ascertained before starting of manufacturing.

7.0 Packing & Keeping Quality

The material shall be packed in clean, dry & air tight container. The material stored in original air tight containers shall continue to satisfy all the properties of Silica Gel for not less than 6 months from date of packing.

8.0 Compliance Status / Deviation

Bidder shall indicate compliance status for every requirement & feature, on the right hand side margin of the specification.

9.0 Documents Comprising The Bid

The bidder shall complete the bid proposal sheets inclusive of copy of the specification duly filled in with compliance status, quality & operational manuals, Test certificates etc.

Indicating the material to be supplied, a brief description of the goods, their quantity and prices. In absence of these documents, the offer shall be considered incomplete & may be rejected.

SCHEDULE – A

Guaranteed Technical Particulars (Data by Seller)

Sr.No.	Particular	Specified / Required	Offered
1.0	General		
1.1	Make		
1.2	Type	As per Annexure C of specification	
2.0	Nominal continuous rating, KVA		
2.1	ONAN	As per Cl 11.1 of Annexure C	
2.2	ONAF	As per Cl 11.2 of Annexure C	
3.0	Rated voltage (KV)		
3.1	HV winding	As per Cl 9.1 of Annexure C	
3.2	LV winding	As per Cl 9.2 of Annexure C	
4.0	Rated current (Amps)		
4.1	HV winding, ONAN / ONAF		
4.2	LV winding , ONAN / ONAF		
5.0	Connections		
5.1	HV winding	As per Annexure C of specification	
5.2	LV winding	As per Annexure C of specification	
5.3	Vector group reference	DYn11	
6.0	Impedance at principal tap rated current and frequency%		
6.1	Impedance (%)	12% for 20 & 31.5 MVA	
6.2	Reactance (%)		
6.3	Resistance (%)		
6.4	Impedance at lowest tap rated current and frequency		
6.5	Impedance at highest tap rated current and frequency		
7.0	Resistance of the winding at 75^0Cat principal tap (ohm)		
7.1	a) HV		
7.2	b)LV		
8.0	Zero sequence impedance (ohm)		
8.1	a) HV		
8.2	b) LV		
9.0	Guaranteed maximum losses at principal tap at full load and 75^0 C without any positive tolerance kW		
9.1	No load losses (max.)	As per Cl 13.0 Annexure C	
9.2	Load losses (max.)	As per Cl 14.0 Annexure C	
9.3	Cooler fan losses (max.)		
9.4	Total I SQR losses of windings @ 75 deg C		
9.5	Total stray losses @ 75 deg C		

9.6	Total losses (max.)		
9.7	No load loss at maximum permissible voltage and frequency (approx.) kW		
10.0	Temperature rise over reference design ambient of 40 ^{0}C		
10.1	Top oil by thermometer ^{0}C	40^0 C	
10.2	Winding by resistance ^{0}C	45^0 C	
10.3	Winding gradient at rated current ^{0}C		
10.3.1	HV		
10.3.2	LV		
11.0	Efficiency		
11.1	Efficiency at 75^0 C and unity power factor %		
11.1.1	At 110% load		
11.1.2	At 100% load		
11.1.3	At 80% load	Not less than 99.5 %	
11.1.4	At 60% load		
11.1.5	At 40% load		
11.1.6	At 20% load		
11.2	Efficiency at 75^0 C and 0.8 power factor lag %		
11.2.1	At 110% load		
11.2.2	At 100% load		
11.2.3	At 80% load		
11.2.4	At 60% load	Not less than 99.5 %	
11.2.5	At 40% load		
11.2.6	At 20% load		
11.3	Maximum efficiency %		
11.4	Load and power factor at which Max efficiency occurs		
12.0	Regulation (%)		
12.1	Regulation at full load at 75^0 C		
12.1.1	At unity power factor		
12.1.2	At 0.8 power factor lagging		
12.2	Regulation at 110% load at 75^0 C		
12.2.1	At unity power factor		
12.2.2	At 0.8 power factor lagging		
13.0	Tapping		
13.1	Type		
13.2	Capacity		
13.3	Range-steps x % variation	As per Annexure C of specification	
13.4	Taps provided on HV winding (Yes/No)	Yes	
14.0	OLTC gear		
14.1	Make		
14.2	Type		
14.3	Reference std		
14.4	No of compartment		

14.5	Mounting arrangement	Side mounted type although External Intank Type is also preferable	
14.6	Rated current Amp		
14.7	Rated step capacity, kVA		
14.8	Short circuit withstand for 2 secs, kA		
14.9	Time required for one step change sec.		
14.10	Rated voltage for motor, V AC		
14.11	Rating of motor		
14.12	Rated voltage for auxiliaries V		
14.13	Consumption of auxiliaries		
14.14	OLTC features as per specification, Yes/No		
14.15	Does the overload rating of OLTC match with that of the transformer under all conditions Yes/No		
16.0	Cooling system		
16.1	Type of cooling	As per Annexure C of specification	
16.2	No. of cooling unit groups		
16.3	Capacity of cooling units		
16.4	Mounting of radiators		
16.5	Number of radiators and Size		
16.6	Type & size of radiator header main valve		
16.7	Type & size of individual radiator valve		
16.8	Total radiating surface, sq mm		
16.9	Thickness of radiator tubes, mm	Minimum 1.2 mm	
16.10	Schematic flow diagram of the cooling system furnished (Yes/No)		
16.11	Type and make of Fan motor		
16.12	No. of fan motor per bank (Working + Standby)		
16.13	Rated Power Input (kW)		
16.14	Rated Voltage, Speed of Motor		
16.15	Efficiency of motor at Full load(%)		
16.16	Locked Rotor current(Amps)		
17.0	Details of tank		
17.1	Material	Robust mild steel plate without pitting and low carbon content	
17.2	Thickness of sides mm		
17.3	Thickness of bottom mm		
17.4	Thickness of cover mm		
17.5	Confirmation of tank designed and tested for vacuum pressure (Ref: CBIP manual) (Yes/No)		
17.5.1	Vacuum mm of Hg. / (kN/m^2)	As per CBIP	

17.5.2	Pressure mm of Hg	Twice the normal head of oil / normal pressure + 35 kN/m^2 whichever is lower , As per CBIP	
17.6	Is the tank lid slopped?	Yes	
17.7	Inspection cover provided (Yes/No)	As per clause No 3.2.1.5	
17.8	Location of inspection cover (Yes/No)	As per clause No 3.2.1.5	
17.9	Min. dimensions of inspection cover (provide list of all inspection cover with dimension), mm x mm		
18.0	Core		
18.1	Type:	Core	
18.2	Core material grade	Premium grade minimum M4 or better	
18.3	Thickness of lamination mm	Max. 0.27 mm with insulating coating on both sides	
18.4	Insulation between core lamination		
18.5	Design flux density of the core at rated condition at principal tap,Tesla		
18.6	Maximum flux density allowed in the core at extreme overexcitation / overfluxing , Tesla		
18.7	Equivalent cross section area of core, mm^2		
18.8	Guaranteed No load current at 90% / 100% / 110% rated voltage & frequency (Amp)		
18.8.1	HV		
18.8.2	LV		
19.0	Type of winding		
19.1	HV		
19.2	LV		
19.3	Conductor material	Electrolytic copper as per relevant standard	
19.4	Maximum current density allowed, Amp per mm^2	As per Annexure C	
19.5	Gauge/area of cross section of conductor, mm^2		
19.5.1	HV		
19.5.2	LV		
19.6	Maximum current density achieved in winding (LV/HV/HVT) – Amps/ mm^2		
19.7	Insulating material		
19.7.1	HV turn		
19.7.2	LV turn		
19.7.3	LV- core		
19.7.4	HV-LV		

19.8	Insulating material thickness, mm		
19.8.1	HV turn		
19.8.2	LV turn	-	
19.8.3	LV to core		
19.8.4	HV to LV		
20.0	Minimum design clearance , mm		
20.1	HV to earth in air		
20.2	HV to earth in oil		
20.3	LV to earth in air		
20.4	LV to earth in oil	-	
20.5	Between HV & LV in Air		
20.6	Between HV & LV in oil		
20.7	Top winding and yoke	-	
20.8	Bottom winding and yoke		
21.0	Insulating oil		
21.1	Quantity of oil Ltrs	-	
21.1.1	In the transformer tank		
21.1.2	In each radiator		
21.1.3	In OLTC chamber		
21.1.4	Total quantity		
21.2	10% excess oil furnished?	Yes	
21.3	Type of oil	New insulating oil as per IS: 335, and Cl. 4.2.7 of the specification	
21.4	Oil preservation system provided (Yes/No)	As per Annexure C of specification	
22.0	Bushing		
22.1	Make		
22.2	Type		
22.3	Reference standard		
22.4	Voltage class, kV		
22.4.1	HV side bushing		
22.4.2	LV side line and neutral bushing		
22.5	Creepage factor for all bushing mm / kV	As per Annexure C of specification	
22.6	Rated current , Amp		
22.6.1	HV bushing		
22.6.2	LV line and neutral bushing		
22.7	Rated thermal short current		
22.7.1	HV bushing	As per Annexure C of specification	
22.7.2	LV line and neutral bushing	As per Annexure C of specification	
22.8	Weight Kg		
22.8.1	HV bushing		
22.8.2	LV line and neutral bushing		
22.9	Free space required for bushing removal, mm		
22.9.1	HV bushing		
22.9.2	LV line and neutral bushing		
23.0	Terminal connections		

23.1	HV	As per Annexure C of specification				
23.2	LV	As per Annexure C of specification				
23.3	LV Neutral	As per Annexure C of specification				
24.0	H.V. Cable box/Terminals					
24.1	Suitable for cable/conductor type size	As per Annexure C of specification				
24.2	Termination height , mm	1000 mm , minimum				
24.3	Gland plate dimension mm x mm					
24.4	Gland plate material	Aluminium				
24.5	Gland plate thickness , mm	5 mm minimum				
24.5	Phase to clearance inside box / terminals , mm					
24.6	Phase to earth inside box / terminals , mm					
25.0	L.V line side cable box					
25.1	Suitable for cable type , size	As per Annexure C of specification				
25.2	Termination height , mm	1000 mm , minimum				
25.3	Gland plate dimension mm x mm					
25.4	Gland plate material	Aluminium				
25.5	Gland plate thickness , mm	5 mm minimum				
25.6	Phase to clearance inside box / terminals , mm					
25.7	Phase to earth inside box , mm					
26.0	LV Neutral cable box					
26.1	Suitable for cable type , size	As per Annexure C of specification and for accommodating NCT spec. – Annex D				
26.2	Termination height , mm					
26.3	Gland plate dimension mm x mm					
26.4	Gland plate material	Aluminium				
26.5	Gland plate thickness , mm	5 mm minimum				
26.6	Phase to clearance inside box , mm					
26.7	Phase to earth inside box , mm					
27.0	Marshalling box cubical provided as per clause no. of spec. (Yes / no)					
27.1	Mounting of marshalling box	Project specific to be filled up (Separate / tank mounted)				
28.0	Neutral Current Transformer (NCT)	For Delhi DISCOM				
28.1	Type					
28.2	Make					
28.3	Reference standard					
28.4	Rated Voltage	12kV				
28.5	CT Ratios	20/25 MVA, Dyn11		25/31.5 MVA, Dyn11		
		Core 1	Core 2	Core 1	Core 2	
		1600/1 A	1600/5A	2000/1	2000/1 A	

				A		
28.6	Burden ,VA	-	20	-	20	
28.7	Class of Accuracy	PS	5P20	PS	5P20	
28.8	KPV , volts , minimum	40(Rct+8)	-	40(Rct+8)	-	
28.9	Resistance, ohm @ 75 deg C, maximum	1	-	1	-	
28.10	Magnetizing current @ Vk/4 , mA , maximum	30	-	100	-	
28.11	Short time withstand current	26.3 kA for 3 sec.				
29.0	Winding current transformer (WCT)					
29.1	Type					
29.2	Make					
29.3	Reference standard					
29.4	CT ratio					
29.5	Burden ,VA	Manufacturer Std.				
29.6	Class of accuracy	Manufacturer Std.				
30.0	Pressure release device					
30.1	Minimum pressure the device is set to rupture					
30.1.1	For main tank					
30.1.2	For OLTC					
31.0	Alarm and trip contact ratings of protective devices					
31.1	Rated/making/ breaking currents , Amp @ voltage for					
31.1.1	PRV for main tank					
31.1.2	PRV for OLTC					
31.1.3	Buchholz relay					
31.1.4	Oil surge relay for OLTC					
31.1.5	Sudden pressure relay					
31.1.6	OTI					
31.1.7	WTI					
31.1.8	Magnetic oil gauge					
32.0	Fittings accessories each transformer furnished as per clause No. (Bidder shall attach separate sheet giving details, make and bill of materials)					
33.0	Painting: as per clause for the transformer , cable boxes, radiator, marshalling box, etc (Yes/No)					
34.0	Over all transformer dimensions					
34.1	Length , mm					
34.2	Breadth , mm					
34.3	Height , mm					
35.0	Transformer tank dimensions					
35.1	Length , mm					

35.2	Breadth , mm		
35.3	Height , mm		
36.0	Marshalling box dimensions		
36.1	Length , mm		
36.2	Breadth , mm		
36.3	Height , mm		
37.0	Weight data		
37.1	Core, kG		
37.2	Frame parts, kG		
37.3	Core and frame, kG		
37.4	Total winding, kG		
37.5	Core and frame winding, kG		
37.6	Tank, kG		
37.7	Tank lid, kG		
37.8	Empty conservator tank , kG		
37.9	Each radiator empty , kG		
37.10	Total weight of all radiator empty , kG		
37.11	Weight of oil in tank , kG		
37.12	Weight of oil in each conservator , kG		
37.13	Weight of oil in each radiators , kG		
37.14	Total weight of oil in radiator , kG		
37.15	OLTC gear including oil , kG		
37.16	Total transport weight of the transformer , kG		
37.17	Total transport weight of the transformer with OLTC and all accessories		
38.0	Volume data		
38.1	Volume of oil in main tank , liters		
38.2	Volume of oil between highest and lowest levels of main conservator ,liters		
38.3	Volume of oil between highest and lowest levels of OLTC conservator, liters		
38.4	Volume of oil in each radiator , liters		
38.5	Total volume of oil in radiators , liters		
38.6	Volume of oil in OLTC , liters		
38.7	Transformer total oil volume , liters		
39.0	Shipping data		
39.1	Weight of heaviest package, kG		
39.2	Dimensions of the largest package (L x B x H) mm		

40.0	Tests		
40.1	All in process tests confirmed as per Cl. (Yes /No)		
40.2	All types tests confirmed as per Cl. (Yes /No)		
40.3	All in routine tests confirmed as per Cl. (Yes /No)		
40.4	All in special tests confirmed as per Cl. (Yes /No)		

SCHEDULE – B
Guaranteed Technical Particulars of Transformer Oil

Bidder to submit hard copy duly filled & signed along with techno commercial offer. Bidder to submit separate GTP for each type of insulating oil

S.no	Description	Specification requirement	Offered
1	Manufacturer Name		
1.1	Address		
1.2	Contact Person		
1.3	Contact telephone no		
2.1	Appearance	Clear, transparent and free from suspended matter or sediments	
2.2	Density at 29.5 C	0.89G/CM^3	
2.3	Kinematics viscosity Max	16 cSt at 27 C	
		11cSt at 40 C	
2.4	Interfacial tension at 27^0C, min	0.04N/m	
2.5	Flash point Pensky-Marten (Closed),140^0C Min.	140 C	
2.6	Pour point Max	-15 C	
	Neutalization value		
	1) Total acidity ,Max	0.03 mg KOH/ g	
	ii) Inorganic acidity/ Alkalinity	Nil	
2.7	Corrosive sulfur	Non corrosive	
2.8	Electric strength breakdown voltage	Average value of six samples	
	1) New unfiltered oil Min	30 Kv rms min	
	2)After filtration Min	60 Kv rms	
2.9	Dieelectric dissipation factor(tan delta)	0.002 at 90 CMax.	
		0.0005 at 27 C Max	
2.10	Specific resistance (resistivity)		
	1) At 90 C Min	150 x 10^ 12ohm-cm	
	2) At 27 C Min	3000 x 10^12 ohm-	

		cm	
2.11	Oxidatioon stability		
	1)Neutralization value after oxidation,Max.	0.15mg KOH/g	
	2)Total sludge ,after oxidation ,Max	0.03%by weight	
	3) Max Tan Delta at 70 deg C	0.1	
2.12	Ageing characterstics after accelerated ageing	(open breaker method with copper catalyst)	
	1) Specific resistance (resistivity)		
	a) at 27 DEG C Min	27x 10^12 ohm-cm	
	b) at 90 deg C Min	2 x 10^12 ohm-cm	
	2) Dielectric dissipation factor (tan delta)at 90 deg C Max	0.1	
	3) total acidity,Max	0.05mg KOH /g	
	4) Total sludge ,Max	0.05% by weight	
2.13	Presence of oxidation inhibitor	No antioxidant additives	
2.14	Water content ,Max	40 ppm	
2.15	Max PCA (Poly cyclic aromatics)	3 %	
2.16	PCB(Poly chlorinated biphenyl content	Not detectable	
2.17	Tests	As per IS335	

TECHNICAL SPECIFICATION

FOR

HT INDOOR SWITCHGEAR (33 & 11KV)

Prepared by		Reviewed by		Approved by		Rev	03
Name	Sign	Name	Sign	Name	Sign	Date	25 Sep 2018
AH		GS		AA		Page	1 of 72

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1.0 RECORD OF REVISION

S. No	Item/ Clause No	Change/ Addition	Reason of Change/Addition
1.1	4.17	Space for APFC Relay	APFC shall be supplied by Auto Switched Capacitor Bank Supplier but cutout for the same has to be provided by 11kV Switchgear Panel Vendor
1.2	12.2	Multifunction Meter	Ammeter has been removed and Multifunction Meter has been included for SCADA integration of all parameters
1.3	16.8	Spare Terminal Block in Capacitor Bank Panel	For APFC Control cables
1.4	17.1.5	SCADA interface port requirement revised	For integration with SCADA on IEC 61850 based on site requirement
1.5	17.6.1	Neutral Unbalance protection by RVT	As Auto Switched Capacitor banks are used, Only one RVT is enough in comparison with three NCTs
1.6	20.1.3	Panel Rating plate requirement revised	All CT, PT and breaker details included in Panel Rating plate for ready reference.
1.7	24.0	Drawing and Data Submission	To streamline drawing/document submission

2.0 SCOPE OF SUPPLY

a. This specification covers the design, manufacture, testing, supply, erection & commissioning of 33kV and 11kV, Air Insulated, metal-enclosed and factory assembled switchgear.

b. This specification shall be used in conjunction with all specifications, switchgear data sheets, single line diagrams, and other drawings attached to the specification / purchase requisition.

3.0 CODES & STANDARDS

Materials, equipment and methods used in the manufacture of switchboards shall conform to the latest edition of following

3.1	Indian Electricity Rules 1956	Latest edition
3.2	Indian Electricity act 1910	Latest edition
3.3	Switchgear and control gear	IEC : 60694, IEC: 60298, IEC : 62271-200, IEC : 60529, IS: 3427, IS: 12729, IS: 12063, IS: 13947, IS: 9046
3.4	Circuit breaker	IEC 62271 - 100, IS 13118, IS 2516
3.5	Isolators & earthing switches	IEC 62271 - 102

3.6	Current transformers	IS:2705, IEC:60185
3.7	Voltage transformer	IS:3156, IEC:60186,
3.8	Indicating Instruments	IS:1248
3.9	Energy meters	IS 13010
3.10	Relays	IS:8686, IS:3231, IS:3842
3.11	Control switches and push buttons	IS 6875
3.12	HV fuses	IS 9385
3.13	Arrangement of Switchgear bus bars, main connections and auxiliary wiring	IS:375
3.14	Code of practice for phosphating iron & steel	IS 6005
3.15	Colours for ready mixed paints	IS 5
3.16	Code of practice for installation and maintenance of switchgear	IS 3072

4.0 PANEL CONSTRUCTION

4.1	Enclosure Type	Free standing, Indoor, Fully compartmentalised, Metal clad, Vermin proof
4.2	Enclosure degree of protection	IP 4X for high voltage compartment IP 5X for low voltage compartment
4.3	Enclosure material	Pre-Galvanized CRCA steel
4.3.1	Load bearing members	2.5 mm thick
4.3.2	Doors and covers	2.0 mm thick
4.3.3	Gland plate	3.0 mm MS for multicore and 5. 0 mm Aluminium for single core cables. All gland plates should be detachable type with gasket
4.4	Dimension of Panel	Maximum 2700mm, Operating height maximum 1600mm. In case of Extension of Existing make panels, vendor shall match the dimension of existing panel.
4.5	Extensibility	On either side

4.6	Separate Compartments for	Bus bar, Circuit Breaker, HV incoming cable, HV outgoing cable, PT, LV instruments & relays
4.7	Transparent inspection window	For cable compartment at height of cable termination.
4.8	Bus end cable box	For direct cable feeder from bus
4.9	Breaker compartment door	Separate, with lockable handle (Design with breaker trolley as the front cover is not acceptable). Door of one panel should not cause hindrance for opening of adjacent panel.
4.10	Inter compartmental connections	
4.10.1	Breaker to bus bar compartment	Through seal-off bushings
4.10.2	Breaker to cable compartment	Through seal-off bushings
4.11	Pressure relief devices	To be provided for each HV compartment
4.12	Bus support insulator	Non-hygroscopic, track-resistant, high strength, Epoxy insulators (Calculation for validating dynamic force withstand capability to be submitted during detailed engineering)
4.13	Fixing arrangement	Doors - Concealed hinged, door greater than 500mm shall have minimum three sets of hinges Covers - SS bolts Gasket - Neoprene
4.14	Required HV cable termination height in the cable compartment	650 mm for 11 KV. 1000mm for 33 KV
4.15	Panel Base Frame	Steel Base frame as per manufacturer's standard.
4.16	Handle	Removable bolted covers with handle for cable chamber and busbar chamber. Panel no./identification to be provided on cable box cover also.

4.17	APFC	Controlling of Capacitor Banks' switching shall be done by APFC. Although APFC shall not be in bidder's scope, Space for cut out shall be provided in the Capacitor panel. Space requirement-150X150 mm^2
4.18	Technical particulars	As per Annexure –C

5.0 CIRCUIT BREAKER

5.1	Type	Truck or cassette type
5.2	Mounting	On withdrawable truck or carriage, with locking facility in service position.
5.3	Switching duty	a. Transformer (oil filled and dry type) b. Motor (of small and large ratings – DOL starting with starting current 6 to 8 times the full load current & with a maximum of 3 starts per hour) c. Underground cable with length up to 10 km
5.4	Interrupting medium	Vacuum
5.5	Breaker operation	Three separate identical single pole units operated through the common shaft
5.6	Operating Mechanism	Re-strike free, Trip free, with electrical anti-pumping feature
5.6.1	Type	Motor wound, spring charged, stored energy type with manual charging facility
5.6.2	Operation on supply failure	One O-C-O operation possible after failure of power supply to the spring charging motor
5.7	Breaker indications & push buttons	
5.7.1	ON/ OFF / Emergency trip push button	a. Manual / mechanical. b. Emergency Off push button should be provided with a protective flap. c. Mechanical ON shall have padlocking facility.

5.7.2	Mechanical ON – OFF indication	On breaker trolley front
5.7.3	Operation counter	On breaker trolley front
5.7.4	Test-service position indicator	On breaker trolley front
5.7.5	Mechanism charge / discharge indicator	On breaker trolley front
5.8	Breaker positions	Service, Test and Isolated
5.9	Inter changeability	Possible, only with breaker of same rating
5.10	Breaker Control	On panel front only
5.11	Handle	Breaker shall be provided with handles for easy handling, rack in–out operation and manual spring charging as applicable.
5.12	Technical particulars	As per Annexure-C

6.0 FUNCTIONAL REQUIREMENTS

6.1	Interlocks	
6.1.1	Breaker compartment door opening	Opening of door and rack out to test/isolated position should be possible with breaker in OFF position only.
6.1.2	Breaker compartment door closing	Should be possible even when breaker is in isolated position
6.1.3	Racking mechanism safety interlock	Mechanical type
6.1.4	Racking in or out of breaker inhibited	When the breaker is closed
6.1.5	Racking in the circuit breaker inhibited	Unless the control plug is fully engaged
6.1.6	Disconnection of the control plug inhibited	As long as the breaker is in service position
6.1.7	Opening of cable compartment cover of Incomer Panels inhibited	As long as cable end is alive
6.2	Safety Devices	

6.2.1	Exposure to live parts	In case the breaker panel door is required to be opened during a contingency, the personnel should not be exposed to any live part. Suitable shrouds/barriers/insulating sleeves should be provided.
6.2.2	Breaker handing	In case the breaker is mounted on a carriage which does not naturally roll out on the floor, a trolley for handling the breaker is to be provided.
6.3	Operation of breaker	In either service or test position
6.3.1	Closing from local	Only when local/remote selector switch is in local position
6.3.2	Closing from remote	Only when local/remote selector switch is in remote position
6.3.3	Tripping from local	Only when local/remote selector switch is in local position
6.3.4	Tripping from remote	Only when local/remote selector switch is in remote position
6.3.5	Tripping from protective relays	Irrespective of position of local/remote switch
6.3.6	Testing of breaker	In test or isolated position keeping control plug connected
6.4	Safety shutters.	
6.4.1	Automatic safety shutter for female primary disconnects	To fully cover contacts when breaker is withdrawn to test. Independent operating mechanism for bus bar & cable side shutters, separately pad-lockable in closed position.
6.4.2	Label for identification	For Bus side and cable side shutters
6.4.3	Warning label on shutters of incoming and other connections	Clearly visible label "Isolate elsewhere before earthing" be provided
6.5	Breaker electrical operation features	
6.5.1	Trip circuit supervision	To be given for breaker close & open condition
6.5.2	Trip circuit supervision relay contact	For indication, alarm & to inhibit closing of breaker

6.5.3	Emergency trip push button contact	Wired directly to trip coil (wired to Master trip relay if second trip coil provided)
6.5.4	Emergency trip push button contact	Wired to inhibit closing of breaker
6.5.5	Master trip relay contact (if given)	Wired to inhibit closing of breaker
6.6	DC control supply bus in all panels	Fed by two DC incoming sources in Bus coupler panel with auto changeover facility
6.7	PT supply bus in all panels	Fed normally by bus PT with automatic changeover facility to incomer line PT

7.0 SURGE SUPPRESSOR

7.1	Provision	To be provided in all panels except bus coupler and BPT.
7.2	Type	Gapless, metal oxide type
7.3	Technical particulars	As per Annexure -C

8.0 CURRENT TRANSFORMER

8.1	Type	Shall be cast resin type with insulation class of E or better.
8.2	Rating and technical particulars	As per Annexure – C (Technical particulars) and Annexure – F (SLDs)
8.3	CBCT	If specified, bidder shall clearly mention his proposal for mounting the same.

9.0 POTENTIAL TRANSFORMER

9.1	Type	Shall be cast resin type with insulation class of E or better.
9.2	Rating and technical particulars	As per Annexure – C (Technical particulars) and Annexure – F (SLDs)

9.3	Mounting	It shall be mounted on a withdrawable carriage. Mounting of PT on the breaker truck is not acceptable. In case it is mounted on the panel rear top, access to the PT and the reinforcement in the panel for allowing a person to stand should be provided.
9.4	Neutral	The HV neutral connection to earth shall be easily accessible for disconnection during HV test.

10.0 FEEDER AND BUS EARTHING

10.1	Earthing arrangement	Through separate earthing truck for bus & feeder
10.2	Short time withstand capacity of earthing truck	Equal to rating of breaker. Refer technical parameters.
10.3	Operation from front	Mechanically operated by separate switch.
10.4	Interlocks	To prevent inadvertent closing on live circuit, with padlocking arrangement to lock truck in close or open position.

11.0 EQUIPMENT EARTHING

11.1	Material of earthing bus	Aluminium
11.2	Earth bus joints	All bolted joints in the bus should be made by connection of two bolts.
11.3	Rating	Sized for rated short circuit current for 3 seconds
11.4	Enclosure & non -current carrying part of the switchboard / components	Effectively bonded to the earth bus.
11.5	Hinged doors	Earthed through flexible copper braid
11.6	Circuit breaker frame /carriage	Earthed before the main circuit breaker contacts/ control circuit contacts are plugged in the associated stationary contacts

11.7	Metallic cases of relays, instruments and other LT panel mounted equipment	Connected to the earth bus by independent copper wires of size not less than 2.5 sq. mm with green colour insulation. For this purpose LT compartment should have a clear designated earth bus to which earth connections from all components are to be connected.
11.8	CT and PT neutral	Earthed at one place at the terminal blocks through links.

12.0 METERS

12.1	Mounting	Flush mounted
12.2	Multifunction Meter	
12.2.1	Model	Rish Delta Energy
12.2.2	Make	Rishabh
12.2.3	SCADA Interfacing	RS485 rear port suitable for integration on Modbus Protocol
12.2.4	Size	96x96 mm^2
12.2.5	Panels where to be provided	All panels
12.2.6	Accuracy Class	1
12.2.7	Auxiliary Supply	48 – 240VDC and AC i.e universal type.
12.3	Voltmeter	Digital type with programmable ratio
12.3.1	Size	96x96 mm^2
12.3.2	Panels where to be provided	Incomer and bus PT panel
12.3.3	Voltmeter switch	Inbuilt in meter
12.3.4	Accuracy Class	1.0
12.4	Energy meter provision	Energy meter is not in supplier's scope. Only space and CT/PT wiring is to be provided in all panels except bus coupler and bus PT. Space for Energy meter shall be 200(w) X 350(h) mm^2

13.0 INDICATION, ALARMS & ANNUNCIATION

13.1	Indications	Flush mounted, High intensity, clustered LED type
13.1.1	Breaker ON	Red
13.1.2	Breaker Off	Green

13.1.3	Spring Charged	Blue
13.1.4	DC control supply fail	Amber
13.1.5	AC control supply fail	Amber
13.1.6	Auto trip	Amber
13.1.7	Test Position	White
13.1.8	Service Position	White
13.1.9	Heater circuit healthy	Yellow (Indication with integrated push button for checking)
13.1.10	Trip circuit healthy	White
13.1.11	PT supply as applicable	R,Y B
13.2	Annunciator (For 33kV Panels only)	
13.2.1	Type	Static type alongwith alarm. Annunciations shall be repetitive type and shall be capable of registering the fleeting signal. Fascia test facility should also be provided.
13.2.2	Note	LED type indications may not be provided for alarm signals provided on annunciator.
13.2.3	Mounting	Flush mounted
13.2.4	Fascia	12 window
13.2.5	Signals to provided on Fascia	Window 1 – Main Protection Operated (Distance /Differential) Window 2 – Backup O/C & E/F Protection Operated Window 3 – LBB operated Window 4 – CB Autotrip Window 5 – Trip Circuit Unhealthy Window 6 – DC Fail Window 7 – AC Fail Window 8 – VT Fuse Fail Window 9 – Protection Relay Faulty
13.2.6	Push Buttons	For test, accept and reset
13.2.7	Potential Free Contacts	To be provided for event logger

13.3	Alarm scheme with isolation switch	a. For DC fail, TC fail and CB auto trip in 11kV panels b. For all signals wired to annunciator in 33kV panels

Sequence of operation of the annunciator shall be as follows-

S No.	Alarm Condition	Fault Contact	Visual Annunciation	Audible Annunciation
a.	Normal	Open	Off	Off
b.	Abnormal	Close	Flashing	On
c.	Accept	Close	Steady on	Off
d.	Return to normal	Open	Steady On	Off
e.	Reset	Open	Off	Off
f.	Reset before return to normal	Close	Flashing	On

14.0 SELECTOR SWITCHES & PUSH BUTTONS

14.1	Selector switches	Flush mounted on LV compartment door, with shrouded terminals
14.1.1	TNC switch with pistol grip	Lockable, spring return to normal position
14.1.2	Local / SCADA selector switch	2 pole
14.1.3	Rotary ON/OFF switches	For heater / illumination circuit
14.1.4	Rating	16 A
14.2	Push Button	Flush mounted on LV compartment door, with shrouded terminals
14.2.1	Emergency trip push button	Red color with stay put
14.2.2	Accept push buttons	Black color – Trip alarm / DC fail alarm
14.2.3	Reset push buttons	Yellow color – Trip alarm / DC fail alarm
14.2.4	Rating	10 A

15.0 INTERNAL WIRING

15.1	Internal wiring	1100 V grade, PVC insulated (FRLS) stranded flexible copper wire.
15.2	Size	2.5 sq mm for CT circuit, 1.5 sq mm for PT & control circuits

15.3	Colour code	
15.3.1	CT & PT	R Ph – Red Y Ph – Yellow B Ph – Blue Neutral – Black
15.3.2	Others	DC– grey, AC-black, Earth – green
15.4	Ferrules	At both ends of wire
15.5	Ferrule type	Interlocked type (one additional red colour ferrule for all wires in trip circuit)
15.6	Lugs	Tinned copper, pre-insulated, ring type, fork type and pin type as applicable. CT circuits should use ring type lugs only.
15.7	Spare contacts	Spare contacts of relays and contactors etc. should be wired upto the terminal block.
15.8	Wiring enclosure	Plastic channels, Inter panel wiring through PVC sleeves
15.9	Interpanel wiring	Wires with ferrule to be terminated in the adjacent shipping section should be supplied with one end terminated and the other end bunched and coiled.
15.10	Auxiliary supply	Auxiliary bus wiring for AC and DC supplies, voltage transformer circuits, annunciation circuits and other common services shall be provided on the same set of terminals in all the panels with proper segregation.

16.0 TERMINAL BLOCKS

16.1	Rating and Type	1100 V grade, moulded piece, stud type screw driver operated terminals complete with insulated barriers, washers, nuts and lock nuts.
16.2	Segregation	TBs shall be segregated.
16.3	Suitability	For termination of minimum 6sqmm flexible copper conductor.

16.4	Marking and covers	White fibre markings strip with clear plastic, slip-on / clip-on terminal covers to be provided.
16.5	Disconnecting Facility	To be provided in CT and PT terminals
16.6	Shorting & Earthing Facility	To be provided in CT Terminals
16.7	Spare Terminals	20% in each TB row
16.8	Spare Terminal Block in Capacitor Bank Panel	Separate Terminal Block with 50 number terminals required (20 Numbers Disconnecting and 30 Number Non Disconnecting type)
16.9	TB shrouds & separators	Moulded non- inflammable plastic material
16.10	Clearance between 2 sets of TB	100 mm min
16.11	Clearance with cable gland plate	250 mm min
16.12	Clearance between AC / DC set of TB	100 mm min
16.13	Test terminal blocks	Screw driver operated stud type for metering circuit

17.0 RELAYS

17.1	Protection Relays – General Features	
17.1.1	Technology and Functionality	Numerical , microprocessor based with provision for multifunction protection, control, metering and monitoring
17.1.2	Mounting	Flush Mounting, IP5X
17.1.3	Architecture	Hardware and software architecture shall be modular and disconnectable to adapt the protection and control unit to the required level of complexity as per the application.
17.1.4	Programming and configuration	Relay shall utilize a user friendly setting and operating multi-lingual software in windows environment with menus and icons for fast access to the data required. Programming software and communication cord for offered relays should be included in scope of supply.

17.1.5	SCADA Interface port	RS485 rear port for interfacing with SCADA on IEC103 and dual fibre optic port for interfacing with SCADA on IEC 61850 & PRP compatible. Through these ports relays shall be connected to switches. Protocol shall be selectable at site. If relays have any other rear port, hardware/software required to achieve the above said compatibility will be in supplier's scope. Ethernet switches at switchgear end shall be suitably mounted in an auxiliary compartment in switchgear panel.
17.1.6	Processing Indications	SCADA functions in monitoring direction shall be executed on SPI (Single Point Input) and DPI (Double Point Input). DPI shall only be used in case of Isolator and Circuit breaker "close" and "open" indication.
17.1.7	Command Processing	Functionality of command processing offered for SCADA interface shall include the processing of single and double commands i.e SCO (Single Command Output) and DCO (Double object command Output). DCO shall only be used in case of Isolator and Circuit Breaker close" and "open" command.
17.1.8	PC Interface port	Front port (preferably serial) for configuration/data downloads using PC. Cost of licensed software and communication cord, required for programming of offered protection relays shall be included in the cost of switchgear.
17.1.9	User Interface	An alphanumeric key pad and graphical LCD display with backlight indicating measurement values and operating messages. It should be possible to access and change all settings and parameters without the use of PC.

17.1.10	Relay Characteristics	Relay shall integrate all necessary protections for different applications in accordance with IS and IEC. Relay shall provide wide setting ranges and choice of all IEC, IEEE and other tripping curves through a minimum of two setting groups.
17.1.11	Event and Fault records	Relay shall have the facility of recording of various parameters during event/fault with option to set the duration of record through settable pre fault and post fault time. Relay shall store records for last 10 events and 10 faults (minimum). It should be possible to download records locally to PC and remotely to SCADA.
17.1.12	Self diagnosis	Relay shall be able to detect internal failures. A watchdog relay with changeover contact shall provide information about the failure.
17.1.13	Time synchronization	All relays shall be capable of being synchronized with the system clock using SCADA interface and PC.
17.1.14	Operation Indicators	LEDs with push button for resetting.
17.1.15	Test Facility	Inbuilt with necessary test plugs.
17.2	Protection Relays for 11kV Incomer panel	
17.2.1	Relay 1	3-phase Directional Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		Undervoltage and overvoltage protection
		Sync Check function
		PT supervision (fuse failure monitoring)
17.2.2	Relay 2	High Impedance Restricted Earth fault protection.
17.2.3	User Configurable DIs and Dos	Relay-1 & 2 should have a total of 16 Dis and 10 Dos (minimum). Each relay should have atleast 2 Dis and 4 Dos
17.2.4	Note	Combining functions of Relay-1 and Relay-2 in single relay is not acceptable.

17.2.5	SLD	Refer annexure – F1
17.3	Protection Relays for 11kV Bus Section panel	
17.3.1	Relay 1	3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		Sync Check function
		User Configurable 12 Dis and 6 Dos (minimum)
17.3.2	SLD	Refer annexure – F2
17.4	Protection Relays for 11kV Outgoing panel	
17.4.1	Relay 1	3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		User Configurable 12 Dis and 6 Dos (minimum)
17.4.2	SLD	Refer annexure – F3
17.5	Protection Relays for 11kV Station Transformer panel	
17.5.1	Relay 1	3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		User Configurable 12 DIs and 6 DOs (minimum)
17.5.2	SLD	Refer annexure – F4
17.6	Protection Relays for 11kV Capacitor panel	
17.6.1	Relay 1	3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		Undervoltage and Overvoltage protection(From Bus PT)
		Neutral Unbalance protection(From RVT associated to Cap Bank)
		PT supervision (fuse failure monitoring)
		Timer for on time delay (minimum 600 seconds)
		User Configurable 12 DIs and 6 DOs (minimum)
17.6.2	SLD	Refer annexure – F5.

17.7	Protection Relays for 33kV Incomer	
17.7.1	Relay 1 (If Distance protection is considered as primary protection)	Distance Protection
		Sync check function
		PT supervision
		Power swing blocking
	Relay 1 (If Line differential protection is considered as primary protection)	Line differential protection
		Software based CT ratio correction
		Dedicated port for communication with remote end relay through optical fibre. This port should be in addition to PC interface and SCADA interface ports.
	Selection of Relay 1	Selection of Relay-1 (primary protection) will depend on site requirements. Hence bid shall contain prices of Incomer panel - a. With Distance protection as primary protection b. With Line differential protection as primary protection.
17.7.2	Relay 2	3-phase Directional Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics.
		Sync check function, if not provided in relay 1.
		Circuit Breaker failure protection
		PT supervision, if not provided in relay 1
17.7.3	User Configurable DIs and DOs	Relay-1 & 2 should have a total of 16 DIs and 12 DOs (minimum). Each relay should have atleast 2 DIs and 6 DOs
17.7.4	Note	Combining functions of Relay-1 and Relay-2 in single relay is not acceptable.
17.7.5	SLD	Refer annexure – F6
17.8	Protection Relays for 33kV Transformer Feeder Panel	
17.8.1	Relay 1	Biased differential protection
		REF protection

		Software based ratio and vector correction feature (without ICT)
		H2 and H5 harmonic restraint
17.8.2	Relay 2	3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		Circuit Breaker failure protection
17.8.3	User Configurable DIs and DOs	Relay-1 & 2 should have a total of 16 DIs and 12 DOs (minimum). Each relay should have atleast 2 DIs and 6 DOs.
17.8.4	Note	Combining functions of Relay-1 and Relay-2 in single relay is not acceptable.
17.8.5	SLD	Refer annexure – F7
17.9	Protection Relays for 33kV Buscoupler Panel	
17.9.1	Relay 1	3-phase Overcurrent and earthfault protection with IDMT, Definite time and instantaneous characteristics.
		Sync check function
		Circuit Breaker failure protection
		PT supervision (fuse failure monitoring) for Bus PT-1
		User Configurable 16 DIs and 8 DOs (minimum)
17.9.2	Relay 2	PT supervision (fuse failure monitoring) for Bus PT-2. May be provided as integral feature of relay-1.
17.9.3	SLD	Refer annexure – F8
17.10	Protection Relays for 33kV Outgoing Panel (For Installation at KCC Consumer Premises)	
17.10.1	Relay 1	3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		Circuit Breaker failure protection
		User Configurable 12 DIs and 6 DOs (minimum)
17.10.2	SLD	Refer annexure – F9

17.11	Protection Relays for 33kV Incomer from 66/33kV Autotransformer	
17.11.1	Relay 1	3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		Sync check function
		Undervoltage and overvoltage protection
		Circuit Breaker failure protection
		PT supervision (fuse failure monitoring)
17.11.2	Relay 2	High Impedance Restricted Earth fault protection
17.11.3	User Configurable DIs and DOs	Relay-1 & 2 should have a total of 16 DIs and 12 DOs (minimum). Each relay should have atleast 2 DIs and 6 DOs
17.11.4	Note	Combining functions of Relay-1 and Relay-2 in single relay is not acceptable
17.11.5	SLD	Refer annexure – F10
17.12	Protection Relays for 33kV Outgoing from 66/33kV Autotransformer	
17.12.1	Relay 1 (Distance protection is considered as primary protection)	Distance Protection
		PT supervision
		Power swing blocking
	Relay 1 (Line differential protection is considered as primary protection)	Line differential protection
		Software based CT ratio correction
		Dedicated port for communication with remote end relay through optical fibre. This port should be in addition to PC interface and SCADA interface ports.
	Selection of Relay-1	Selection of primary protection will depend on site requirements. Hence bid shall contain prices of Incomer panel – a. With Distance protection as primary protection b. With Line differential protection as primary protection.
17.12.2	Relay 2	3-phase Overcurrent and Earthfault protection with

		IDMT, Definite time and instantaneous characteristics.
		Circuit Breaker failure protection
17.12.3	User Configurable DIs and DOs	Relay-1 & 2 should have a total of 16 DIs and 12 DOs (minimum). Each relay should have atleast 2 DIs and 6 DOs
17.12.4	Note	Combining functions of Relay-1 and Relay-2 in single relay is not acceptable.
17.12.5	SLD	Refer annexure – F11
17.13	Protection Relays for 33kV Buscoupler for Switchboard of 66/33kV Autotransformer	
17.13.1	Relay 1	3-phase Overcurrent and earthfault protection with IDMT, Definite time and instantaneous characteristics.
		Sync check function
		Circuit Breaker failure protection
		PT supervision (fuse failure monitoring) for Bus PT-1
		User Configurable 16 DIs and 8 DOs (minimum)
17.13.2	Relay 2	PT supervision (fuse failure monitoring) for Bus PT-2. May be provided as integral feature of relay-1.
17.13.3	SLD	Refer annexure – F12
17.14	Protection Relays – SCADA Interfacing	
17.14.1	Configuration and wiring of DIs in Protection Relays (All panels) for routing status signals to SCADA	DI-1 – TC Unhealthy DI-2 – CB Autotrip (contact from lockout relay) DI-3 – CB Open DI-4 – CB Close DI-5 – CB in service DI-6 – CB in test DI-7 – Spring Charged DI-8 – L/R switch in local DI-9 – AC fail DI-10 – Adjacent Panel DC Fail/DC MCB Trip DI-11 – Adjacent Panel Protection Relay fail

		DI-12 – PT MCB trip (metering and protection, for incomer and capacitor panel only) Sequence of DIs should be strictly as mentioned above. Change in sequence of DIs will not be acceptable.
17.14.2	Configuration and wiring of DOs in Protection relays (all panels) for execution of SCADA commands through SCADA interface port (refer clause 16.1.5).	DO-1 – CB Open DO-2 – CB close DO-3-Electrical Reset Sequence of DOs should be strictly as mentioned above. Change in sequence of DOs will not be acceptable.
17.14.3	Looping of numerical relays	All relays in the switchboard have to be looped to form a common bus for interfacing with SCADA.
17.14.4	Spare DIs and DOs	Should be wired upto terminal block for future use.
17.15	Transformer Monitoring cum AVR Relay	
17.15.1	Features	As per annexure –B
17.15.2	Requirement	To be provided in 33KV Transformer panel only
17.16	Auxiliary Relays – General Features	
17.16.1	Relays for auxiliary, supervision, trip and timer relays	Static or electromechanical type.
17.16.2	Reset mechanism for auxiliary relays	Self reset contacts except for lock-out relays.
17.16.3	Reset mechanism for lockout relays	Electrical reset type for 11kV outgoing panels only. Hand reset type for all other panels.
17.16.4	Operation indicators	With hand-reset operation indicators (flags) or LEDs with pushbuttons for resetting.
17.17	Auxiliary relays – Requirement	
17.17.1	Anti pumping (94), lockout (86) and trip circuit supervision (74) relays	For each breaker
17.17.2	PT selection relays	To be provided for selection between Bus PT and Line PT of respective sections.

17.17.3	Switchgear with two incomer & bus coupler	Lockout relay (86) contact of each incoming breakers to be wired in series in closing circuit of other incoming breakers & bus coupler.
17.17.4	Auxiliary Relays, contact multiplication relays etc.	To effect interlocks and to exchange signals of status & control
17.17.5	Transformer trouble relays (For 33kV Transformer feeder panel only)	Auxiliary relays with indicating flags (contactors will not be accepted) should be provided for the following trip and alarm commands – a. Buchholz trip b. OSR trip c. PRV trip d. SPR trip e. WTI Trip f. OTI Trip g. Buchholz Alarm h. Low oil level alarm i. OTI Alarm j. WTI Alarm.
17.18	General Requirements for all relays/contactors	Auxiliary supply will be 50/220VDC based on requirement. All relays/contactors shall be suitable for continuous operation at 15% overvoltage.

18.0 SPACE HEATERS

18.1	Type	Thermostat controlled with switch for isolation
18.2	Location	In Breaker & HV cable compartment, mounted on an insulator. Heater position in cable compartment should be easily accessible after cable termination. Heater position in breaker chamber shall be accessible with breaker racked-in.

19.0 SOCKETS, SWITCHES & ILLUMINATION LAMPS

19.1	Illumination lamp with switch	For LV & cable chamber

19.2	Universal type (5/15 A) Socket with Switch	In LV chamber

20.0 NAMEPLATES AND MARKING

20.1	Nameplates	To be provided as per the following description
20.1.1	Equipment Nameplates	a. All equipment mounted on front side as well as equipment mounted inside the panels shall be provided with individual name plates with equipment designation engraved. b. All front mounted equipment shall be also provided at the rear with individual name plates engraved with tag numbers corresponding to the one shown in the panel internal wiring to facilitate easy tracing of the wiring.
20.1.2	Feeder Nameplates	a. Large and bold name plate carrying the feeder identification/ numbers shall be provided on the top of each panel on front as well as rear side. On rear side, nameplate should be provided on frame. b. Rear bottom of each panel shall have a nameplate clearly indicating the following: Customer Name – BSES Delhi; PO No. & date; Drawing Reference No. etc.
20.1.3	Rating Plate	Following details are to be provided on Panel rating plate: a. Customer Name – BSES Yamuna Power Limited b. PO No. & Date – c. Complete CT Rating plate details d. Complete PT Rating plate details e. Complete CB Rating Plate details f. Date of Manufacturing- g. Warranty Period- h. Customer care No-
20.1.4	Material	Non-rusting metal or 3 ply lamicoid. Nameplates shall be black with white engraving lettering. Stickers are not allowed.
20.1.5	Fixing	All nameplates/rating plates shall be riveted to the panels at all four corners. Bolting/screwing is not acceptable.
20.2	Markings	Each switch shall bear clear inscription identifying its function.

		Similar inscription shall also be provided on each device whose function is not otherwise identified. If any switch or device does not bear this inscription separate nameplate giving its function shall be provided for it. Switch shall also have clear inscription for each position indicating e.g. Trip-Neutral close, ON-OFF etc.

21.0 SURFACE TREATMENT & PAINTING

21.1	Surface Treatment	Sand blasting or by seven tank process.
21.2	Paint type	Powder coated. Pure polyester base grade-A structure finish.
21.3	Paint shade	RAL 7032 for external & internal surface
21.4	Paint thickness	Minimum 50 microns

22.0 APPROVED MAKES OF COMPONENTS

22.1	Numerical Relays	R series of ABB, Siprotec series of Siemens, Micom series of Schneider/Alstom. Numerical relays used in complete switchboard should be of same make. Use of two different makes of relays in a switchboard is not acceptable.
22.2	Transformer monitoring cum AVR relay	A-eberle/Easun-MR
22.3	Electromechanical Relays	Alstom/Schneider/Siemens/ABB/ER
22.4	Miniature Relays	ABB/Jyoti/Omran
22.5	Contactors	ABB/Siemens/Telemechanique
22.6	Instrument transformers	ECS/ Pragati/ Gemini/Schneider/CGL/Kappa/Narayan power tech
22.7	MCBs	Siemens/Schneider/Legrand/ABB
22.8	Control switches	Switron/Kaycee
22.9	Test terminal blocks	IMP/Schneider/Alstom
22.10	Terminal blocks	Elmex/Connectwell

22.11	Indicating lamps	Siemens/ Teknic/ Binay
22.12	Surge Suppressors	Oblum/Tyco
22.13	Meters	Rishabh/Conzerv

23.0 INSPECTION , TESTING & QUALITY ASSURANCE

23.1	Type Tests	The product must be of type tested quality as per applicable Indian standards / IEC
23.1.1	Type test report validity period	Last five years from date of bid submission. Bidder with type test report more than 5 years old needs to re-conduct the tests without any commercial implication to BSES
23.1.2	Pressure relief device operation	Test certificate for panel to be submitted
23.2	Acceptance & Routine tests	As per the specification and relevant standards. Charges for these tests shall be deemed to be included in the equipment price. In addition to these tests, following tests have to be carried out as acceptance tests -
23.2.1	Primary injection test	To be carried out on panels selected for testing
23.2.2	Temperature rise test	One panel per Purchase order (PO with minimum 10 panels) without any commercial implication to BSES. In-house testing is acceptable.
23.2.3	Paint Thickness/ Peel off	To be carried out on panels selected for testing
23.3	Inspection	The purchaser/owner reserves the right to witness all the acceptance/routine tests during inspection.
23.4	Notice to purchaser for conducting type tests	At least three weeks in advance
23.5	Test reports before dispatch for approval	Six (6) copies of acceptance and routine test reports
23.6	Quality Assurance	
23.6.1	Vendor quality plan	To be submitted for purchaser approval

23.6.2	Inspection points	To be mutually identified & agreed in quality plan

24.0 DRAWINGS & DATA SUBMISSION MATRIX

Drawing submission shall be as per the matrix given below. All documents/ drawing shall be provided on A3/A4 sheet (based on legibility) in box file with separators for each section. PDF shall also be provided of all documents via USB. Language of the documents shall be English only. Deficient/ improper document/ drawing submission shall be liable for rejection.

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
24.1	Contact Person Name, Email ID and Mobile Number	Required			
24.2	Consolidated Deviation Sheet	Required	Required		
24.3	GTP	Required	Required		
24.4	Relevant Type Test as per IS/IEC	Required			
24.5	Power Cable and control cable Philosophy and Schedule		Required		
24.6	Manufacturer's quality assurance plan and certification for quality standards		Required		
24.7	Sizing Calculation of Associated Equipment		Required		
24.8	Recommended Spares Apart from spares stated in Spec(for five years of operation)		Required		
24.9	11 kV / 33 kV Switchgear drawing				
24.9.1	General Arrangement	Required	Required		
24.9.2	Sectional Layout		Required		
24.9.3	Door Layout		Required		
24.9.4	LV Box Internal Layout		Required		

24.9.5	SLD	Required	Required		
24.9.6	Schematic Circuit diagram and Scheme of Each type of Panel		Required		
24.9.7	Communication Architecture		Required		
24.9.8	Bus Bar Arrangement		Required		
24.9.9	QAP		Required		
24.9.10	Panel wise BOQ		Required		
24.9.11	Logic Operation Diagram		Required		
24.9.12	Plan		Required		
24.9.13	Synch Logic Diagram		Required		
24.9.14	Foundation Diagram		Required		
24.9.15	DI sheet		Required		
24.9.16	DO Sheet		Required		
24.9.17	TB Details		Required		
24.9.18	Make of all Component as per specification		Required		
24.10	Drawing of Substation Room		Required		
24.11	Ventilation detail requirement of GIS Room		Required		
24.12	Installation, erection and commissioning manual for switchgear		Required		
24.13	Inspection Reports			Required	
24.14	As manufacturing Drawings			Required	
24.15	Operation and Maintenance Manual			Required	Required
24.16	Trouble shooting manual			Required	Required
24.17	As built Drawings				Required
24.18	Test Report				Required
24.19	Weekly progress report				Required

25.0 PACKING

25.1	Packing Protection	Against corrosion, dampness, heavy rains, breakage and vibration. During transportation/ transit and storage, panels may be subjected to outdoor conditions. Hence, packing of each panel shall be weatherproof.
25.2	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection & identification Label
25.3	Packing Identification Label to be provided on each packing case with the following details	
25.3.1	Individual serial number	
25.3.2	Purchaser's name	
25.3.3	PO number (along with SAP item code, if any) & date	
25.3.4	Equipment Tag no. (if any)	
25.3.5	Destination	
25.3.6	Project Details	
25.3.7	Manufacturer / Supplier's name	
25.3.8	Address of Manufacturer / Supplier / it's agent	
25.3.9	Description and Quantity	
25.3.10	Country of origin	
25.3.11	Month & year of Manufacturing	
25.3.12	Case measurements	
25.3.13	Gross and net weights in kilograms	
25.3.14	All necessary slinging and stacking instructions	

26.0 SHIPPING

26.1	Shipping	The bidder shall ascertain at an early date and definitely before the commencement of manufacture, any transport limitations such as weights, dimensions, road culverts, Overhead lines, free access etc. from the Manufacturing plant to the project site. Bidder shall furnish the confirmation that the proposed Packages can be safely transported, as normal or oversize packages, up to the site. Any modifications required in the infrastructure and cost thereof in this connection shall be brought to the notice of the Purchaser.
		The seller shall be responsible for all transit damage due to improper packing.

27.0 HANDLING AND STORAGE

27.1	Handling and Storage	Manufacturer instruction shall be followed. Detail handling & storage instruction sheet / manual needs to be furnished before commencement of supply.

28.0 PROGRESS REPORTING

28.1	Outline Document	To be submitted for purchaser approval for outline of production, inspection, testing, inspection, packing, dispatch, documentation programme

28.2	Detailed Progress report	To be submitted to Purchaser once a month containing: a. Progress on material procurement b. Progress on fabrication (As applicable) c. Progress on assembly (As applicable) d. Progress on internal stage inspection e. Reason for any delay in total programme f. Details of test failures if any in manufacturing stages g. Progress on final box up h. Constraints / Forward path

29.0 DEVIATION

29.1	Deviation	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.

30.0 ACCESSORIES & TOOLS

30.1	Type and Quantity	Bidder to indicate
30.2	Special tools & tackles required for erection, testing, commissioning and maintenance of the switchboard	The cost of these items shall be indicated separately in the bid as optional.
30.3	Suitable handling truck / trolley for lifting and moving the circuit breaker	To be supplied. (Two trolleys for each type/rating of breaker)

ANNEXURE – A - SCOPE OF SUPPLY

Scope of supply should include the following –

1.1 Design, manufacture, assembly, testing at manufacturer's works, properly packed for transport, supply and FOR delivery at site of following 11kV / 33kV Switchgears as per enclosed specification and single line diagram.

1.2 Base channel frame of the switchgears with hardware.

1.3 Two trolleys for breaker of each size are to be provided per switchboard.

1.4 Programming software and communication cord for numerical relays.

1.5 Unit price of 33kV Incomer with Distance relay as primary protection and 33kV Incomer with Line differential relay as primary protection should be mentioned separately in the bid. Primary protection to be used in Incomer panel will be finalized based on site requirement.

1.6 Unit price of Bus PT should be indicated separately in the bid to enable addition/deletion based on site requirement.

1.7 Bidder should indicate price of one set of special tools and tackles (if any) required for maintenance of switchgear and its components.

1.8 Bidder should indicate price of each spare as per Annexure E.

1.9 All relevant drawings, data and instruction manuals

ANNEXURE – B – TRANSFORMER MONITORING CUM AVR RELAY

1	General features	
1.1	Technology and Functionality	Microprocessor based with provision for multifunction control and monitoring.
1.2	Mounting	Flush Mounting
1.3	Architecture	Hardware and software architecture shall be modular and disconnectable to adapt the control unit to the required level of complexity as per the application.
1.4	Programming and configuration	AVR shall utilize a user friendly setting and operating multilingual software in windows environment with menus and icons for fast access to the data required.
1.5	User Machine Interface	UMI with an alphanumeric key pad and graphical LCD

		display with backlight indicating measurement values and operating messages. Capability to access and change all settings and parameters.
1.6	PC Interface port	Front port (preferably serial) for configuration using PC. Cost of licensed software and communication cord, required for programming of offered protection relays using PC, shall be mentioned separately in the bid.
1.7	SCADA Interface port	RS485 rear port for interfacing with SCADA on IEC103 and dual fibre optic port for interfacing with SCADA on IEC 61850 & PRP compatible. Through these ports relays shall be connected to switches. Protocol shall be selectable at site. If relays have any other rear port, hardware/software required to achieve the above said compatibility will be in supplier's scope. Ethernet switches at switchgear end shall be suitably mounted in an auxiliary compartment in switchgear panel.
1.8	Self diagnosis	Shall be able to detect internal failures. A watchdog relay with changeover contact shall provide information about the failure.
1.9	Auxiliary supply	220VDC or 48VDC
2	Inputs and Outputs	
2.1	CT Input	1/5A selectable through programming
2.2	PT Input	110VAC
2.3	Binary Inputs	Sixteen programmable binary inputs should be provided
2.4	Analog Inputs (4-20mA)	One input to be provided
2.5	PT-100 direct input	Two inputs to be provided
2.6	Direct Resistance Input	For tap position indication (18 steps)
2.7	Binary Outputs	Ten programmable binary outputs should be provided
3	Control	

3.1	Control Tasks	Ability to implement control functions through programmable logics
3.2	Voltage setting	Programmable Voltage set point
3.3	Voltage Regulation	Raise/Lower tap position to maintain the preset value of voltage.
3.4	Voltage Regulation modes	Automatic and Manual
3.5	Operation Modes	Local and Remote
3.6	Fan and Pump control	To be provided
3.7	Transformer Paralleling	Capability to parallel transformers whose AVRs are interconnected via a communication network.
4	SCADA Interfacing	
4.1	Configuration of DIs for routing alarm/trip signals to SCADA.	DI-1 – Buchholz trip DI-2 – OSR Trip DI-3 – PRV trip DI-4 – SPR trip DI-5 – OTI trip DI-6 – WTI trip DI-7 – Buchholz alarm DI-8 – Oil Level low alarm (MOG alarm) DI-9 – WTI alarm DI-10 – OTI alarm DI-11 – Tap changer trouble/stuck/out of step DI-12 – Tap changer motor supply fail DI-13 – Tap changer in local control All signals from DI-1 to DI-10 are to be wired up from transformer trouble auxiliary relays.
4.2	Configuration of DOs for executing commands from SCADA through interface port/CRP	DO-1 – Tap raise DO-2 – Tap lower DO-3 – Fan group 1 control DO-4 – Fan group 2 control
4.3	Spare DIs and DOs	To be wired upto the terminal block.
5	Measurement, Event Recording and Monitoring	

5.1	Measured Quantities (optional)	Voltage, Current, Active Power, Reactive Power, Apparent Power, Power factor, frequency
5.2	Event Recording	Facility for recording parameters during various events such as tap change, change in binary input status etc.
5.3	Monitoring	Capability to monitor important transformer parameters such as Oil temperature, Winding Temperature etc and give indication/alarm when the value of a particular parameter exceeds the preset value.

ANNEXURE – C - TECHNICAL PARTICULARS (DATA BY PURCHASER)

1.0	SWITCHGEAR		
1.1	Type	Metal clad, air insulated with VCB type circuit breaker	
1.2	Service	Indoor	
1.3	Mounting	Free standing, floor mounted	
1.4	System Voltage	11 KV	33kV
1.5	Voltage variation	+/- 10%	
1.6	Frequency	50 Hz +/- 5%	
1.7	Phase	3	
1.8	Rated voltage	12 KV	36 kV
1.9	Rated current	As per SLDs given in Annexure-F	
1.10	Short time rating for 3 sec.	25kA	25kA
1.11	Internal arc classification and rating		
1.11.1	Classification	IAC – A - FLR	IAC – A - FLR
1.11.2	Rating	25kA for 1 second	25kA for 1 second.
1.12	Insulation level (PF rms / Impulse peak)	28 kV / 75 kV	70 kV/ 170 kV

1.13	System ground	Effectively earthed	Effectively earthed
1.14	Enclosure degree of protection	IP – 4X for high voltage compartment and IP – 5X for metering and protection compartment	
1.15	Bus bar - Main	Rating as per SLDs given in annexure - F, Short time rating as per clause 1.10.	
1.15.1	Material	Tinned Electrolytic copper	
1.15.2	Bus bar sleeve	Sleeved with shrouds on joints. Tape on joints is not acceptable.	
1.15.3	Bus identification	Colour coded	
1.15.4	Temperature rise	40 deg. C for conventional joints. 55 deg. C for silver plated joints	
1.16	Auxiliary bus bar	Electrolytic grade tinned copper	
1.17	Auxiliary DC Supply	220 V DC / 48 V DC	
1.18	Auxiliary AC supply	240 V AC 50 Hz	
1.19	Hardware	Stainless steel.	
1.20	Earth bus	Aluminium	
1.21	Bus duct entry	From top (where ever applicable)	
1.22	Power cable entry	From bottom and rear	
1.23	Control cable entry	From bottom and front (i.e breaker compartment)	
2.0	CIRCUIT BREAKER		
2.1	Voltage class, insulation level, short time rating	As specified for switchgear	
2.2	Rated current	As per SLDs given in annexure - F. Use of two breakers in parallel to meet the required current rating shall not be acceptable.	
2.3	Duty cycle	O – 0.3 sec – CO - 3min - CO	
2.4	Short circuit rating		
2.4.1	A.C sym. breaking current	25kA	25kA
2.4.2	Short circuit making current	62.5kA	62.5kA
2.5	Operation time		

2.5.1	Break time	Not more than 4 cycles
2.5.2	Make time	Not more than 5 cycles
2.6	Range of Auxiliary Voltage	
2.6.1	Closing	85% - 110%
2.6.2	Tripping	70% - 110%
2.6.3	Spring Charging	85% - 110%
2.7	No. of spare aux. Contacts of Breaker, for Owner's use.	Minimum 6 NO + 6 NC
2.8	No. of spare contacts of Service and Test position limit switch	2 NO
3.0	CURRENT TRANSFORMERS	
3.1	Voltage class, insulation level and short time rating	As specified for switchgear
3.2	Type	Cast resin, window / bar primary type
3.3	Class of insulation	Class E or better
3.4	Ratio	As per SLDs given in annexure - F
3.5	Number of secondaries	As per SLDs given in annexure - F
3.6	Accuracy class	
3.6.1	Protection core	5P20
3.6.2	Protection (Diff. / REF)	PS
3.6.3	Metering	0.2s
3.6.4	Core balance CT	PS
3.7	Burden (VA)	Adequate for the protection & instruments offered
3.8	Excitation current of PS Class CTs	30 mA at Vk/4
3.8	Knee Point Voltage of PS Class CTs (Vk)	>= 40 (Rct + 4)

3.9	Primary operating current sensitivity of CBCTs	5A	
4.0	VOLTAGE TRANSFORMERS		
4.1	Type	Cast resin, draw out type, single phase units	
4.2	Rated Voltage		
4.2.1	Primary	11000/sq.rt.3	33000/sq.rt.3
4.2.2	Secondary	110V/sq.rt.3	
4.3	No. of phases	3	
4.4	No. of secondary windings	2	
4.5	Method of connection	Star/Star	
4.6	Rated voltage factor	1.2 continuous, 1.9 for 30 seconds	
4.7	Class of insulation	Class E or better	
4.8	Accuracy class		
4.8.1	Protection	3P	
4.8.2	Metering	0.2	
4.9	Primary and secondary fuses	HRC current limiting type, Primary fuse replacement shall be possible with VT in withdrawn position	
5.0	HV FUSES		
5.1	Voltage class	12kV	36kV
5.2	Rupturing capacity	50kA	
5.3	Rated current	As per application	
6.0	SURGE ARRESTORS	For 11kV switchgear	For 33kV switchgear
6.1	Rated Voltage	9kV	30kV
6.2	Maximum continuous operating voltage (MCOV)	7.65kV	25kV
6.3	Discharge current	10kA	10kA
6.4	Discharge class	3	3

Note - The auxiliary DC voltage shall be checked on a case to case basis by Purchaser

ANNEXURE – D - GUARANTEED TECHNICAL PARTICULARS (DATA BY BIDDER)

Sr. No.	Description	Feeder Panel Type				
		Incomer	Bus Coupler	Outgoing	Capacitor	Station Trafo
1.0	SWITCHGEAR ASSEMBLY					
1.1	Make					
1.2	Type					
1.3	Reference Standard					
1.4	Voltage (Normal/Max.) kV					
1.6	Frequency (Hz)					
1.7	Short Circuit Rating					
1.7.1	Short time current and duration.					
1.8	Internal Arc Classification and rating (Refer Annexure –C)					
1.8.1	Classification					
1.8.2	Rating with gas ducts/deflectors					
1.8.3	Rating without gas ducts/deflectors					
1.9	Insulation Level					
1.9.1	Impulse Withstand (kV peak)					
1.9.2	1 minute 50 Hz. Voltage Withstand (kV rms)					
2.0	CONSTRUCTION					
2.1	Metal Clad Construction Yes/No					
2.2	Degree of protection :					
2.3	Minimum thickness of sheet metal used (mm)					
2.4	Draw out feature provide for					
2.4.1	Breaker with Service, Test & Isolated position -Yes/No					

Sr. No.	Description	Feeder Panel Type				
		Incomer	Bus Coupler	Outgoing	Capacitor	Station Trafo
2.4.1	Voltage Transformer : Yes/ No					
2.4.3	Protective relays : Yes/ No					
2.5	Breaker Cubicle					
2.5.1	Cubicle door can be closed with breaker in Test and isolated position : Yes/ No					
2.5.1	Working zone units from floor level (mm)					
2.6	All meters, switches & relays flush mounted type: Yes/No					
2.7	Minimum clear space required					
2.7.1	Front for breaker withdrawal (mm)					
2.7.2	Rear (mm)					
2.8	Typical Vertical Section					
2.8.1	Overall Dimensions					
a.	Length (mm)					
b.	Breadth (mm)					
c.	Height (mm)					
2.8.2	Weight (kg)					
3.0	BUS BAR					
3.1	Make					
3.2	Material & Grade					
3.3	Reference Standard					
3.4	Cross Sectional area (mm^2)					
3.5	Bus connection (Joints)					
3.5.1	Silver Plated Yes/No					

Sr. No.	Description	Feeder Panel Type				
		Incomer	Bus Coupler	Outgoing	Capacitor	Station Trafo
3.5.2	Conventional made with anti oxide grease Yes/No					
3.6	Rated Continuous Current Amps					
3.7	Maximum temperature rise at rated continuous current °C					
3.8	Short time current and duration (KA and secs)					
3.9	D.C. Resistance at 85°C (Ω/m/∅)					
3.10	Minimum clearance of bus bar and connection					
3.10.1	Phase to phase (mm)					
3.10.2	Phase to earth (mm)					
3.11	Bus Bar provided with					
3.11.1	Insulation Sleeve					
3.11.2	Phase barriers					
3.11.3	Cast Resin shrouds for joints					
3.12	Bus bar support spacing (mm)					
3.13	Bus support insulators					
3.13.1	Make					
3.13.2	Type					
3.13.3	Reference Standard					
3.13.4	Voltage Class (kV)					
3.13.5	Min. creepage distance (mm)					
3.13.6	Cantilever strength Kg/mm^2					
3.13.7	Net Weight (kg)					
4.0	CIRCUIT BREAKER					
4.1	Make					

Sr. No.	Description	Feeder Panel Type				
		Incomer	Bus Coupler	Outgoing	Capacitor	Station Trafo
4.2	Type					
4.3	Reference Standard					
4.4	Rated Voltage					
4.5	Rated Frequency					
4.6	Rated Current					
4.6.1	Rated Current and its reference ambient temperature.					
4.6.2	Continuous current to limit the maximum temperature rise to 55 Deg C for silver plated connections and 40 Deg C for conventional connections.					
4.7	Rated operating Duty					
4.8	Symmetrical Breaking capacity at rated voltage & operating duty KA rms					
4.9	Rated making Current (KAp)					
4.10	Short time current and duration (KA and secs)					
4.11	Insulation Level					
4.11.1	Impulse voltage withstand on 1/50 full wave					
4.11.2	1 minute 50 Hz. Voltage withstand					
4.12	Maximum over voltage factor when switching off					
4.12.1	Un loaded transformer					
4.12.2	Loaded transformer					

Sr. No.	Description	Feeder Panel Type				
		Incomer	Bus Coupler	Outgoing	Capacitor	Station Trafo
4.12.3	Un loaded cables					
4.12.4	Capacitors					
4.12.5	Motors					
4.13	Opening time maximum No load condition (ms)					
4.14	Number of permissible breaker operations under vacuum loss					
4.15	At 100% Breaking capacity					
4.15.1	Opening time-Max. (ms)					
4.15.2	Arcing time-Max (ms)					
4.15.3	Total break time (ms)					
a.	Make time (Max) (ms)					
b.	Total closing time (ms)					
4.17	Total length of contact travel (mm)					
4.18	No. of breaker operations permissible without requiring inspection, replacement of contacts and other main parts.					
4.18.1	At 100% rated current					
4.18.2	At 100% rated breaking current					
4.19	Type of contacts					
4.20	Material of contact					
4.21	Minimum clearance in air (mm) from live part					
4.21.1	Between phases					
4.21.2	Between live parts and ground					
4.22	Type of arc control device provided					

Sr. No.	Description	Feeder Panel Type				
		Incomer	Bus Coupler	Outgoing	Capacitor	Station Trafo
4.23	Operating mechanism-closing					
4.23.1	Type					
4.23.2	No. of breaker operations stored					
4.23.3	Trip free or fixed trip					
4.23.4	Anti pumping features provided					
4.24	Operating mechanism-tripping					
4.24.1	Type					
4.24.2	No. of breaker operations stored					
4.24.3	Trip free or fixed trip (V)					
4.24.4	Anti pumping features provided (%)					
4.25	Spring Charging motor					
4.25.1	Rating (kW)					
4.25.2	Make					
4.25.3	Voltage and permissible variation (%)					
4.26	Closing coil					
4.26.1	Voltage (V)					
4.26.2	Permissible voltage variation (%)					
4.26.3	Closing current at rated voltage (A)					
4.26.4	Power at rated voltage (W)					
4.27	Tripping Coil					
4.27.1	Voltage					
4.27.2	Permissible voltage variation (%)					
4.27.3	Tripping Current at rated Voltage (A)					

Sr. No.	Description	Feeder Panel Type				
		Incomer	Bus Coupler	Outgoing	Capacitor	Station Trafo
4.27.4	Power at rated voltage (W)					
4.28	Breaker/Accessories Accessories such as control switch indication lamps etc. furnished as specified: (Please attach separate sheet giving details of all accessories, inter locks and safety shutters)					
4.28.1	Mechanical Safety Interlock					
4.28.2	Automatic Safety Interlock					
4.28.3	Operational Interlock					
4.28.4	Emergency manual trip					
4.28.5	Operation counter					
4.28.6	Change/discharge indicator					
4.28.7	Manual spring charging facility					
4.28.8	Auxiliary switch with 6NO+ 6 NC for Owner's use.					
4.28.9	Contacts wear indicator					
4.29	Auxiliary Switch					
4.29.1	Switch contacts type					
4.29.2	Contacts rating at					
a.	Make & Continuous (Amps)					
b.	Break (Inductive) (Amps)					
4.30	Net weight of the breaker (Kg)					
4.31	Impact load foundation design (to include dead load plus impact value on opening at maximum interrupting rating) (kG)					

Sr. No.	Description	Feeder Panel Type				
		Incomer	Bus Coupler	Outgoing	Capacitor	Station Trafo
4.32	On Vacuum loss (Amps)					
4.32.1	Possible load current breaking (Amps)					
4.32.2	Possible fault current breaking (Amps)					
4.33	Overall Dimensions					
4.33.1	Length (mm)					
4.33.2	Breadth (mm)					
4.33.3	Height (mm)					
4.34	Type test report on identical breaker furnished					
5.0	CONTROL & INDICATIONS					
5.1	Push Buttons Make					
5.1.1	Type & Catalog No.					
5.1.2	Contact rating at 110V / 220V D,C,					
5.1.3	Make & continuous (Amps)					
5.2	LED lamps: Make :					
5.2.1	Type & Catalog No.					
5.2.2	Watts/Voltage					
5.2.3	Lamps & Lens replaceable from front with glass cover					
5.3	Selector switch: Make					
5.3.1	Type & Catalog No.					

Sr. No.	Description	Feeder Panel Type				
		Incomer	Bus Coupler	Outgoing	Capacitor	Station Trafo
5.3.2	Contact rating.					
5.3.3	Make & continuous (Amps)					
5.3.4	Break (inductive) (Amps)					
6.0	CURRENT TRANSFORMER					
6.1	Make					
6.2	Type & voltage level					
6.3	Reference standard					
6.4	C.T. ratio as specified					
6.5	Short circuit withstand Short time current for 1 Sec. - kA rms Dynamic current - kA peak					
6.6	Class of insulation					
6.7	Temperature rise					
6.8	Basic insulation level					
6.9	For metering & protection					
6.9.1	CT Ratio					
6.9.2	Class of accuracy					
6.9.3	Rated burden VA					
6.9.4	Knee point voltage V					
6.9.5	Excitation current at $V_k/4$					
6.9.6	Rated saturating current Amp					
6.10	For differential protection					
6.10.1	CT Ratio					
6.10.2	Class of accuracy					
6.10.3	Rated burden VA					

Sr. No.	Description	Feeder Panel Type				
		Incomer	Bus Coupler	Outgoing	Capacitor	Station Trafo
6.10.4	Knee point voltage V					
6.10.5	Excitation current at $V_k/4$ Amps					
6.10.6	Rated saturating current Amp					
6.10.7	Secondary resistance (Ω)					
6.11	For restricted earth fault protection					
6.11.1	CT Ratio					
6.11.2	Class of accuracy					
6.11.3	Rated burden VA					
6.11.4	Knee point voltage V					
6.11.5	Excitation current at $V_k/4$					
6.11.6	Amps					
6.11.7	Rated saturating current Amp					
6.11.8	Secondary resistance (Ω)					
6.12	For stand by earth fault protection					
6.12.1	CT Ratio					
6.12.2	Class of accuracy					
6.12.3	Rated burden VA					
6.12.4	Knee point voltage V					
6.12.5	Excitation current at $V_k/4$ Amps					
6.12.6	Rated saturating current Amp					
6.12.7	Over current rating Continuous % over load (%)					

Sr. No.	Description	Feeder Panel Type				
		Incomer	Bus Coupler	Outgoing	Capacitor	Station Trafo
6.13	For sensitive earth fault protection (CBCT) CT Ratio					
6.13.1	Class of accuracy					
6.13.2	Rated burden VA					
6.13.3	Knee point voltage V					
6.13.4	Excitation current at V_k/4 Amps					
6.13.5	Rated saturating current Amp					
6.13.6	Over current rating Continuous % over load (%)					
7.0	POTENTIAL TRANSFORMER					
7.1	Make					
7.2	Type and voltage level					
7.3	Reference Standard					
7.4	Voltage Ratio					
7.5	Accuracy					
7.5.1	Winding-1					
7.5.2	Winding-2					
7.6	Rated Burden (VA)					
7.6.1	Winding-1					
7.6.2	Winding-2					
7.7	Over voltage factor					
7.7.1	Continuous					
7.7.2	30 seconds					
7.8	Class of Insulation					

Sr. No.	Description	Feeder Panel Type				
		Incomer	Bus Coupler	Outgoing	Capacitor	Station Trafo
7.9	Temperature rise over ambient (°C)					
7.10	Basic Impulse level (kV peak)					
7.11	Winding connection					
7.11.1	Primary					
7.11.2	Secondary					
7.12	Fuses					
7.12.1	Continuous rating HV/LV (Amp)					
7.12.2	Symmetrical fault rating HV/LV kA rms					
7.12.3	Make					
7.13	Maximum ratio error at					
7.13.1	90% to 100% of rated voltage and 25% to 100% of rated secondary burden at Unity Power factor.					
7.13.2	90% to 106% of rated voltage and 10% to 50% of rated secondary burden at 0.2 p.f.					
7.14	Maximum phase difference at					
7.14.1	90% to 100% of rated voltage and 25% to 100% of rated secondary burden at unity p.f.					

Sr. No.	Description	Feeder Panel Type				
		Incomer	Bus Coupler	Outgoing	Capacitor	Station Trafo
7.14.2	90% to 106 of rated voltage and 10% to 50% of rated secondary burden at 0.2 p.f.					
7.15	Weight (kg)					
8.0	RELAYS					
8.1	Manufacturer					
8.2	Model Type					
8.3	Draw out type with built in test facilities. Yes/No					
8.4	Built in test facility . Yes/No					
8.5	Type of mounting					
8.6	Reference standard					
8.7	All relays furnished as per drawing and specification					
8.8	All relevant relay leaflets and catalogue furnished					
8.9	Communication port type					
8.10	Auxiliary supply					
8.11	Measurement and data acquisition feature.					
8.12	Control and supervision					
a	IEC protocol					
b	Open protocol feature					
c	Programming facility					
d	Separate output for individual element					

Sr. No.	Description	Feeder Panel Type				
		Incomer	Bus Coupler	Outgoing	Capacitor	Station Trafo
e	Event recording facility Number of events					
f	Required softwares offered					
8.13	C.T. secondary current					
8.14	Self diagnostic feature					
8.15	Modular design					
8.16	Relay details:-					
8.16.1	Overcurrent					
a	Make					
b	Type					
c	Characteristics available					
d	Range of settings a) Current b) Time					
e	Range of settings a) Current b) Time					
f	Rated burden					
8.16.2	Synchronizing check relay (if applicable) :					
a	Make					
b	Type					
c	Setting range					
8.16.3	Earth fault					
a	Make					
b	Type					
c	Characteristics available					

Sr. No.	Description	Feeder Panel Type				
		Incomer	Bus Coupler	Outgoing	Capacitor	Station Trafo
d	Range of settings a) Current b)Time					
e	Rated burden					
8.16.4	Over current (Directional) if applicable					
a	Make					
b	Type					
c	Characteristics available					
d	Range of settings a) Current b) Time					
e	Rated burden					
8.16.5	Earth fault (Directional) If applicable					
a	Make					
b	Type					
c	Characteristics available					
d	Range of settings a) Current b)Time					
e	Rated burden					
8.16.6	Neutral unbalance relay					
a	Make					
b	Type					
c	Characteristics available					

Sr. No.	Description	Feeder Panel Type				
		Incomer	Bus Coupler	Outgoing	Capacitor	Station Trafo
d	Range of settings Current Time					
e	Rated burden					
8.16.7	Under Voltage Relay					
a	Make					
b	Type					
c	Range of setting					
d	Rated burden					
8.16.8	Over Voltage Relay					
A	Make					
b	Type					
c	Range of setting					
d	Rated burden					
8.16.9	Busbar Differential Relay					
a	Make					
b	Type					
c	High impedance /Low impedance					
d	Facility for CT ratio adjustment possible through software. Yes/No					
e	CT supervision facility available. Yes/No					
8.16.10	Transformer Differential Relay					
a	Make					
b	Type					
c	High impedance /Low impedance					

Sr. No.	Description	Feeder Panel Type				
		Incomer	Bus Coupler	Outgoing	Capacitor	Station Trafo
d	Facility for CT ratio adjustment possible through software. Yes/No					
e	Facility of transformer vector group adjustment through software. Yes/No					
f	Setting range.					
g	Rated burden.					
8.16.11	Restricted earth fault relay					
a	Make					
b	Type					
c	Combined with differential relay. Yes/No					
d	Setting range					
e	Rated burden.					
8.16.12	Standby earth fault relay					
a	Make					
b	Type					
c	Characteristics					
d	Setting range					
e	Rated burden					
8.17	Terminal block for relay testing provided (Yes / No)					
9.0	METERS					
9.1	Multifunction Meter					
a	Model					
b	Make					

Sr. No.	Description	Feeder Panel Type				
		Incomer	Bus Coupler	Outgoing	Capacitor	Station Trafo
c	SCADA Interfacing					
d	Size					
e	Panels where to be provided					
f	Accuracy Class					
g	Auxiliary Supply					
9.2	Voltmeter					
a	Make					
b	Type					
c	Reference standard					
d	Size					
e	Accuracy class					
10.0	SECONDARY WIRING					
10.1	Type and insulation					
10.2	Voltage grade					
10.3	Conductor material					
10.4	Conductor size (minimum) and insulation wiring					
10.4.1	Potential circuit					
10.4.2	Control & current circuit					
11.0	TERMINAL BLOCK					
11.1	Make					
11.2	Type					
11.3	Catalog No.					
11.4	20% Spare terminals furnished					
12.0	CABLE TERMINATIONS					
12.1	Clearance for power cable					

Sr. No.	Description	Feeder Panel Type				
		Incomer	Bus Coupler	Outgoing	Capacitor	Station Trafo
	termination					
12.2	Removable gland plate					
12.2.1	Material for multi core cable					
12.2.2	Material for single core cable					
12.2.3	Thickness of the plate					
13.0	NAME PLATE					
13.1	Material					
13.2	Thickness					
13.3	Size for					
13.3.1	Breaker cubicle					
13.3.2	Instruments/devices					
14.0	Space Heater/Plug Socket					
14.1	Cubicle Heater					
14.1.1	Thermostat controlled					
14.1.2	Wattage					
14.1.3	Voltage					
14.1.4	Resistance (ohms)					
14.1.5	Thermostat range					
14.2	Plug Socket					
14.2.1	Type					
14.2.2	Rating					
14.3.	Cubicle heater & plug socket circuit provided with MCBs					
15.0	A.C/D.C Supply					
15.1	Isolating Switches for incoming supply					
15.1.1	A. C. Type & rating					

Sr. No.	Description	Feeder Panel Type				
		Incomer	Bus Coupler	Outgoing	Capacitor	Station Trafo
15.1.2	D.C. Type & rating					
15.2	Isolating Switch at each cubicle					
15.2.1	A. C. Supply-type & rating					
15.2.2	D.C. Supply-type & rating					
16.0	Tropical Protection					
16.1	Any special treatment for tropical protection					
17.0	Painting					
17.1	Finish of Switchgear					
17.1.1	Inside					
17.1.2	Outside					
18.0	No. of Accessories Furnished					
18.1	Breaker lifting & handling trolley					
18.2	Any other					
19.0	TESTS					
19.1	Reference Standard					
19.2	Routine tests to be performed on Switchgear					
19.3	Type Tests certificates submitted					
20.0	Drawing/Data					
20.1	General arrangement for Panel Board					
20.2	Foundation plan					
20.3	Bill of material					
20.4	Cross Sectional drawing for every type of switchgear (Add sheets if					

Sr. No.	Description	Feeder Panel Type				
		Incomer	Bus Coupler	Outgoing	Capacitor	Station Trafo
	necessary)					

Place : Signature :

Printed Name : Designation :

Business Address : (Including Telex, Telephone & Telefax No.)

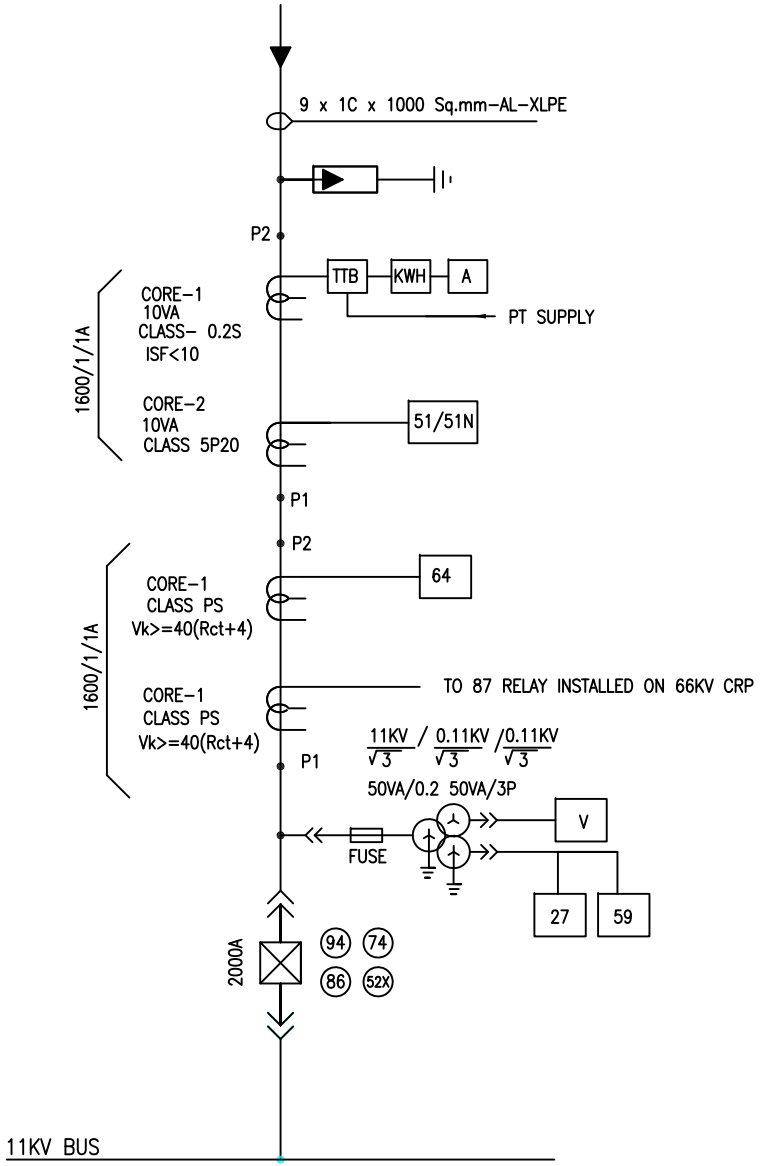
Name & Address of the Principal Officer :

ANNEXURE – E – SPARES REQUIREMENT

Unit rate of all below mentioned spares have to be provided in the bid.

S No.	Description	Qty
1	Line voltage transformer	3 (1 set)
2	Bus voltage transformer	3 (1 set)
3	Current transformer of each ratio	3 (1 set)
4	Trip Coil	4
5	Closing Coil	4
6	CB Spring charging motor	2
7	Auxiliary switch	2 sets (2 Nos. each type)
8	Bursting disc / pressure relief plate complete	2
9	Numerical relay of each type	1 nos. (each type)
10	Vacuum Interrupter Bottle	1 set (3 nos.) of each rating
11	Breaker contacts for busbar	1 set (3 nos.) of each rating
12	Breaker testing cable with plug suitable for breaker on one side and plug suitable for the panel on the other side	3 meter(each type)
13	SCADA Spare	20% of Supplied Items

ANNEXURE–F1



25 KA for 3 secs, 2000A at 50 degree celsius

LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

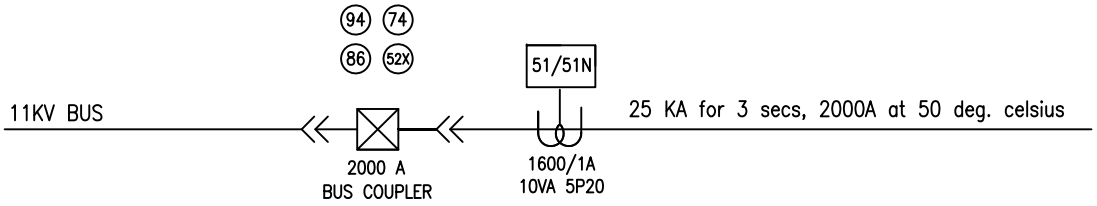
SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:–

1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

DRAWN	RAJESH	TITLE:– STANDARD SLD FOR 11KV INCOMER	BSES Yamuna Power Limited
CHECKED	G.S		SPECIFICATION NO. SP–HTSWG–01–R3
APPD.	A.A		SLD–SWG–11KV–01
DATE	07.08.18		
SCALE	NTS		

ANNEXURE–F2



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

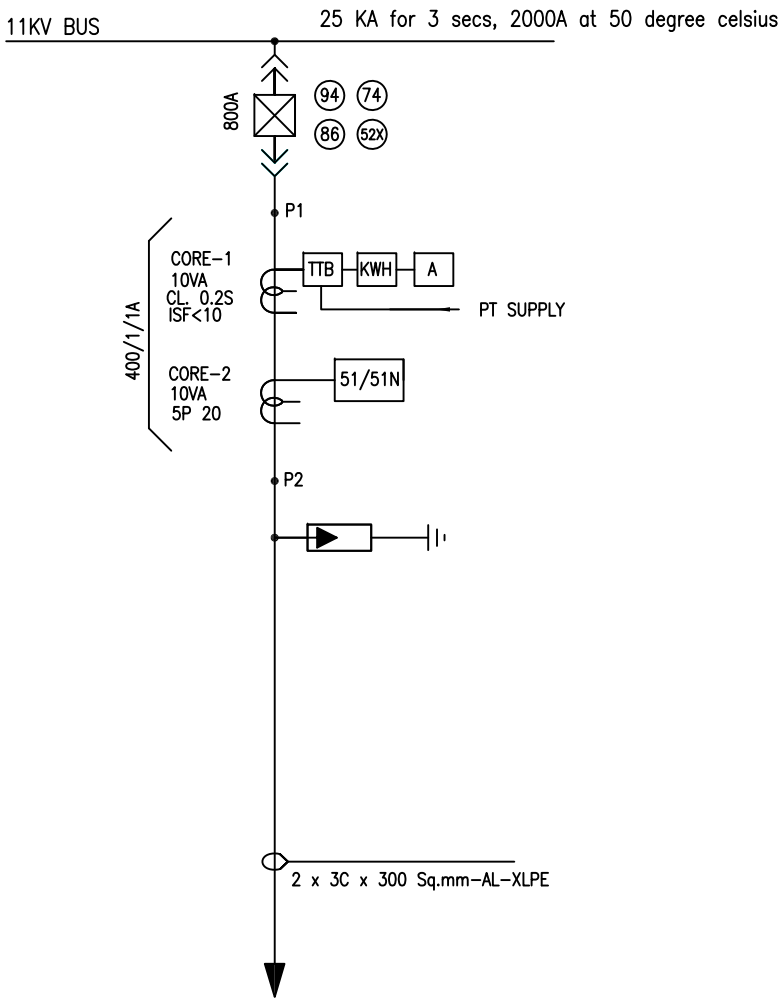
SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:–

1. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

DRAWN	RAJESH	TITLE:– STANDARD SLD FOR 11KV BUS SECTION	BSES Yamuna Power Limited
CHECKED	G.S		
APPD.	A.A		
DATE	07.08.18		SPECIFICATION NO. SP–HTSWG–01–R3
SCALE	NTS		SLD–SWG–11KV–02

ANNEXURE–F3



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

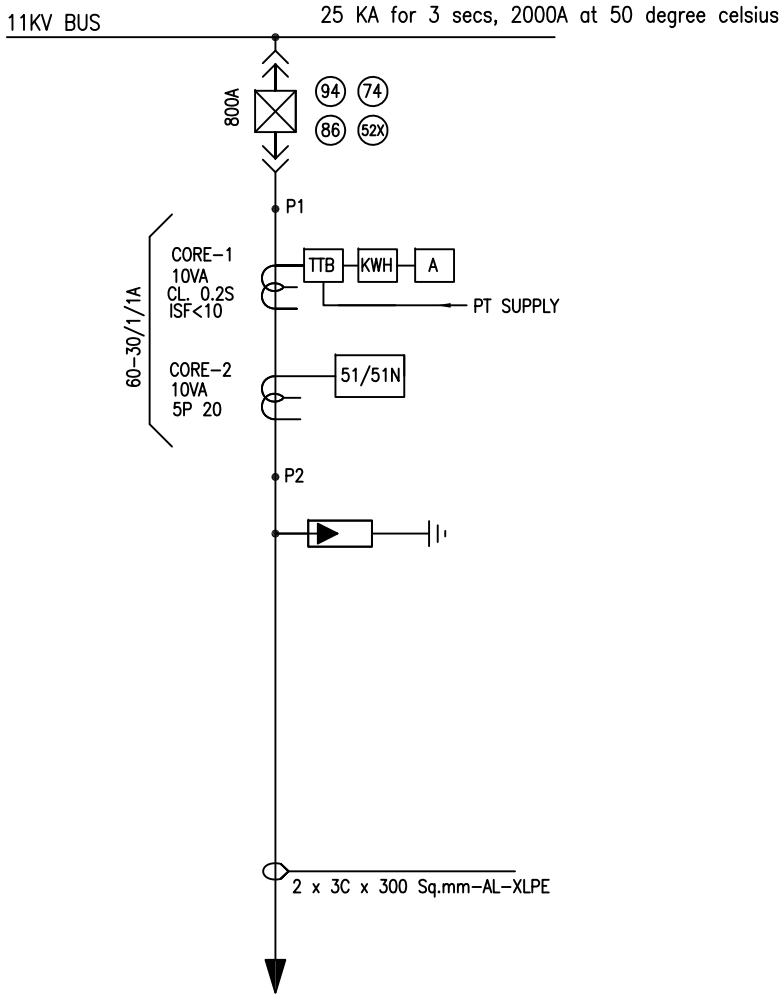
SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:–

1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

DRAWN	RAJESH	TITLE:– STANDARD SLD FOR 11KV OUTGOING FEEDER	BSES Yamuna Power Limited
CHECKED	G.S		SPECIFICATION NO. SP–HTSWG–01–R3
APPD.	A.A		SLD–SWG–11KV–03
DATE	07.08.18		
SCALE	NTS		

ANNEXURE–F4



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:–

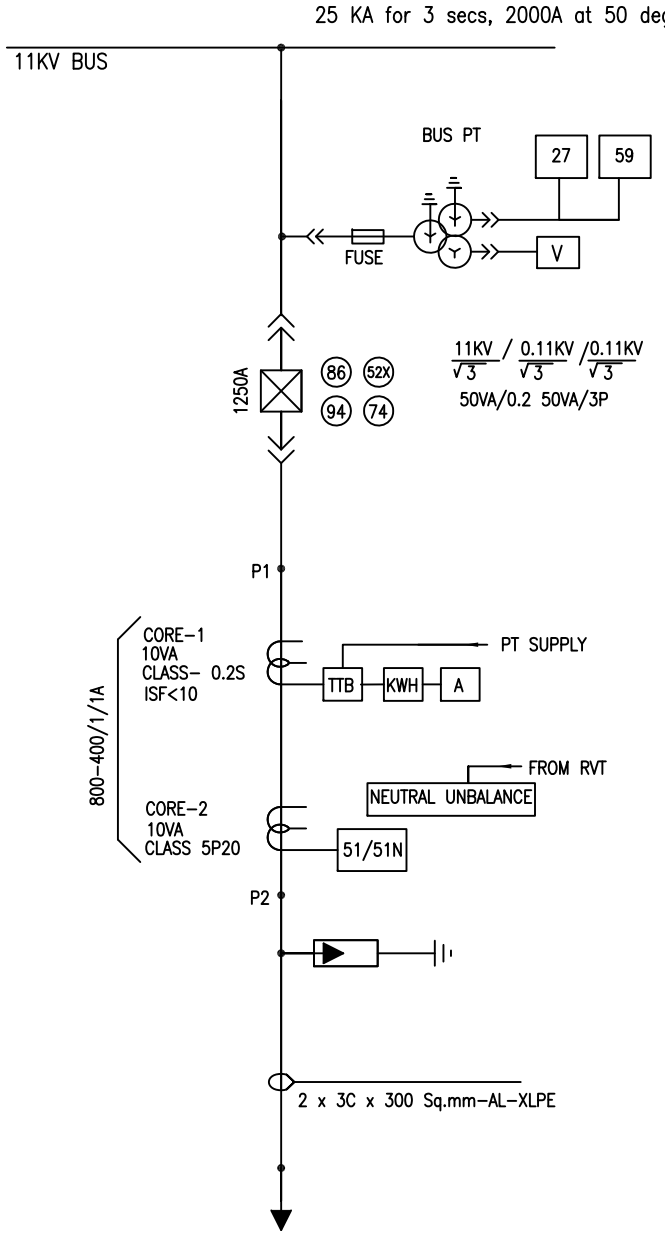
1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

DRAWN	RAJESH
CHECKED	G.S
APPD.	A.A
DATE	07.08.18
SCALE	NTS

TITLE:–
STANDARD SLD FOR 11KV STATION TRANSFORMER FEEDER

BSES Yamuna Power Limited
SPECIFICATION NO. SP–HTSWG–01–R3
SLD–SWG–11KV–04

ANNEXURE–F5



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

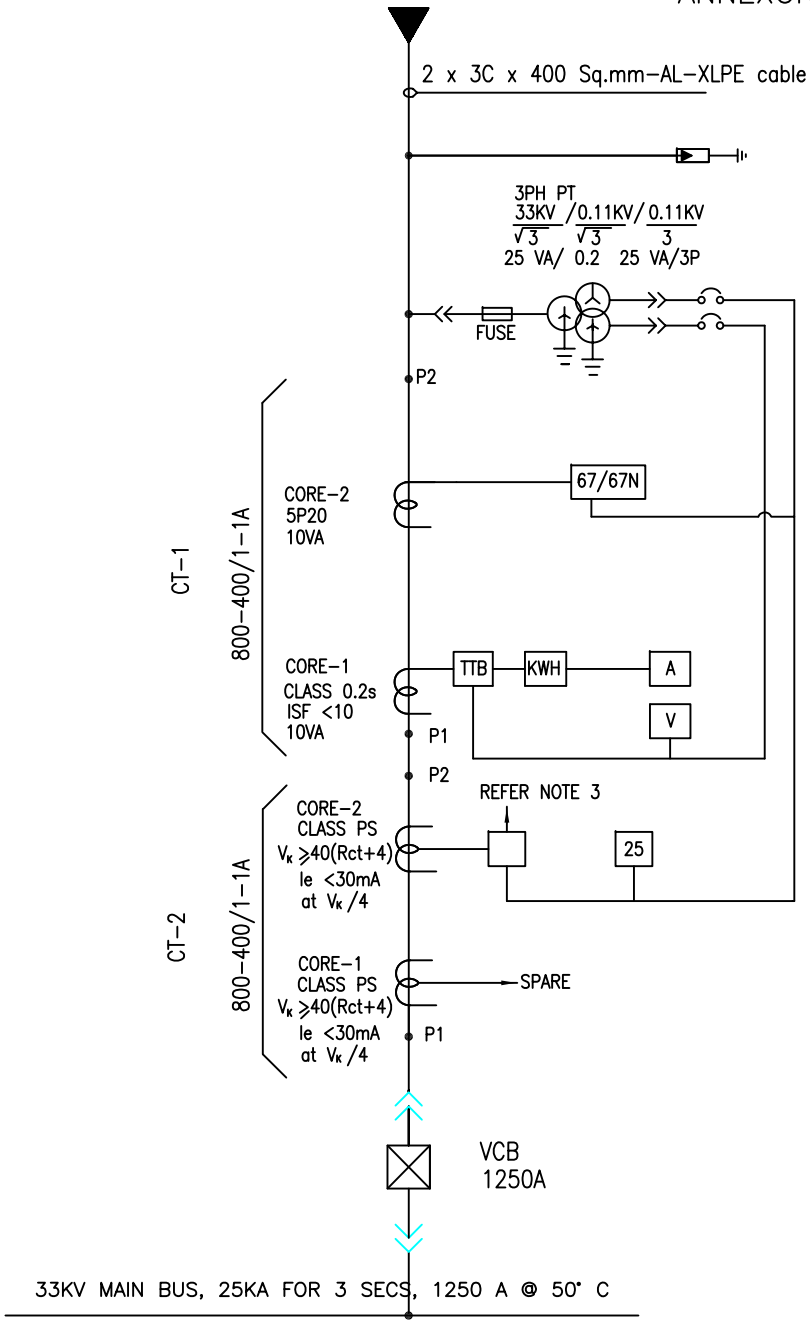
SYMBOL	DESCRIPTION
KWH	ENERGY METER
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:–

1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS
3. ONE BPT TO BE CONSIDERED FOR EACH CAPACITOR PANEL

DRAWN	RAJESH	TITLE:– STANDARD SLD FOR 11KV CAPACITOR FEEDER	BSES Yamuna Power Limited
CHECKED	G.S		SPECIFICATION NO. SP–HTSWG–01–R3
APPD.	A.A		SLD–SWG–11KV–05
DATE	07.08.18		
SCALE	NTS		

ANNEXURE–F6



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:
1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS
3. LINE DIFFERENTIAL OR DISTANCE RELAY. REFER CLAUSE 16.7.1 OF SPECIFICATION

DRAWN	RAJESH
CHECKED	G.S
APPD.	A.A
DATE	07.08.2018
SCALE	NTS

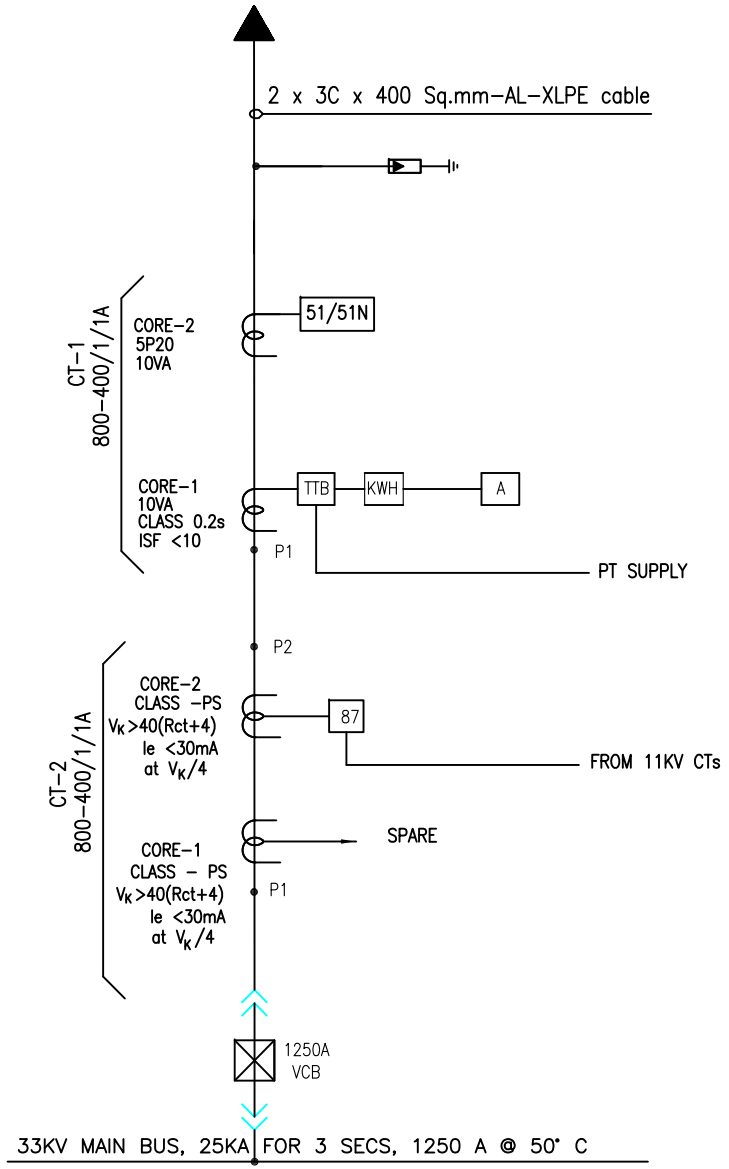
TITLE
TYPICAL SLD FOR 33KV INCOMER

BSES Yamuna Power Limited

SPECIFICATION NO. SP-HTSWG-01-R3

SLD-SWG-33KV-01

ANNEXURE–F7



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

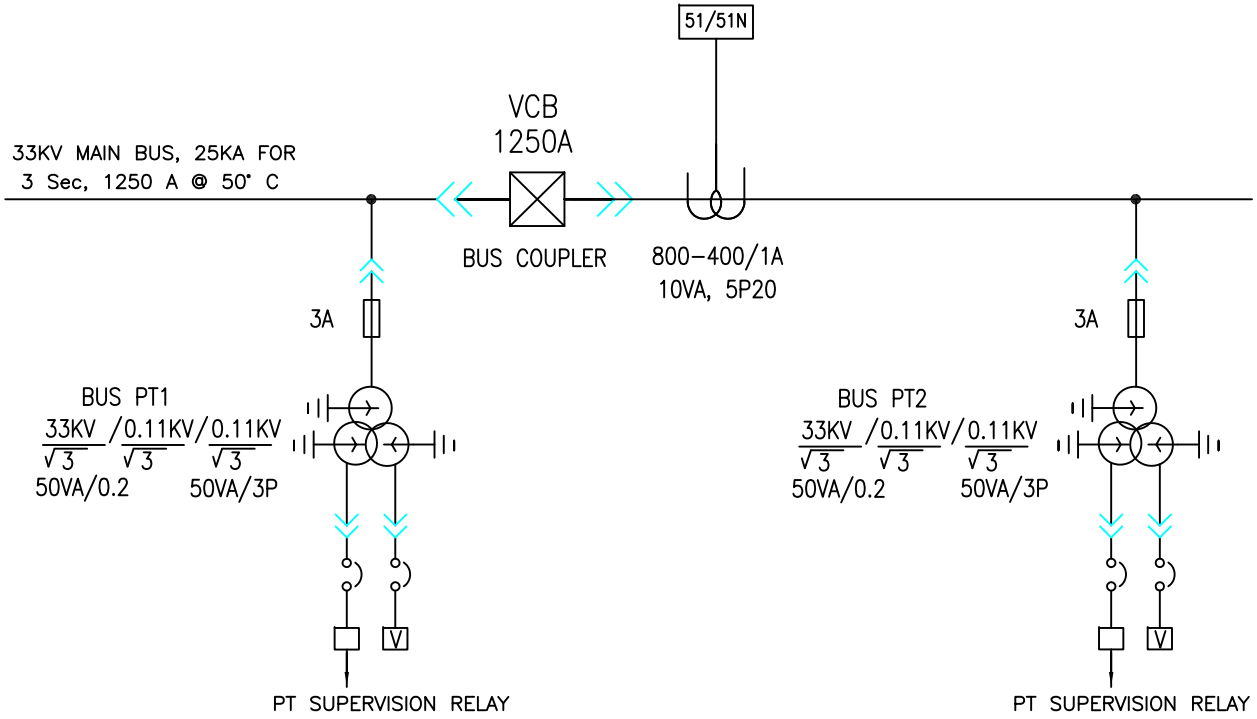
SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE: 1. KWH METER NOT IN SUPPLIER'S SCOPE

2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

DRAWN	RAJESH	TITLE	BSES Yamuna Power Limited
CHECKED	G.S	TYPICAL SLD FOR 33/11KV TRANSFORMER FEEDER	SPECIFICATION NO. SP-HTSWG-01-R3
APPD.	A.A		
DATE	07.08.2018		SLD-SWG-33KV-02
SCALE	NTS		

ANNEXURE–F8



LEGEND

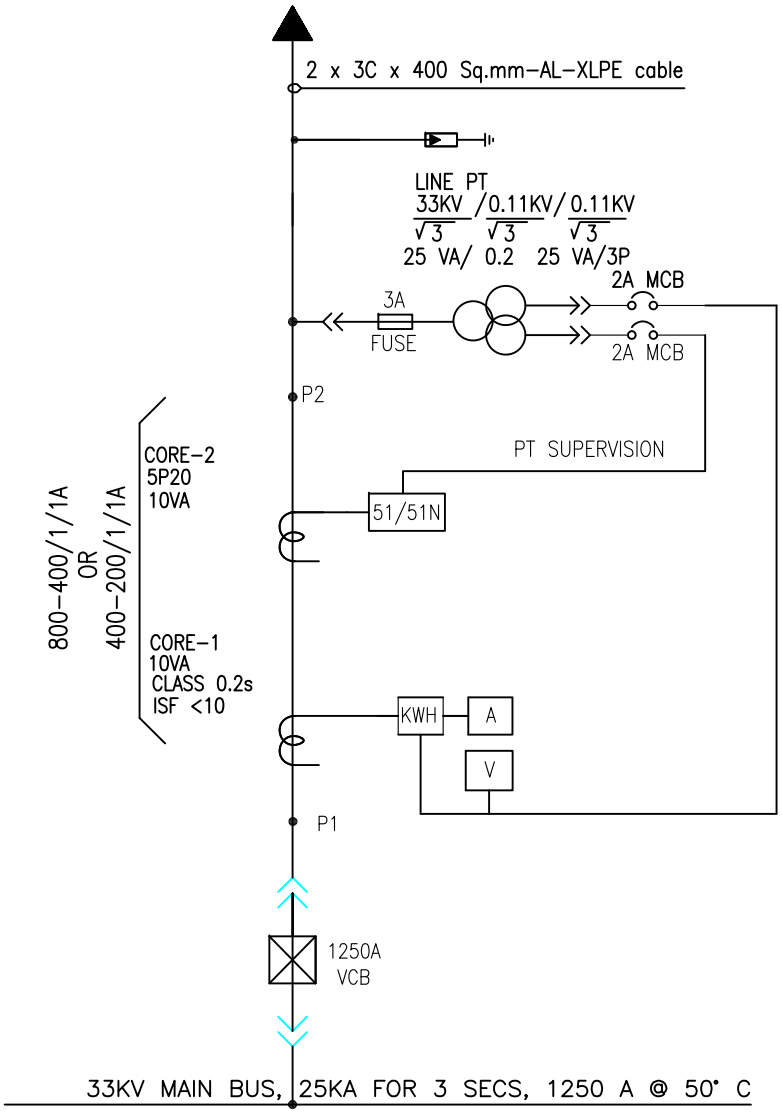
SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:–

1. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

DRAWN	RAJESH	TITLE	BSES Yamuna Power Limited
CHECKED	G.S	TYPICAL SLD FOR 33KV BUS COUPLER CUM BUS PT	SPECIFICATION NO. SP-HTSWG-01-R3
APPD.	A.A		
DATE	07.08.2018		
SCALE	NTS		SLD-SWG-33KV-03



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:
1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS
3. TTB NOT REQUIRED IN THIS PANEL

DRAWN	RAJESH
CHECKED	G.S
APPD.	A.A
DATE	07.08.2018
SCALE	NTS

TITLE

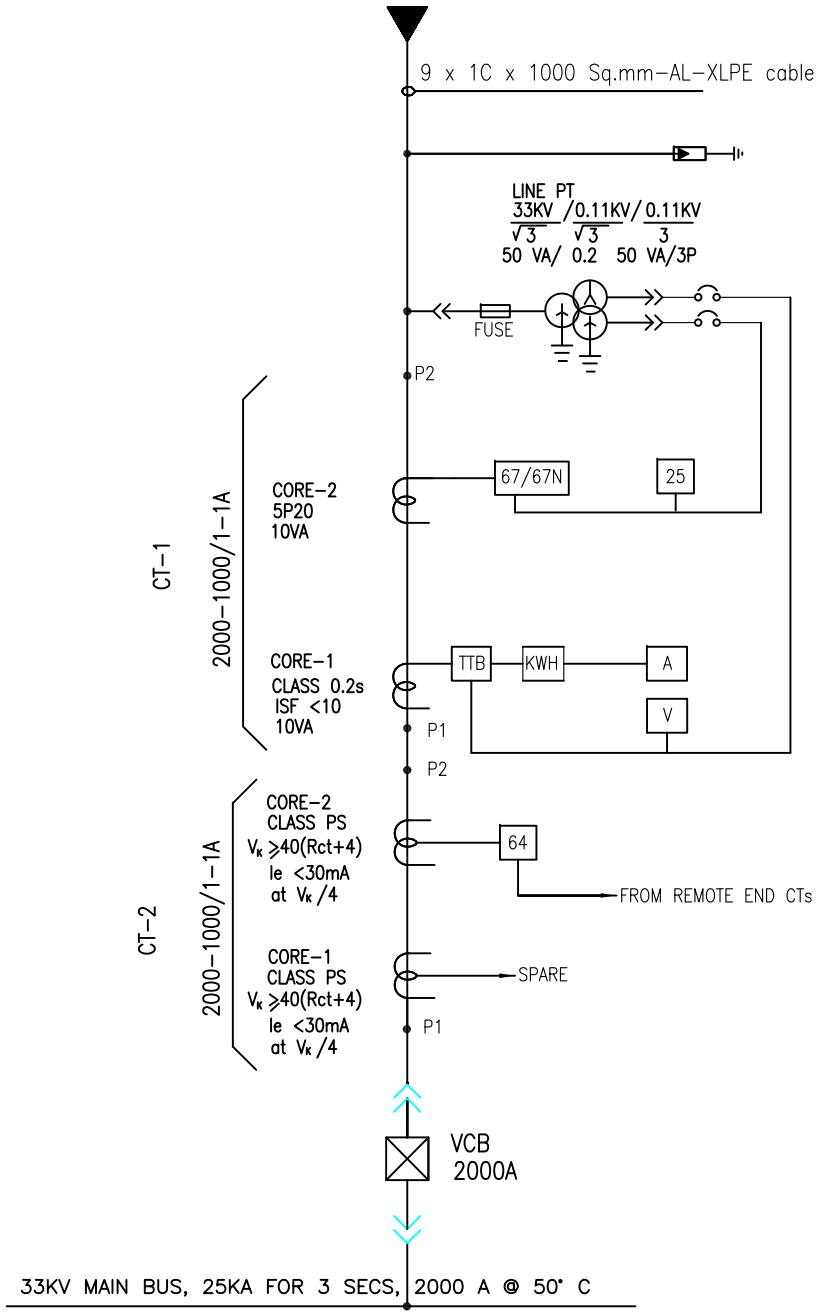
TYPICAL SLD FOR 33 KV OUTGOING FEEDER (FOR INSTALLATION AT KCC CONSUMERS PREMISES)

BSES Yamuna Power Limited

SPECIFICATION NO. SP-HTSWG-01-R3

SLD-SWG-33KV-04

ANNEXURE–F10



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:
1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

DRAWN	RAJESH
CHECKED	G.S
APPD.	A.A
DATE	07.08.2018
SCALE	NTS

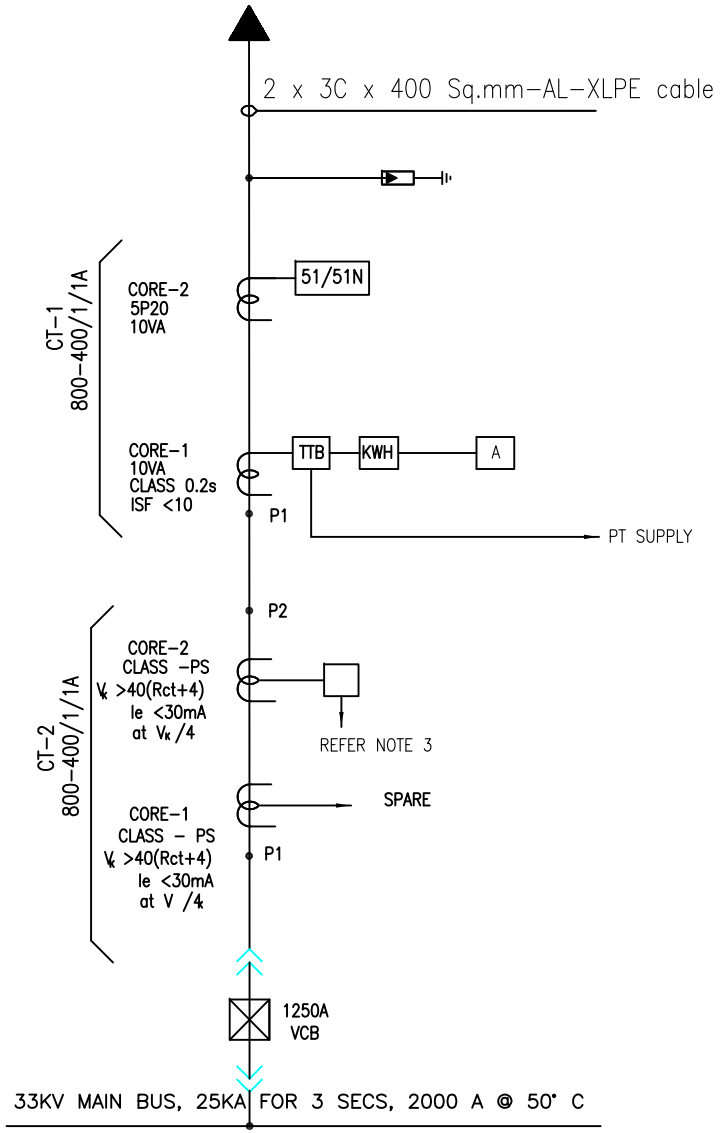
TITLE
TYPICAL SLD FOR 33KV INCOMER FROM 66/33KV AUTO TRANSFORMER

BSES Yamuna Power Limited

SPECIFICATION NO. SP-HTSWG-01-R3

SLD-SWG-33KV-05

ANNEXURE–F11



LEGEND

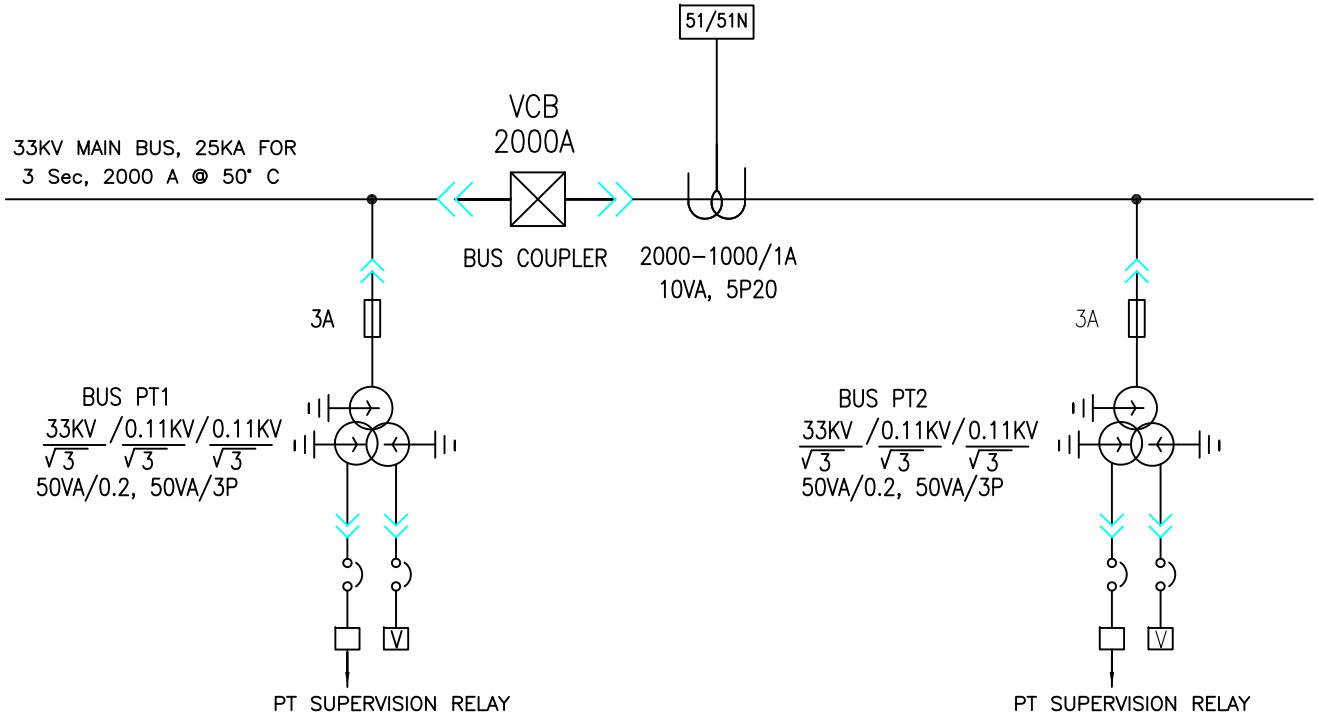
SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:
1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS
3. LINE DIFFERENTIAL OR DISTANCE RELAY. REFER CLAUSE 16.12.1 OF SPECIFICATION

DRAWN	RAJESH	TITLE TYPICAL SLD FOR 33KV OUTGOING FROM 66/33KV AUTO TRANSFORMER	BSES Yamuna Power Limited
CHECKED	G.S		SPECIFICATION NO. SP-HTSWG-01-R3
APPD.	A.A		
DATE	07.08.2018		SLD-SWG-33KV-06
SCALE	NTS		

ANNEXURE–F12



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:–

1. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

DRAWN	RAJESH	TITLE	BSES Yamuna Power Limited
CHECKED	G.S	TYPICAL SLD FOR BUS COUPLER CUM BUS PT PANEL FOR 33KV SWITCH BOARD OF 66/33KV AUTO TRANSFORMER	SPECIFICATION NO. SP-HTSWG-01-R3
APPD.	A.A		
DATE	07.08.2018		SLD-SWG-33KV-07
SCALE	NTS		

TECHNICAL SPECIFICATION

FOR

11KV AUTO SWITCHED CAPACITOR BANK

INDEX

1.0 RECORD OF REVISION 3
2.0 SCOPE OF SUPPLY 4
3.0 CODES & STANDARDS 4
4.0 SERVICE CONDITIONS 5
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6.0 SINGLE PHASE CAPACITOR UNIT 7
7.0 VACUUM CONTACTOR FOR AUTO SWITCHING 7
8.0 SERIES REACTOR 8
9.0 RVT 8
10.0 APFC 9
11.0 ISOLATOR 10
12.0 LIGHTNING ARRESTOR 10
13.0 PERFORMANCE 10
14.0 LABELS & FINISH 11
15.0 APPROVED MAKES OF COMPONENTS 12
16.0 INSPECTION & TESTING 12
17.0 TYPICAL SCHEME OF HT CAPACITOR BANK 13
18.0 MANDATORY SPARES 13
19.0 DRAWING AND DATA SUBMISSION MATRIX 13
20.0 GUARANTEED TECHNICAL PARTICULARS 15

1.0 RECORD OF REVISION

S. No	Item/ Clause No	Change/ Addition	Reason of Change/Addition
1	5.13	Peek Hole in Enclosure doors	To see the status of Capacitor bank fuse
2	5.14	Exhaust Fan with Air filter And Canopy	For heat suppression in capacitor bank compartment
3	5.21	Cutout space for Power Cable Entry	For ease of Power Cable Entry
4	6.10	Inclusion of External Fuse	For Ease of O&M
5	7.1	Addition of Shreem make vacuum contactor	Vacuum contactor of Shreem complies the specification of BSES Yamuna Power Limited
6	8.10	Class of Insulation	For more clarity on Series Reactor Data
7	9.0	Updation of RVT data	For More clarity on RVT Data
8	10.4	Communication Protocol as Modbus	For Communication with SCADA
9	10.7	Supply of APFC has been changed to 48-220 VDC to 220 VAC	No vendor provides APFC with Auxilliary voltage 48-220 VDC
10	14.6	Inclusion of Warranty period, and Customer care Number in Name Plate rating	For ease of O&M
11	15.0	Approved Make Table	For Quality Products
12	17.0	Typical SLD	Upgradation of SLD due to stepped Capacitor Bank
13	20.0	Inclusion of Drawing and Data Submission Matrix	To streamline drawing/document submission

2.0 SCOPE OF SUPPLY

a. This specification covers the design, manufacturing, testing, supply, erection & commissioning of 7.2 MVAR (One fixed step of 1.8 MVAR and three steps of 1.8 MVAR), 12.65 KV three phase outdoor Auto Switched Capacitor Bank with bus bar arrangement at site in an enclosure including but not limited to 0.2% series reactors, capacitor switch/contactor, Isolator cum earth switch, HT fuses, RVT, APFC Panel and all necessary equipment for auto switching. No Equipment should lie outside the enclosure apart from APFC panel which shall be the part of VCB panel. Necessary space will be provided for APFC panel in switchboard. Fitting and wiring of this panel shall be in vendor's scope. (Although in case of unavailability of space in switchboard, separate wall mounted panel shall be provided by the vendor). Isolator, Earth Switch etc should be incorporated in enclosure only.NDR will not be the part of vendor's scope but wiring for NDR shall be in vendor's scope.

b. This specification shall be used in conjunction with all specifications, data sheets, single line diagrams, and other drawings attached to the tender.

3.0 CODES & STANDARDS

Indian Electricity Rules	
Indian electricity act	
CBIP manual	
IS 13925 part 1,2 & 3	Shunt capacitors above rated voltage 1000v
IS 11298 part 3	Plastic films for capacitors
IS 9921-1985	Isolator
IS 5553	Series reactor
IS 2099	Bushings for voltages above 1000v
IS 12672	Internal fuses & disconnector for shunt capacitors
IS 2705	Current transformers
IS 13067	Imp regnant for power capacitors
IS5	Color of mixed paints
IS 3156	RVT
IS 15086	Surge arrestor
IS 3070 (Pt 3)	Surge arrestor
IS 2629	Recommended practice for Hot dip galvanizing of steel
IS 4759	Hot dip Zinc coating on Steel structures and other allied products
IEC 60871	Shunt capacitors for AC power Systems
IEC 61000	Automatic Power Factor Controller
IS 9920-2002	Vacuum Contactors/Capacitor Switch

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

4.0 SERVICE CONDITIONS

4.1	Max Ambient Temperature	50 deg C
4.2	Max Daily average ambient temp	40 deg C
4.3	Min Ambient Temp	0 deg C
4.4	Maximum Humidity	95%
4.5	Minimum Humidity	10%
4.6	Maximum annual rainfall	750 mm
4.7	Average no of rainy days per annum	60
4.8	Rainy months	June to Oct
4.9	Altitude above MSL	300 M
4.10	Seismic Zone	IV

5.0 GENERAL

5.1	Capacitor Scheme	3 Phase, 7.2 MVAR @ 12.65KV,Single Star with RVT protection.
5.2	Switching	Auto switched in three steps of 1.8 MVAR with one fixed step of 1.8 MVAR. Auto switching will be controlled by APFC.
5.3	Service location	Suitable for outdoor use
5.4	Connection	Single star for individual steps
5.5	HT capacitor bank assembly	a. Individual single phase capacitor units mounted on steel stand / rack & connected externally by sleeved flexible copper connectors b. Sleeves to be Red, Yellow, Blue, & Black in colour.
5.6	Interchangeability	Between various single phase capacitor units without disturbing other units
5.7	Capacitor bank enclosure	For enclosing complete capacitor bank including capacitor units, Reactors, flexible copper connectors, RVT & terminal bus bar. Enclosure's door shall be provided with limit switch having interlock with Isolator and Circuit breaker.
5.8	Enclosure size	Max 6m X 1.5m
5.9	Enclosure mounting	Panel mounted
5.10	Degree of Ingress Protection for Bank Enclosure	IP55

5.11	Enclosure side walls	CRCA metal may be used for enclosure with thickness of loaded parts-2mm and unloaded parts-1.5mm
5.12	Enclosure doors of width 1500mm	Hinged, center opening, double leaf type, two doors provided on adjacent side walls with bolting as well as padlocking and interlocking facility.
5.13	Peek hole	Peek hole shall be provided in each door to see the status of fuse of Capacitor Bank
5.14	Exhaust Fan with Air filter And Canopy	Exhaust fan shall be provided in each step for heat suppression in compartment. Exhaust fan must operate of that step when capacitor bank is in ON condition.
5.15	Enclosure top cover	CRCA sheet metal 2mm thick with stiffeners
5.16	Door Interlock	Doors shall be provided with solenoid type lock to avoid door opening (after tripping of breaker) for a minimum of 10 minutes.
5.17	Earth Connection	All wire CRCA Sheet metal side walls/, doors & top cover shall be connected to each other by metallic jumper links, two earth studs with hole size for M10 bolt to be provided on enclosure frame bottom
5.18	Bus bar for HV cable termination	One for each phase mounted on porcelain or epoxy insulators
5.19	Bus bar material	Tinned copper, sized for 150% of rated current and rated fault duty
5.20	Bus bar arrangement	Suitable for outdoor termination of HT cable size up to 2 x 3C x 300sqmm for each phase
5.21	Cutout space for Power Cable Entry	Suitable for outdoor termination of HT cable size up to 2 x 3C x 300sqmm for each phase. (Preferebly-400x400 mm^2)
5.22	External hardware for HT capacitor bank enclosure (nuts/bolts/handles)	Stainless steel
5.23	GA drawing	Manufacturer shall submit the G.A. Drawings for Capacitor Bank with mounting of series reactor inside the bank.
5.24	Power Frequency Withstand Voltage	28kVrms
5.25	Impulse Withstand Voltage	75kVp

6.0 SINGLE PHASE CAPACITOR UNIT

6.1	Single phase capacitor unit	Totally enclosed, leak proof, dust proof suitable for outdoor application, comprising individual capacitor elements connected in series & parallel groups. Continuous operating current shall be minimum 1.43 times to max. 1.65 times as per clause 6.2 of IS 13925.
6.2	Capacitor unit size	Preferred size is 200kVAR, however higher unit sizes may be considered if the space availability at site is scarce
6.3	Capacitor element	Developed from alternate layers of conducting metal foil & dielectric film
6.4	Conducting layer material	Aluminum foil
6.5	Dielectric material	Hazy Poly Propylene (APP), Double layer minimum
6.6	Cooling	Natural air
6.7	Impregnating liquid	Non PCB(Poly chlorinated Biphenyl), less toxic, with low bio-accumulation and bio-degradable liquid filled under vacuum
6.8	Capacitor unit enclosure	Fabricated from sheet metal CRCA steel of thickness 2mm minimum, hermetically sealed & hydraulically tested
6.9	Discharge device	For each single phase capacitor unit
6.10	Fuse	External HRC Fuse
6.11	Surge arrestor	Gap less metal oxide type
6.12	Rated voltage	9kV
6.13	Maximum continuous operating voltage	7.65kV
6.14	Discharge current	10 kA
6.15	Spare capacitor unit	One capacitor unit for each bank

7.0 VACUUM CONTACTOR FOR AUTO SWITCHING

7.1	Rated Voltages	12 KV
7.2	Rated Continuous Current	200% of full load current (minimum) of unit being switched
7.3	Rated Capacitor Switching Current	150% of full load current (minimum) of unit being switched
7.4	Frequency	50 Hz
7.5	Control supply	230 V Single phase AC supply
7.6	Type	Vacuum
7.7	Installation	Inside Enclosure
7.8	Mechanical Endurance	10000 operations (minimum)
7.9	Electrical Endurance	10000 electrical operations at rated capacitive switching current (minimum)
7.10	Indicator	To show number of operations

7.11	Trip lever	For emergency tripping operation
7.12	Closing lever	For capacitor bank discharging
7.13	Make	ABB/EPCOS/SHREEM

8.0 SERIES REACTOR

8.1	Series Reactor	Shall be provided fulfilling following requirement, a. Parallel switching of one bank with another two bank in service b. Suitable design calculation shall be submitted at the time of drawing approval c. Reactors shall be suitably designed to limit inrush current with proper calculation to be submitted to BYPL. d. The series reactor shall be designed to suit the final capacity of Capacitor Bank e. The manufacturer shall submit the G.A. Drawings for Capacitor Bank with mounting of series reactor inside the bank
8.2	Series reactor continuous rating	0.2% of capacitor bank rating
8.3	Series reactor rated voltage	Same as capacitor bank rated voltage
8.4	Series reactor rated frequency	50Hz
8.5	Series reactor single phase unit connections	Connected between single phase capacitor units and neutral star point
8.6	Series reactor type	Dry type with air natural cooling
8.7	Series reactor power frequency withstand voltage	28 KV
8.8	Series reactor lightening impulse withstand voltage	75 KV
8.9	Series reactor short time withstand current rating for 3 seconds	16 times capacitor rated current at 130% rated voltage
8.10	Class of Insulation	F

9.0 RVT

9.1	Type	Resin cast suitable for Panel Mounting
9.2	Application	Indoor inside the outdoor panel
9.3	Connection	Star/Star-Open delta winding(11KV/Sqrt 3:110 V/Sqrt 3: 190 V)
9.4	Winding	Three winding Star/Star –Open Delta. Secondary winding in Star shall be for Metering and

		secondary winding for open delta shall be for Residual/ Unbalance voltage Protection.
9.5	Protection	One RVT for All banks' protection. NDR (Neutral Displacement Relay) will not be in vendor's scope. Although its wiring shall be in vendor's scope.
9.6	Accuracy Class	0.5/ 3 PR
9.7	Nominal System Voltage	11 KV
9.8	Highest System Voltage	12 KV
9.9	Power frequency withstand voltage	28 kVrms(As per IS 13925 Part 1 Table 3A)
9.10	Lightning impulse withstand voltage	75 kV Peak(As per IS 13925 Part 1 Table 3A)

10.0 APFC

10.1	Installation	Indoor Type. To be fitted in VCB panel.
10.2	Power Factor Setting Range	0.7 Inductive to 0.7 Capacitive
10.3	DIs and DOs	DIs and DOs shall be as per control scheme suitable for auto switching of 3 phase, 7.2MVAR capacitor bank in three stages i.e steps of 1.8MVAR (0.6MVAR per phase). Automatic control has to be achieved by switching of vacuum contactors/switches provided in the capacitor bank to achieve the set power factor.Atleast 4 Dis and 4 Dos shall be spare for future use
10.4	Interface	Scada Compatible with RS-485 communication port and Modbus protocol. In case of any other port, suitable convertor shall be provided by the vendor) . Integration of APFC with RTU and Capacitor bank shall be in bidder's scope.
10.5	Operation	Both Automatic and Manual Mode. Shall switch ON and OFF the bank through vaccum contactor/switch as per the desired power factor value.Over riding provision shall also be made for electrical switching ON and OFF of the capacitor contactor/switch by operator from APFC panel.The switching ON operation should take place after period of 10 minutes. The switching OFF operation of relevant step shall be instantaneous.
10.6	Ingress Protection(Except for Terminals)	IP 42
10.7	Auxiliary Supply	220 VAC
10.8	Current Measuring	0 - 5A, suitable for CT x/1A and x/5A

10.9	Display	Power, Energy, Voltage, Current, Average PF, Missing Reactive Power, Supplied Reactive Power,Total no of switching of each vaccum contactor/isolator , ON and OFF indication of Vaccum contactor/switch, THD measurement with odd harmonics coefficient
10.10	Size	Maximum 150x150 mm^2
10.11	Logging	Recording of Electrical Data upto last 2 months in the form of Hourly Records, Fault Records and Daily Records
10.12	Protection	Over/Under Load, Over/Under Frequency, Load Unbalance, Over Current, Over Temperature
10.13	NDR Relay	Not Required
10.14	LED Required on APFC For ON and OFF Status of Each step	8

11.0 ISOLATOR

11.1	Installation	Outdoor
11.2	Rated Voltage	11 KV
11.3	Type	Single throw double break off, off load type , triple pole horizontal gang operated with earth switch. Mechanical interlock should be provided between isolator and Earth Switch.
11.4	Operation Type	Manual

12.0 LIGHTNING ARRESTOR

12.1	Voltage Rating	9 kV
12.2	Type	Gapless ZnO type
12.3	Discharge Class	III
12.4	Nominal Discharge Current	10 kA

13.0 PERFORMANCE

13.1	Over voltage operation	as per IS 13925 part1
13.2	Over current operation	as per IS 13925 part1
13.3	Operating temperature category	+5/C as per IS 13925 part1
13.4	Discharge characteristic as per IS 13925 part1	a. Each capacitor single phase unit residual voltage after disconnection from mains supply

		shall be 50V (maximum) within 10 minutes b. Capacitor bank residual voltage after disconnection from mains supply shall be 50V (maximum) within 10 minutes
13.5	Power loss and tangent of Loss angle (tan δ)	To be specified by manufacturer as per IS 13925 part1

14.0 LABELS & FINISH

14.1	Rating plate for HT Capacitor bank	
14.2	Material	Anodized aluminum 16SWG
14.3	Background	Satin silver
14.4	Letters, diagram & border	Black
14.5	Process	etching
14.6	Bank Name plate details	Mfg name, Mfg Sr. No., Month & year of Mfg, equipment type, total output rating, Bank Capacitance in μF, Bank watt losses, Owner name & order number, Temp. category, connection diagram, Warranty period, Customer care Number
14.7	Rating plate for each single phase capacitor unit	Anodized aluminum with white character on black background and details as per clause no 10.1 of IS 13925
14.8	Unit Name plate details	Mfg name, Mfg Sr. No., Month & year of Mfg, equipment type, total output rating, unit Capacitance in μF, unit watt losses, Temp. category, Discharge device rating, connection diagram, Owner name & order number, Guarantee period, unit wt. in kG,
14.9	Danger plate on front & rear side of wired mesh enclosure	Anodized aluminum with white letters on red background
14.10	Painting - Capacitor single phase unit	
14.11	Surface preparation	Shot blasting or chemical 7 tank process
14.12	External finish	Powder coated pure-polyester base Mat finish, shade– Siemens Gray RAL 7032, uniform thickness 50 microns minimum
14.13	Painting–frame enclosure	a. Chemical 7 tank process for surface b. Hot dipped Galvanized with uniform thickness 65 microns minimum as per IS 2629 and 4759.
14.14	SLD	SLD of Approved drawing must be engraved in inside the enclosure door

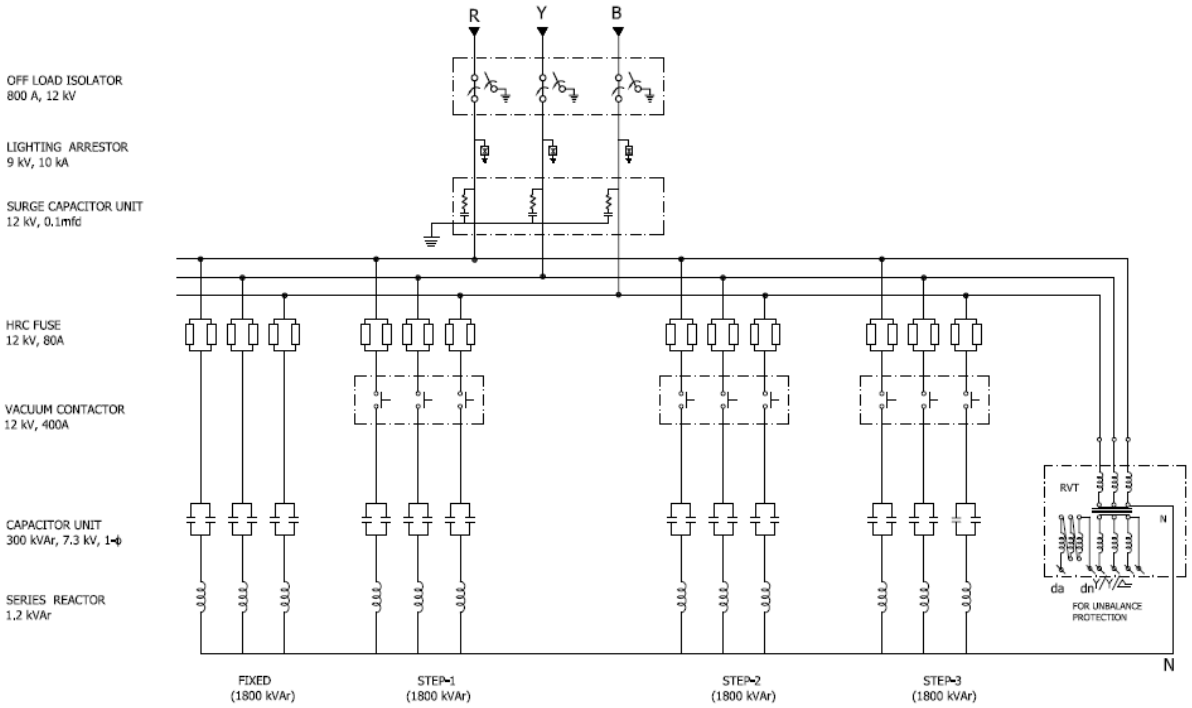
15.0 APPROVED MAKES OF COMPONENTS

15.1	APFC	Beluk/ABB/EPCOS/Shreem
15.2	Vacuum Contactor	ABB/ EPCOS/Shreem
15.3	RVT	Pragati/Kappa
15.4	Electromechanical Relays	Alstom/Schneider/Siemens/ABB/ER
15.5	Miniature Relays	ABB/Jyoti/Omran
15.6	Contactors	ABB/Siemens/Telemechanique
15.7	Instrument transformers	ECS/ Pragati/ Gemini/Schneider/CGL/Kappa/Narayan power tech
15.8	MCBs	Siemens/Schneider/Legrand/ABB
15.9	Control switches	Switron/Kaycee
15.10	Test terminal blocks	IMP/Schneider/Alstom
15.11	Terminal blocks	Elmex/Connectwell
15.12	Indicating lamps	Siemens/ Teknic/ Binay
15.13	Surge Suppressors	Oblum/Tyco
15.14	Meters	Rishabh/Conzerv

16.0 INSPECTION & TESTING

16.1	Type test	Equipment of type tested quality only, type test certificate to be submitted along with offer.
16.2	Routine test	As per relevant Indian standard
16.3	Acceptance test as per IS	To be performed in presence of Owner at manufacturer works, as per relevant Indian standard along with BOM.

17.0 TYPICAL SCHEME OF HT CAPACITOR BANK



18.0 MANDATORY SPARES

Following spares have to be provided for each capacitor bank set of 7.2 MVAR

a. Capacitor Units – 2 nos
b. Series Reactors – 2 nos
c. Vacuum Switch/ Contactor – 2 nos

19.0 DRAWING AND DATA SUBMISSION MATRIX

Drawing submission shall be as per the matrix given below. All documents/ drawing shall be provided on A3/A4 sheet in box file with separators for each section. PDF shall also be provided of all documents via USB. Language of the documents shall be English only. Deficient/ improper document/ drawing submission may liable for rejection.

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
19.1	Contact Person Name, Email ID and Mobile Number	Required			
19.2	Consolidated Deviation Sheet	Required	Required		
19.3	GTP	Required	Required		

19.4	Relevant Type Test as per IS/IEC	Required			
19.5	Power Cable and control cable Philosophy and Schedule		Required		
19.6	Manufacturer's quality assurance plan and certification for quality standards		Required		
19.7	Sizing Calculation of Associated Equipment		Required		
19.8	Recommended Spares Apart from spares stated in Spec(for five years of operation)		Required		
19.9	**11 kV Auto Switched Capacitor Bank**				
19.9.1	General Arrangement	Required	Required		
19.9.2	Sectional Layout		Required		
19.9.3	Door Layout		Required		
19.9.4	SLD	Required	Required		
19.9.5	Schematic Circuit diagram and Scheme		Required		
19.9.6	Bus Bar Arrangement		Required		
19.9.7	QAP		Required		
19.9.8	BOQ		Required		
19.9.9	Logic Operation Diagram		Required		
19.9.10	Plan		Required		
19.9.11	Interlock Diagram		Required		
19.9.12	Foundation Diagram		Required		
19.9.13	DI sheet		Required		
19.9.14	DO Sheet		Required		
19.9.15	TB Details		Required		
19.9.16	Make of all Component as per specification		Required		

19.9.17	Drawing of Outdoor yard providing Position of Capacitor Bank		Required		
19.10	Installation, erection and commissioning manual for Bank		Required		
19.11	Inspection Reports			Required	
19.12	As manufacturing Drawings			Required	
19.13	Operation and Maintenance Manual			Required	Required
19.14	Trouble shooting manual			Required	Required
19.15	As built Drawings				Required
19.16	Test Report				Required
19.17	Weekly progress report				Required

20.0 GUARANTEED TECHNICAL PARTICULARS

S. No	Description	Specification Requirement	Bidder's Data
20.1	**General**		
20.1.1	Reference Standard	IS-13925,Part 1,2012	
20.1.2	Capacitor Scheme	3 Phase, 7.2 MVAR @ 12.65KV,Single Star with RVT protection.	
20.1.3	Switching	Auto switched in three steps of 1.8 MVAR with one fixed step of 1.8 MVAR	
20.1.4	Service location	Outdoor	
20.1.5	Connection	Single star for individual steps	
20.1.6	HT capacitor bank assembly	a. Individual single phase capacitor units mounted on steel stand / rack & connected externally by sleeved flexible copper connectors	
		b. Sleeves to be Red, Yellow, Blue, & Black in colour.	
20.1.7	Capacitor bank enclosure	No component shall be outside the enclosure	
20.1.8	Enclosure size	Max 6m X 1.5m	
20.1.9	Enclosure mounting	Panel mounted	
20.1.10	Degree of Ingress Protection for Bank Enclosure	IP55	
20.1.11	Enclosure side walls	CRCA metal with thickness of loaded parts-2mm and unloaded	

		parts-1.5mm	
20.1.12	Enclosure doors	Hinged, center opening, double leaf type, two doors provided on adjacent side walls with bolting as well as padlocking and interlocking facility.	
20.1.13	Peek hole	Peek hole shall be provided in each door to see the status of fuse of Capacitor Bank	
20.1.14	Exhaust Fan with Air filter And Canopy	Exhaust fan must ON when that particular bank is in ON condition	
20.1.15	Enclosure top cover	CRCA sheet metal 2mm thick with stiffeners	
20.1.16	Door Interlock	Solenoid type lock to avoid door opening (after tripping of breaker) for a minimum of 10 minutes.	
20.1.17	Earth Connection	All wire CRCA Sheet metal side walls/, doors & top cover shall be connected to each other by metallic jumper links, two earth studs with hole size for M10 bolt to be provided on enclosure frame bottom	
20.1.18	Bus bar for HV cable termination	One for each phase mounted on porcelain or epoxy insulators	
20.1.19	Bus bar material	Tinned copper, sized for 425 A rated current and Fault Current 26.3 kA for 3 Sec	
20.1.20	Bus bar arrangement	Suitable for outdoor termination of HT cable size up to 2 x 3C x 300sqmm for each phase	
20.1.21	Cutout space for Power Cable Entry	400x400 mm^2	
20.1.22	External hardware for HT capacitor bank enclosure (nuts/bolts/handles)	Stainless steel	
20.1.23	Power Frequency Withstand Voltage	28kVrms	
20.1.24	Impulse Withstand Voltage	75kVp	
20.2	**Capacitor Unit**		
20.2.1	Make		
20.2.2	Continuous operating current	Continuous operating current shall be minimum 1.43 times to max. 1.65 times as per clause 6.2 of IS 13925.	
20.2.3	Capacitor unit size	Preferred size is 200kVAR, however higher unit sizes may be considered if the space availability at site is scarce	
20.2.4	Capacitor element	Developed from alternate layers of conducting metal foil & dielectric film	
20.2.5	Conducting layer material	Aluminum foil	

20.2.6	Dielectric material	Hazy Poly Propylene (APP), Double layer minimum	
20.2.7	Cooling	Natural air	
20.2.8	Impregnating liquid	Non PCB(Poly chlorinated Biphenyl), less toxic, with low bio-accumulation and bio-degradable liquid filled under vacuum	
20.2.9	Capacitor unit enclosure	CRCA steel of thickness 2mm minimum, hermetically sealed & hydraulically tested	
20.2.10	Discharge device	For each single phase capacitor unit	
20.2.11	Fuse	External HRC Fuse	
20.2.12	Surge arrestor	Gap less metal oxide type	
20.2.13	Rated voltage	9kV	
20.2.14	Maximum continuous operating voltage	7.65kV	
20.2.15	Discharge current	10 kA	
20.2.16	Losses	≤0.2 Watts/kVAR	
20.2.17	Power Frequency Withstand Voltage	28 kVrms(As per IS 13925 Part 1 Table 3A)	
20.2.18	Impulse Withstand Voltage	75 kV Peak(As per IS 13925 Part 1 Table 3A)	
20.2.19	Discharging Values	Less than 50 V in 10 Minutes	
20.3	**VACUUM CONTACTOR**		
20.3.1	Make	ABB/EPCOS/SHREEM	
20.3.2	Reference Standard	IEC 62271-103/IS 9920 (Part IV)	
20.3.3	Rated Voltages	12 KV	
20.3.4	Rated Continuous Current	≥164 A	
20.3.5	Rated Capacitor Switching Current	≥124 A	
20.3.6	Short Time withstand current for 1 sec		
20.3.7	Power Frequency Withstand Voltage	28 kVrms(As per IS 13925 Part 1 Table 3A)	
20.3.8	Impulse Withstand Voltage	75 kV Peak(As per IS 13925 Part 1 Table 3A)	
20.3.9	Opening Time(lower and Upper limit)	35/60 ms	
20.3.10	Closing Time(lower and Upper limit)	60/90 ms	
20.3.11	Frequency	50 Hz	
20.3.12	Control supply	230 V Single phase AC supply	
20.3.13	Type	Vacuum	
20.3.14	Installation	Inside Enclosure	
20.3.15	Mechanical Endurance	10000 operations (minimum)	
20.3.16	Electrical Endurance	10000 electrical operations at rated capacitive switching current (minimum)	

20.3.17	Indicator	To show number of operations	
20.3.18	Trip lever	For emergency tripping operation	
20.3.19	Closing lever	For capacitor bank discharging	
20.4	**Series Reactor**		
20.4.1	Make		
20.4.2	Reference Standard	IS:5553 (Part 3)	
20.4.3	Series Reactor	Submission of Suitable design Calculation	
20.4.4	Series reactor continuous rating	1.2 kVAR	
20.4.5	Series reactor rated voltage	Same as capacitor bank rated voltage	
20.4.6	Series reactor rated frequency	50Hz	
20.4.7	Series reactor single phase unit connections	Connected between single phase capacitor units and neutral star point	
20.4.8	Series reactor type	Dry type with air natural cooling	
20.4.9	Series reactor power frequency withstand voltage	28 kVrms(As per IS 13925 Part 1 Table 3A)	
20.4.10	Series reactor lightening impulse withstand voltage	75 kV Peak(As per IS 13925 Part 1 Table 3A)	
20.4.11	Rated Current	82.15A	
20.4.12	Series reactor short time withstand current rating for 3 seconds	16 times capacitor rated current at 130% rated voltage	
20.4.13	Class of Insulation	F	
20.5	**RVT**		
20.5.1	Make		
20.5.2	Reference Standard	IS 3156	
20.5.3	Application	Indoor inside the outdoor panel	
20.5.4	Type	Resin cast suitable for Panel Mounting	
20.5.5	Connection	Star/Star-Open delta winding(11KV/Sqrt 3:110 V/Sqrt 3: 190 V)	
20.5.6	Accuracy Class	0.5/ 3 PR	
20.5.7	Nominal System Voltage	11 kV	
20.5.8	Highest System Voltage	12 kV	
20.5.9	Power frequency withstand voltage	28 kVrms(As per IS 13925 Part 1 Table 3A)	
20.5.10	Lightning impulse withstand voltage	75 kV Peak(As per IS 13925 Part 1 Table 3A)	
20.5.11	Winding	Three winding Star/Star –Open Delta. Secondary winding in Star shall be for Metering and secondary winding for open delta	

		shall be for Residual/ Unbalance voltage Protection.	
20.5.12	Protection	One RVT for All banks' protection	
20.6	**APFC**		
20.6.1	Make	Beluk/ABB/EPCOS/Shreem	
20.6.2	Reference Standard		
20.6.3	Installation	Indoor Type and To be fitted on VCB Panel	
20.6.4	Power Factor Setting Range	0.7 Inductive to 0.7 Capacitive	
20.6.5	DIs and Dos	4 Dis and 4 Dos shall be spare for future use	
20.6.6	Interface	Scada Compatible with RS-485 communication port and Modbus protocol. In case of any other port, suitable convertor shall be provided by the vendor) . Integration of APFC with RTU and Capacitor bank shall be in bidder's scope.	
20.6.7	Operation	Both Automatic and Manual Mode	
20.6.8	Ingress Protection	IP 54	
20.6.9	Auxilliary Supply	48-250 VDC	
20.6.10	Current Measuring	0 - 5A, suitable for CT x/1A and x/5A	
20.6.11	Display	Power, Energy, Voltage, Current, Average PF, Missing Reactive Power, Supplied Reactive Power,Total no of switching of each vaccum contactor/isolator , ON and OFF indication of Vaccum contactor/switch, THD measurement with odd harmonics coefficient	
20.6.12	Size	Maximum 150x150 mm2	
20.6.13	Logging	Recording of Electrical Data upto last 2 months in the form of Hourly Records, Fault Records anmd Daily Records	
20.6.14	Protection	Over/Under Load, Over/Under Frequency, Load Unbalance, Over Current, Over Temperature	
20.6.15	Space Required in Switchgear Panel for APFC		
20.6.16	NDR Relay offered	No	
20.6.17	Number of LED required on APFC for Cap bank ON and OFF status of	8	

	each stage		
20.7	**ISOLATOR**		
20.7.1	Make		
20.7.2	Reference Standard		
20.7.3	Installation	Outdoor	
20.7.4	Rated Voltage	11 KV	
20.7.5	Type	Single throw double break off, off load type ,triple pole horizontal gang operated with earth switch. Mechanical Interlock should be provided between isolator and Earth Switch	
20.7.6	Operation Type	Manual	
20.8	**Lightning Arrestor**		
20.8.1	Reference Standard	IS 3070-1993(Part-3)	
20.8.2	Voltage Rating	9 kV	
20.8.3	Type	Gapless ZnO type	
20.8.4	Discharge Class	III	
20.8.5	Nominal Discharge Current	10 kA	
20.8.6	Power frequency withstand voltage	28 kVrms(As per IS 13925 Part 1 Table 3A)	
20.8.7	Lightning impulse withstand voltage	75 kV Peak(As per IS 13925 Part 1 Table 3A)	
20.9	**Labels and Finish**		
20.9.1	Rating plate for HT Capacitor bank		
20.9.2	Material	Anodized aluminum 16SWG	
20.9.3	Background	Satin silver	
20.9.4	Letters, diagram & border	Black	
20.9.5	Process	etching	
20.9.6	Bank Name plate details	Mfg name, Mfg Sr. No., Month & year of Mfg, equipment type, total output rating, Bank Capacitance in µF, Bank watt losses, Owner name & order number, Temp. category, connection diagram, Warranty period, Customer care Number	
20.9.7	Rating plate for each single phase capacitor unit	Anodized aluminum with white character on black background and details as per clause no 10.1 of IS 13925	
20.9.8	Unit Name plate details	Mfg name, Mfg Sr. No., Month & year of Mfg, equipment type, total output rating, unit Capacitance in µF, unit watt losses, Temp. category, Discharge device rating, connection	

		diagram, Owner name & order number, Guarantee period, unit wt. in kG,	
20.9.9	Danger plate on front & rear side of wired mesh enclosure	Anodized aluminum with white letters on red background	
20.9.10	Painting - Capacitor single phase unit		
20.9.11	Surface preparation	Shot blasting or chemical 7 tank process	
20.9.12	External finish	Powder coated pure-polyester base Mat finish, shade– Siemens Gray RAL 7032, uniform thickness 50 microns minimum	
20.9.13	Painting–frame enclosure	a. Chemical 7 tank process for surface	
		b. Hot dipped Galvanized with uniform thickness 65 microns minimum as per IS 2629 and 4759.	
20.9.14	SLD	SLD of Approved drawing must be engraved in inside the enclosure door	

Technical Specification
For Heat Shrinkable And Cold Shrinkable Straight Through Jointing Kit
(11 KV, 33 KV, 66 KV XLPE Insulated Cables)

Specification no – SP-HCSTJ-03-R1

Prepared by		Reviewed by		Approved by		Rev	Date
Name	Sign	Name	Sign	Name	Sign		
PG		GS		AA		R0	02/06/2017

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Record of Revision

Item/Clause No.	Change in Specification	Approved By	Rev

1.0.0 Scope of work

A. Heat Shrinkable / Cold shrinkable Straight through Joint Kits (hereinafter briefly referred to as “STJ Kits”), suitable for 11 kV, 33 & 66kV XLPE cables, shall be designed, manufactured, tested, packed and delivered by the Vendor, as per Purchaser’s requirements.

B. During post-installation period, if a joint fails at site, the vendor shall depute a technical team to site for a root-cause analysis of the failure of the joint, in the presence of BSES officials. An Analysis Report shall then be submitted for BSES’s review and approval. If this report concludes the cause of failure as due to a design/manufacturing defect in a component, then vendor shall replace all such components in the entire stock available with BSES.

2.0.0 Codes & standards

2.1.0 National Standards:

S No.	Standard Number	Title
2.1.1	IS- 13573: 2011	Joints & Terminations of Polymeric Cables for working voltages from 6.6 kV up to and including 33 kV Performance Requirements and Type Tests
2.1.2	IS- 7098: Part 2:1985	Cross-linked Polyethylene (XLPE) Insulated PVC sheathed cables: Part 2 - For working voltages from 3.3 kV up to and including 33 kV
	IS- 7098: Part 3:1993	Cross-linked polyethylene insulated thermoplastic sheathed Cables specification: Part 3 - For working voltages from 66 kV up to and including 220 KV
2.1.3	IS- 10810: 1984	Methods of test for cables

2.1.1 International Standards:

S No.	Standard Number	Title
2.2.1	EA TS - 09-13	Electricity Association - Technical Specification – 09 - 13 Material component for use in Electric Power Cable Termination & Joints for System voltage above 1kV up to 36 kV
2.2.2	IEC - 60183	Guide to the selection of high voltage cables
2.2.3	IEC - 885 Part 1 to 3	Electric test methods for electric cables
2.2.4	IEC - 60502 - 4	Power Cable Accessories for XLPE Cables above 3kV & up to 30 kV Test methods
2.2.5	IEC - 60840	Power cable with extruded insulation and their accessories for rated voltage above 30 kV (Um=36 KV) up to 150 KV (Um=170 KV) - test methods and requirements.

3.0.0 Cable Construction

Normal sizes of XLPE cables used in BSES system and the construction features of these cables are indicated below:

11kV, 3-core x 150 sq mm AL
11kV, 3-core x 300 sq mm AL
11kV, 1-core x 1000 sq mm AL
33kV, 3-core x 300 / 400 sq mm AL
66kV, 1-core x 630 sq mm AL
66KV, 1 core x 1000 sq mm AL

3.1.0	Conductor	a) Electrolytic Grade Stranded Aluminium Conductor b) Grade: H2 / H4 as per IS: 8130 / 1984 (For Al) c) Stranded, compacted and circular in shape d) Class 2 e) Longitudinal "Water-Blocking Arrangement" (or water-tight construction or water barrier protection)
3.1.1	Conductor Screen	Extruded Semi Conducting material
3.1.2	Insulation	Extruded XLPE Insulation.
3.1.3	Insulation Screen	Freely strippable Semi Conducting (without application of heat) for 66KV firmly bonded.
3.1.4	Water Swell able Tape	Semi-conducting Water Swell able Tape under the copper tape on each core.
3.1.5	Copper Tape	Copper Tape applied helically over the layer formed by application of insulation screen, water swell able tape and identification strip
3.1.6	Filler	All interstices, including center interstices filled by PP filler.
3.1.7	Over all three cores	Binder tape
3.1.8	Inner Sheath	Extruded Inner Sheath of Black PVC type ST-2.
3.1.9	Armour	a) For 3-core Cables : Galvanized Steel flat strip armour b) For 1-core Cables : Non-Magnetic, Hard drawn Aluminium wire (flat/round) c) Corrugated aluminium or lead sheathed for 66KV Cable
3.1.10	Binder Tape	Rubberized cotton tape
3.1.11	Outer Sheath	Extruded outer sheath of PVC (ST-2) for 11 KV and 33 KV and HDPE ST 7 for 66KV with termite- repellant and anti-rodent properties.

4.0.0 Straight-Through Joints (STJ)

General Technical Requirements for Straight-Through Joints (STJ) for XLPE cables are as follows:

Scope: Design, manufacture, testing and supply of Straight-Through Joint Kits for 11 KV, 33 KV & 66KV Power Cables.

Functional requirements for Heat Shrinkable / Cold Shrinkable STJ joints are given below:

4.1.0 Heat Shrinkable / Cold Shrinkable STJ joints		
4.1.1	Cable preparation	Cable preparation shall be as per installation instruction sheet. Manufacturer shall be provide Installation instruction sheet in every kit
Connector		
4.1.2	Conductor Screen	For 11kV a) Conductors to be jointed by crimping connectors b) Annular CSA (cross-sectional area) of the ferrule shall not be less than CSA of the conductor of the cable. Length of the ferrule shall be sufficient to allow adequate number of crimps, to limit temperature rise at the joint. (Vendor to furnish dimensional drawing for ferrule, indicating crimp marks.) c) For aluminium cable, the crimped ferrule shall be of aluminium d) Refer annexure F for GA drawing of crimping ferrule For 33kV and 66KV a) Shear bolt type mechanical connector b) Approved make: • Tyco Electronics (BSM-185/400-U) • Pfisterer (332617010) • Or equivalent make (Manufacturer shall take prior approval from CES) d) Maintain smooth surface over connector after cut the shear head bolt e) Vendor to furnish drawing for the mechanical connector
4.1.3	Void filling and stress relief over crimped connector and cut point of the insulation screen.	By means of High permittivity mastic tapes / Lubricant.
4.1.4	Metal screen continuity	By means of Tinned copper wire mesh, wrap individual core from cu screen with 50 % overlap and continue on other side cu screen. Bind the copper wire mesh on copper screen with copper binding wire
Armour / Earthing Continuity		

4.1.5	Armour bond	a) By means of a combination of steel (G.I.) support ring (for 3 - core Cable) or Aluminium support ring (for 1 - core Cable) and two nos. of stainless steel hose clips. b) GI Support Ring shall be 'zinc-sprayed Split Type
4.1.6	Armour continuity	By means of two nos. Of tinned copper braided conductor of 25 sq. mm. for 11 kV 35 sq. mm. for 33kV and 50 sq mm for 66KV.
Accessories		
4.1.7	Suppression of electrical discharges over XLPE insulation	Cleaning solvent /equivalent, for manual application.
4.1.8	Installation Instruction	Shall be provided in English and Hindi and shall be inside every kit.
4.1.9	Sheet paper Tap	Paper tape, required for measurements during jointing, shall be provided inside every kit.
4.1.10	Identification Tag (for traceability)	a) An aluminum pouch with paper tag & sealing arrangement at one end shall be provided. b) This tag is required to be tied over the cable at one side of the joint. c) The paper tag shall give following information 1) Vendor kit designation 2) Division 3) Breakdown ID/Shutdown ID/Scheme No. 4) Cable section 5) Type of joint 6) Size of Joint 7) Make of joint 8) Voltage class 9) Serial no. of kit 10) Vendor lot & batch no 11) Month & year of manufacturing 12) Date of installation 13) Name of jointer 14) Name of vendor supervisor 15) Name of BSES supervisor 16) Remarks
4.1.11	Printing on each Heat/cold shrinkable or Moulded component	Month and year of manufacturing, batch no. /lot no., size, make, type etc.

4.2.0 Only for Heat Shrinkable STJ joints		
4.2.1	Stress Control System	a) The earthed insulation screen of an XLPE cable is terminated at a suitable distance (minimum 75 mm) from the connector (Ferrule). b) The stress control tube is in electrical contact with insulation screen. c) Impedance of the tube shall be constant up to an operating temperature and shall be within the range 1 x 10^8 ohm-cm to 8x10^8 ohm-cm. d) The physical and electrical properties shall conform to EA TS 09-13.
4.2.1	Insulation build-up	a) Maximum three layers of insulation tubes shall be used. Total thickness of the insulation being provided in the joint shall not be less than 1.2 times the insulation of the cable being jointed. b) Outer-most tube shall be screened insulating tube (dual wall tube). This tube shall be manufactured by extrusion process. c) Physical and Electrical properties shall conform to EA TS 09-13.
4.2.2	Sealing end of tube	By means of Core end sealing sleeve with red mastic coating.\ Bidder must ensure to provide a solution to prevent water/moisture ingress in the joint.
4.2.3	Mechanical Protection	a) For 3-core cable: By means of a rollable steel mat (with required protective coating against corrosion) (Refer Annex F) b) For 1-core cable: i) Copper wire mesh ii) Adhesive coated medium wall tube iii) One more layer of copper wire mesh iv) Medium wall tube
4.2.4	Corrosion Protection	By means of semi-rigid tubes, internally coated with water blocking sealant. Thick wall Insulating tube

4.3.0 Only for Cold Shrinkable ST joints Scope: The term cold shrink applies to materials, which are capable of shrinking without raising the material above the ambient temperature of its immediate surroundings. The material of the rubber insulator used in the Cold Shrink assembly shall be silicone which is factory expanded and placed on a removable core. The removing of the core causes the cold shrink assembly to shrink. The cold shrink assembly shall maintain a compressive force on the cable continuously throughout the life of the product. This pressure will ensure a complete moisture seal.		
4.3.1	Stress Control System	By means of one piece body (splice assembly) providing stress control, insulation and screen continuity.

4.3.2	Mechanical Protection	By application of mastic coated vinyl tape and armor cast structural material. The taped armor cast layer may also be sprayed with water to hasten the curing.

4.4.0	Technical Particulars	Vendor shall submit Guaranteed Technical Particulars (GTP) as per Annexure A.
4.5.0 Testing & Inspection		
4.5.1	Type Tests	a) Straight-Through Joint shall be of type-tested quality. b) In addition to this, vendor will be required to conduct type-testing on heat/cold -shrinkable and moulded components, stress grading mastic, etc., in line with EA TS 09-13 standard, at third party test laboratory once in 6 months on randomly selected sample of each voltage rating without any commercial implication.
4.5.2	Routine & acceptance Tests	I) All the routine and acceptance tests shall be carried out as per EA TS 09-13 guidelines, refer Annexure C. II) H.V. Test shall be carried out on a randomly selected and installed Straight-Through Joint, in the presence of Purchaser's representative, at manufacturer's works. III) The joint shall withstand a test of 4Uo voltage for 4 hours.
4.5.6	Inspection	I) Purchaser reserves the right to inspect /witness all tests on the STJ Kits at Seller's works at any time, prior to dispatch, to verify compliance with the specification. II) In-process and / or final inspection call intimation shall be given in advance to purchaser.
4.5.7	Test Certificates	i) Three sets of complete Test Certificates (Routine & Acceptance tests) shall be submitted along with the delivery of STJ Kits. ii) Bought-out Items: Vendor shall submit Test Certificates, lot/batch number-wise, from their sub- suppliers / principal. TC's should clearly indicate the measured technical parameters, in accordance with sub-supplier's specification. (Also refer Annexure - C)
4.6.0	Documents	"Documents" refer to Documents, Data, Manuals, etc. (Scanned copy of signed documents also shall be part of entire soft file (e-file).

4.7.0	Along with the Bid	Vendor shall submit signed 3 sets (plus 1 set of soft copy) of following documents a) GTP (duly filled-in) (as per Annexure — A) b) Cross-sectional drawings for components Assembly. c) Type Test Certificates d) Complete Catalogue and Installation Instructions. e) Any other document.
4.8.0	After Award Contract	Vendor shall submit signed 2 sets (plus 1 set of soft copy) of above-mentioned documents within 15 days, for Purchaser's approval.
4.8.0	"As-Built" documents	Final signed "As-built" documents for the equipment in 3 sets (hard copy), 1 no. soft copy and 1 no. CD. These documents shall include signed Routine & Acceptance Test Certificates also.
4.9.0	Packing, Marking, Shipping, Handling and Storage	a). Every component / kit / box shall be properly sealed/ packed for protection against damage. Stress grading mastic shall be packed in air-tight / air-sealed packing. b). Every kit box shall be wrapped in polythene covers. c. Separate packing (sub-kits) shall be provided, for components (given below) used in crotch area and connector area. These sub-kits, labeled as "CROTCH KIT" and "CONNECTOR KIT', shall be placed inside every kit box. i) Crotch Kit Components --Conductive cable break-out -- Yellow moulded wedge -- Break-out end sealing tube -- Break-out finger sealing tube -- Stress grading mastic ii) Connector Kit : Components -- Ferrule (connector) -- Void Filling mastic (yellow)

4.9.1	Identification Label	Markings / Labels shall be on both sides of every packed box. 1) Identification number/type designation (as per manufacturer's standard) 2) Voltage grade, size, description of the Kit (including the voltage grade, size, type of the cables, for which it is to be used) 3) Batch no., lot no., etc. 4) Quantity 5) a) Purchase Order no. & date b) Purchaser's name BSES Yamuna Power Ltd c) BSES's SAP code number 6) Weights (kg) of each Cable Termination Kit and of each box containing kits. 7) Manufacturer's name 8) Month & Year of Manufacturing 9) Date of packing, shelf life (if applicable)
4.9.2	Transit damage	The seller shall be responsible for any transit damage due to improper packing.

5.0.0 Quality Assurance Plan (QAP)

5.1.0	Vendor's Quality Assurance Plan (QAP)	To be submitted for Purchaser's approval.
5.2.0	Sampling Method	Sampling Method for quality checks shall be as per manufacturer's standard practice / ESI guidelines and Purchaser's prior approval shall be taken for the same.
5.3.0	Inspection Hold-Points	To be mutually identified, agreed and approved in Quality Plan.

6.0.0 Deviations

6.1.0	Deviations	a) Deviations from this specification can be acceptable, only where the Seller has listed in his quotation the requirements he cannot, or does not, wish to comply with and which deviations the Buyer has agreed to in writing, before any order is placed. b) In the absence of any list of deviations from the Seller, it will be assumed by the Buyer that the Seller complies with the Specification fully.

7.0.0 Delivery

7.1.0	Delivery	Dispatch of Material: Vendor shall dispatch the material, only after the Routine Tests /Final Acceptance Tests (FAT) of the material witnessed/waived by the Purchaser, and after receiving written Material Dispatch Clearance Certificate (MDCC) from the Purchaser.

Annexure - A: Guaranteed Technical Particulars (GTP)

The Vendor is deemed to have examined all parts of the Specification documents and to have been fully informed, as to the nature of work and the conditions related to its performance.

S No.	Description	Purchase requirement	Vendor's data
1	Manufacturer's name		
2	Purchase Order no. & date		
3	Guarantee Period (minimum)	60 Months (from date of commissioning) / 66 Months (from date of receipt at Purchaser's store),whichever is earlier	
4	Applicable IS / IEC Standard followed by Vendor (incl. type test standard)		
5	Voltage Grade (kV)		
5.1	Lightning Impulse Voltage Withstand Test		
5.2	4Uo AC voltage withstand test for 4 hours	Test report submitted	
6	Continuous operating temperature	90 deg. C	
7	Functional Requirements		
7.1	Method of Stress Control and Discharge Suppression		
7.2	Method of Insulation build-up and screening		
7.3	Method of earth bond a) Size and no. of braids b) Size of armour support c) No. of hose clips		
7.4	Method of mechanical protection a) for 3-core Cable b) for 1-core Cable		
7.5	Method of protection against corrosion (type & coating thickness of protective layer on steel mat)		
7.6	Method of conductor continuity a) For crimping connector b) For mechanical connector		

8	Description of items in the Kit, which are imported /sourced From Principal /Sub-suppliers		
9	Names of items in the Kit and their respective shelf life (months l years)		
10	Kit Content Table (KCT) enclosed? (Refer Annexure — B)	Yes / No	
11	Drawing for connector (ferrule) enclosed	Yes / No (If yes, mention the document reference)	
12	Is Annexure - D (Technical Deviation Sheet) duly filled-in?		
13	Packing (Qty) i) Packing of every Kit h) Group Packing	1 no -- No. of Kits per Box -- No. of Boxes	
14	Installation Procedure enclosed?	Yes / No (If yes, mention the document reference)	
15	Quality Assurance Programme (QAP for raw materials, in-process inspection, factory testing) is enclosed?	Yes / No	
16	Whether all heat-shrinkable and moulded components of the kit meet the requirements of and have been tested in accordance with EA TS -09-1 3.(for heat-shrinkable joints)	Yes / No (If yes, details of test report no. /Date /name of test laboratory to be mentioned.)	
17	Type Test Reports (TTR) (Relevant test report no. & date, With type, size, other details of each type of Kit.) a) Prepared Joint: CPRI TTR as per BIS / IEC enclosed? b) Loose Components: CPRI TTR as per EA TS 09-13 enclosed?	Yes/No Yes/No	
18	Printing details on each of the Heat- shrinkable and Moulded components	(Mention the text, presently printed on each of the component)	

Annexure - B: Kit Content Table (KCT)

Vendor shall submit KCT as a consolidated table, consisting of all data, such as:

A. Heading

1. Voltage grade, size, description of the Kit
(Including the voltage grade, size, type of the cables, for which it is to be used)
2. Type designation (as per manufacturer's standard)

B. Details / Parameters (For each component/item of the KCT)

1. Lot no. /Batch no., etc.
2. Item number (manufacturer's standard)
3. Description
   a) Material, type, make and grade
   b) Dimensions cross sectional area
   c) Colour,
   d) Other description, if any
4. Function of the item
5. Quantity
6. Make/Name/Location of manufacturer/sub-vendor
   a) Minimum supplied (or in expanded form) diameter
   b) Maximum freely recovered diameter
7. a) Minimum supplied (or in expanded form) thickness
   b) Maximum freely recovered thickness

C. Notes on the KCT

Markings, printings and other details for individual/group of components is to be mentioned on KCT. For example:
a) Printing of item code, size, batch no., etc.
b) Printing on components
c) Other embossing or engraving, it any.

(Note: Vendor may attach an Annexure, for any additional information, if required.)

Annexure - C: Routine and Acceptance Test

A. Visual Examination

Condition of selected items / components, as per sampling method, shall be recorded. Some of the normal check-points can be as follows:

1. Every component shall be verified in quantity and description as per KCT.
2. All items shall be free from any defects, pin holes, cracks, etc.
3. Metallic components to be free from sharp edges.

B. Measurements of Dimensions

(Required / observed dimension — length, diameter, etc.)

1. Supplied dimensions
2. Recovered dimensions

C. Destructive Testing

On various heat-shrinkable / moulded components of ready Kits (items 3 and 4 are applicable only for heat-shrinkable components)

1. Tensile Strength
2. Wall Thickness Ratio
3. Heat Shock
4. Longitudinal Change, after full recovery
5. Ultimate Elongation
6. Low Temperature Flexibility
7. Dielectric Strength
8. Volume Resistivity

Routine Test Reports (RTR) (Typical)

Each RTR shall clearly indicate P.O. no. & date and also BSES's SAP code no. RTR shall record the serial numbers of the kits selected, as per vendor's sampling method. Following details, besides vendor's/manufacturers standard check-points, shall appear in every RTR.

Annexure - D: Deviation Sheet

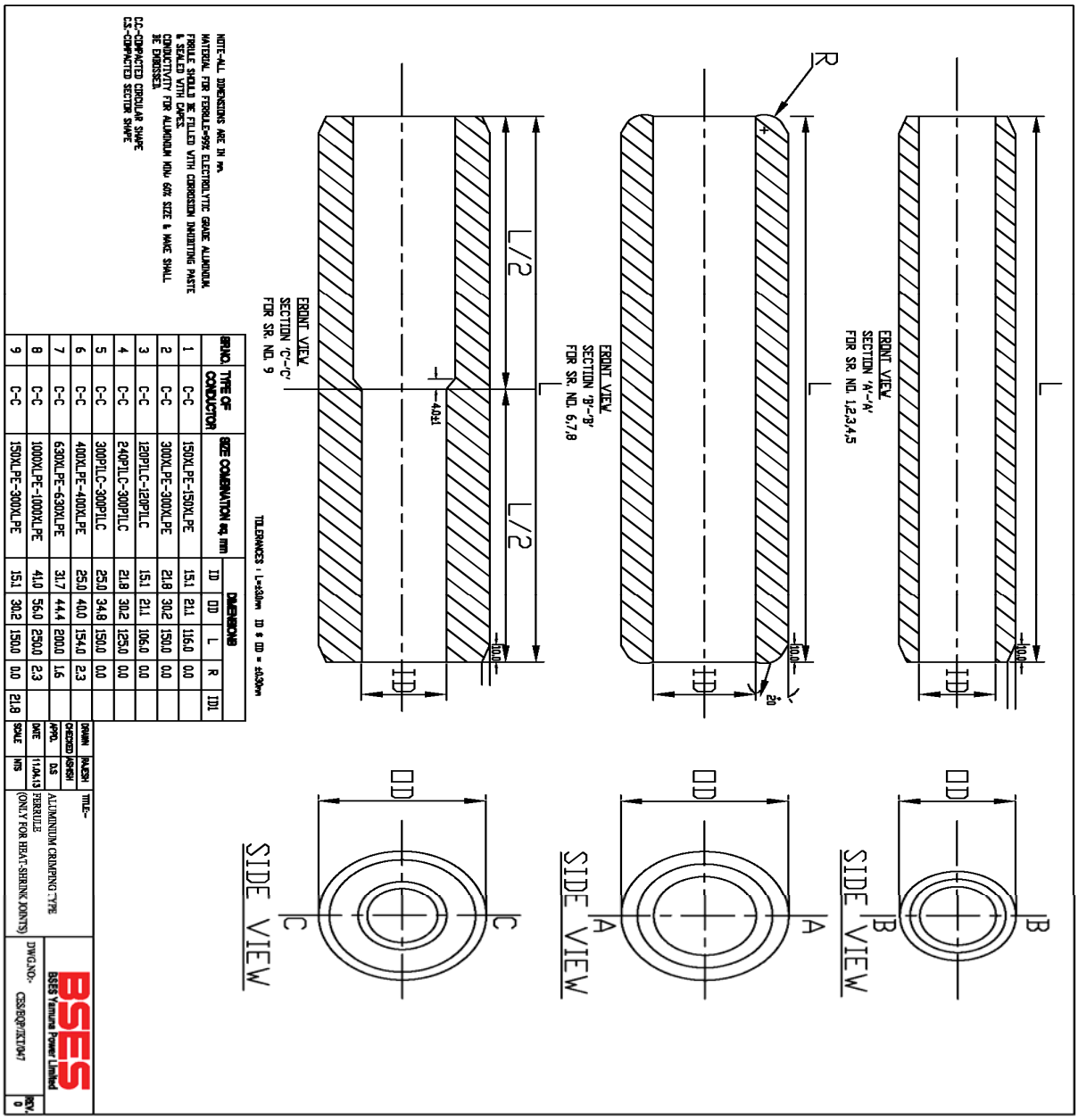
Sr No.	Clause No.	Deviation

Annexure - E: Service Conditions

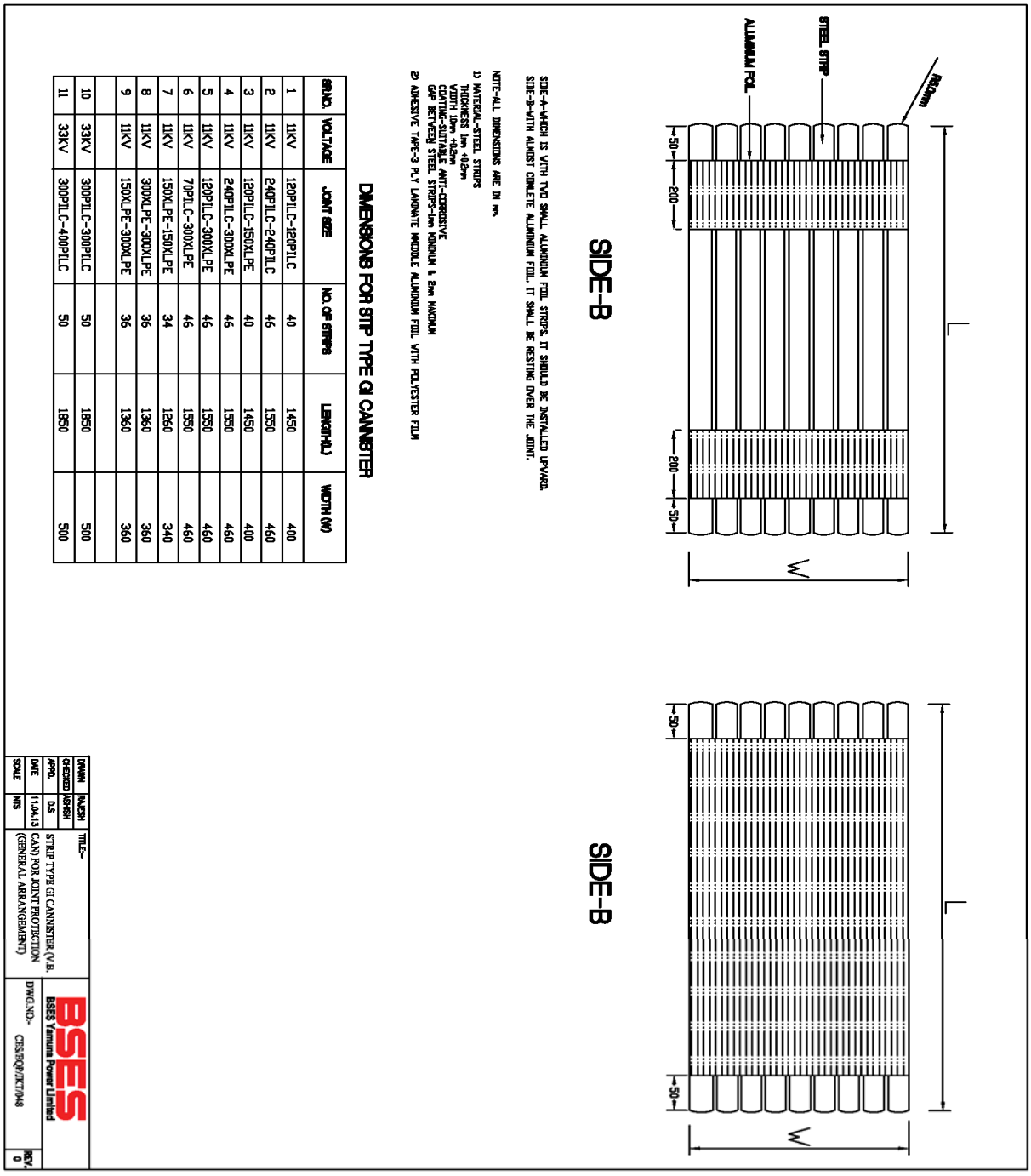
(Atmospheric conditions in Delhi)

a)	Average grade Soil Condition	
b)	Maximum altitude above sea level	1000 M
c)	Ambient Air temperature	Highest 50 Deg C, Average 40 Deg C
d)	Minimum ambient air temperature	0 Deg C
e)	Relative Humidity	100 % Max
f)	Thermal Resistivity of Soil	150 Deg C cm/W
g)	Seismic Zone	4
h)	Rainfall	750 mm concentrated in four months

Annexure - E: Aluminium crimping-type Ferrule for compacted circular conductor only for Heat Shrink joints



Annexure – F: Strip type GI canister (V.B. Can) for joint protection only for Heat Shrink Joint



SIDE-A-WHICH IS WITH TWO SMALL ALUMINIUM FOIL STRIPS. IT SHOULD BE INSTALLED UPWARD.
SIDE-B-WITH ALMOST COMPLETE ALUMINIUM FOIL. IT SHALL BE RESTING OVER THE JOINT.

NOTE-ALL DIMENSIONS ARE IN mm.

1) MATERIAL-STEEL STRIPS
THICKNESS 1mm ±0.2mm
WIDTH 10mm ±0.2mm
COATING-SUITABLE ANTI-CORROSIVE
GAP BETWEEN STEEL STRIPS-1mm MINIMUM & 2mm MAXIMUM

2) ADHESIVE TAPE-3 PLY LAMINATE WHOOLE ALUMINIUM FOIL WITH POLYESTER FILM

DIMENSIONS FOR STIP TYPE GI CANNISTER

SR.NO.	VOLTAGE	JOINT SIZE	NO. OF STRIPS	LENGTH(L)	WIDTH (W)
1	11KV	120PILC-120PILC	40	1450	400
2	11KV	240PILC-240PILC	46	1550	460
3	11KV	120PILC-150XLPE	40	1450	400
4	11KV	240PILC-300XLPE	46	1550	460
5	11KV	120PILC-300XLPE	46	1550	460
6	11KV	70PILC-300XLPE	46	1550	460
7	11KV	150XLPE-150XLPE	34	1260	340
8	11KV	300XLPE-300XLPE	36	1360	360
9	11KV	150XLPE-300XLPE	36	1360	360
10	33KV	300PILC-300PILC	50	1850	500
11	33KV	300PILC-400PILC	50	1850	500

DRAWN	RAJESH	TITLE:-	BSES Yamuna Power Limited
CHECKED	ASHISH	STRIP TYPE GI CANNISTER (V.B. CAN) FOR JOINT PROTECTION (GENERAL ARRANGEMENT)	
APPD.	DJS		
DATE	11.04.13	DWG.NO:- CES/RQP/JKT/044	REV. 0
SCALE	NTS		

Technical Specification
For Heat Shrinkable and GIS Cable Termination Kit (For 11 KV, 33 KV & 66 KV Cables)

Specification no – SP-HSGTK-04-R1

Prepared by		Reviewed by		Approved by		Rev	Date
Name	Sign	Name	Sign	Name	Sign		
AV		GS		AA		R0	02/06/2017

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Record of Revision

Item/Clause No.	Change in Specification	Approved By	Rev

1.0.0 Scope of work

Heat Shrinkable & GIS Termination Kits, suitable for 11 kV & 33 kV, 66KV XLPE / PILC cables, shall be designed, manufactured, tested, packed and delivered by the Vendor, as per Purchaser's requirements.

2.0.0 Codes & standards

2.1.0 National Standards:

SL	Standard Number	Title
2.1.1	IS - 13573: 2011	Joints & Terminations of Polymeric Cables for working voltages from 6.6 kV up to and including 33 kV Performance Requirements and Type Tests
2.1.2	IS – 7098 Part 2 : 1985	Cross-linked Polyethylene (XLPE) Insulated PVC sheathed cables : Part 2 : For working voltages from 3.3 kV upto and including 33 kV
2.1.3	IS - 692: 1994	Paper insulated lead-sheathed cables (PILC) for rated voltages up to and including 33 kV specification
2.1.3	IS - 10810: 1984	Methods of test for cables

2.1.1 International Standards:

S No.	Standard Number	Title
2.2.1	EA TS - 09 - 13	Electricity Association - Technical Specification -09-13 Material component for use in Electric Power Cable Termination & Joints for System voltage above 1000 V up to 36 kV
2.2.2	IEEE - 48	Standards Test Procedures and requirements for high voltage alternating current cable termination
2.2.3	IEC - 60183	Guide to the selection of high voltage cables
2.2.4	IEC - 885 Part 1-3	Electric test methods for electric cables
2.2.5	IEC - 60840	Power cable with extruded insulation and their accessories for rated voltage above 30 kV (Um=36 KV) up to 150 KV (Um=170 KV) - test methods and requirements.

3.0.0 Cable Construction

Normal sizes of XLPE cables used in BSES system and the construction features of these cables are indicated below:

XLPE type Cables: 3-core x 150, 300 & 400 sq. mm. Al
1-core x 630 or 1000 sq. mm. Al

PILC type Cables: 3-core 240 or 300 sq. mm. Al

3.1.0	Conductor	For XLPE : a) Electrolytic Grade stranded Aluminium b) Grade: H2/ H4 as per IS: 8130/84 (For Al) c) Shape: Compacted Circular d) Class 2 For PILC : a) 11 kV : sector-shaped b) 33kV: oval-shaped
3.2.0	Conductor Screen	For XLPE : Extruded Semi Conducting material For PILC : 11 kV : no conductor screen 33 kV : carbon paper
3.3.0	Insulation	For XLPE: Extruded XLPE Insulation For PILC: Layers of impregnated papers
3.4.0	Insulation Screen	For XLPE : a) Freely strippable Semi Conducting (without application of heat) for 66KV firmly bonded b) Copper Tape For PILC : a) 11 kV : absent (Belted) b) 33kV: metallised paper tape
3.5.0	Water Swellable Tape	For XLPE: Semi-conducting Water Swellable Tape shall be provided under the copper tape on each core. For PILC : not applicable
3.6.0	Filler	For XLPE: All interstices, including centre interstices filled by PP filler. For PILC : a) 11 kV : Crushed paper filler b) 33kV: Jute twine
3.7.0	Over all three cores	XLPE : Binder tape PILCA : 11 kV : belt paper 33kV: Copper Woven Fabric tape
3.8.0	Inner Sheath	For XLPE: Extruded Inner Sheath of Black PVC type ST-2. For PILC : Lead alloy sheath
3.9.0	Bedding Tape	For XLPE: not applicable For PILC: two layers of paper, followed by compounded (bituminized) cotton tape.
3.10.0	Copper Woven Fabric Tape (CWF tape)	For XLPE : not applicable For PILC : a) 11 kV : absent (Belted cable) b) 33 kV : applicable for screened cable

3.11.0	Armour	For XLPE : a) Galvanised steel flat strip armour (For 3 core cables) b) Hard drawn Aluminium Wire (For 1 core cables) c) Aluminium or lead sheathed for 66KV cable For PILC : a) 11 kV double steel tape armour
3.12.0	Binder Tape	For XLPE: Rubberised cotton tape
3.13.0	Outer Sheath	For XLPE: Extruded outer sheath of PVC (ST-2) for 11 KV/ 33 KV and HDPE for 66KV Cable with termite- repellent. For PILC : compounded (bituminised) Jute/PVC

4.0.0 Cable Termination Kits

General Technical Requirements for Cable Termination Kits are as follows:

<table>
<tr><td>4.1.0</td><td>Scope</td><td>Design, manufacture, testing and supply of Cable Termination Kits for H. T. Power Cables.</td></tr>
<tr><td>4.2.0</td><td>Functional Requirements</td><td></td></tr>
<tr><td>4.2.1.</td><td>Conductor Connection</td><td>
<table>
<tr><th>Voltage Grade</th><th>Cable Size</th><th>Application</th><th>Material of Lug</th><th>Connection Method</th></tr>
<tr><td rowspan="4">11 KV</td><td rowspan="2">3Cx 150 & 3Cx 300 sq mm</td><td>Indoor</td><td>Bi-Metal</td><td>Mechanical connector</td></tr>
<tr><td>Outdoor</td><td>Aluminium</td><td>Mechanical connector</td></tr>
<tr><td rowspan="2">1Cx1000 sq mm</td><td>Indoor</td><td>Aluminium</td><td>Crimping</td></tr>
<tr><td>Outdoor</td><td>Aluminium</td><td>Crimping</td></tr>
<tr><td rowspan="2">33 KV</td><td rowspan="2">3Cx400 sq mm</td><td>Indoor</td><td>Bi-Metal</td><td>Mechanical connector</td></tr>
<tr><td>Outdoor</td><td>Aluminium</td><td>Mechanical connector</td></tr>
<tr><td rowspan="2">66 KV</td><td rowspan="2">1Cx630 & 1Cx1000 sq mm</td><td>Indoor</td><td>Aluminium</td><td>Crimping</td></tr>
<tr><td>Outdoor</td><td>Aluminium</td><td>Crimping</td></tr>
</table>
a) For 240 sq. mm. PILC cable and 300 sq. mm. XLPE cable, the lug suitable for 300 sq. mm. XLPE cable shall be used.
b) For GIS cable termination kits: Conductor connection assembly shall be done by standard method of split, silver-plated copper cone and pressure-fit contact assembly or as per manufacturer's standard.
</td></tr>
</table>

4.2.2	Stress Control System	a) The earthed insulation screen of an XLPE cable is terminated at a suitable distance from the conductor. b) The tube is in electrical contact with insulation screen. c) Impedance of the tube shall be constant upto an operating temperature and shall be within the range $1x10^{08}$ ohm-cm to $8x10^{08}$ ohm-cm. d) Minimum length of stress control tube for 11 kV and 33 kV shall be 130 mm and 260 mm respectively. e) The physical and electrical properties shall conform to ESI 09: 13. f) For GIS cable termination kits Stress control shall be done by means of a polymeric stress cone. External profile of the cone shall match inner profile of GIS epoxy bushing. Vendor shall specify the material (EPDM / Silicone) of the cone.
4.2.3	Insulation Protection	a) XLPE insulation shall be protected by means of an outer tube, resistant to tracking and weathering. b) One end of the tube shall be coated internally with red sealant mastic for a length of 50 mm. c) Physical and Electrical properties shall conform to ESI 09: 13.
4.2.3.1	Outer Anti-tracking Tube	Outer length of the tube shall be controlled by providing creepage Extension Shed having the same material composition as the tube. These lengths are given in the table below:

Cable System		Minimum Length of tube (mm)		Creepage Extension Shed (No.) (min)	
Voltage	Cores	Indoor	Outdoor	Indoor	Outdoor
11 kV	3 - core	650	650	Nil	2
	1 - core	340	340	Nil	2
33 kV	3 - core	800	1200	2	5
	1 - core	600	600	2	5

4.2.3.3	Oil Barrier Tube (applicable for PILC cable termination)	a) Transparent tube is used for restoring the insulation provided by belt paper, which is terminated at the crotch. b) 33 kV PILC Termination: The oil barrier tube provides an oil-resistant layer to contain impregnating compound within, thus preventing anti-tracking tube coming in contact with the impregnating compound.

4.2.4	Environmental Sealing System	a) Red Sealant Mastic Tape: This tape, used for sealing at ends, shall be synthetic rubber-based and resistant to tracking and weathering. Sufficient quantity of this tape shall be provided. b) Lug-sealing Sleeve: It shall have the same material composition as outer anti-tracking tube. The sleeve shall be fully coated internally with red sealant mastic tape. Length of the sleeve shall be so as to cover half length of the lug barrel and an equal length of track-resistant tube. c) Conductive Break-out: It shall be provided over the crotch for 3-core cables. The break-out base shall overlap PVC outer sheath by a 50 mm. minimum. d) For GIS termination kits : Environmental sealing of cores below the switchgear shall be by means of a trifurcation kit, consisting of heat shrinkable conductive break-out and heat-shrinkable conductive tube of total length of 6 metres supplied in one roll.
4.2.5	Earth Bond System	a) Earth Bond Assembly shall comprise of copper braided conductors as earthing conductors, GI armour support ring (split type) and two stainless steel hose clips. b) For GIS termination kit The earthing arrangement for 3-core cables shall be the same as stated under 'a' above. c) Two nos. copper braided conductors shall be of size: 25 sq. mm. for 11 kV cables, 35 sq. mm. for 33 kV cables and 50 sq mm for 66KV. d) Length of the copper braided conductor shall be 750 mm. e) Each copper braided conductor shall be supplied with copper lug, crimped at one end. Size of lug : 70 sq. mm. for 11 kV and 120 sq. mm. for 33 kV.
4.2.6	Suppression of electrical discharges	Following materials are required for use during cable termination : a) Silicone-based compound Required for filling-in minute services/ surface cracks over XLPE insulation. b) Polymeric mastic Required for application over semiconducting screen, for, eliminating any air-entrapment at any cut point on the surface. It should have sufficient elongation and electrical properties compatible with stress control tube.
4.2.7	Installation. Instruction Sheet	It shall be in English and Hindi language and shall be provided inside every kit.
4.2.8	Identification Tag (for traceability)	a) An aluminum pouch with paper tag & sealing arrangement at one end shall be provided. b) This tag is required to be tied over the cable at one side of the joint. c) The paper tag shall give following information 1) Vendor kit designation 2) Division 3) Breakdown ID/Shutdown ID/Scheme No. 4) Cable section 5) Type of joint 6) Size of Joint 7) Make of joint

		8) Voltage class 9) Serial no. of kit 10) Vendor lot & batch no 11) Month & year of manufacturing 12) Date of installation 13) Name of jointer 14) Name of vendor supervisor 15) Name of BSES supervisor 16) Remarks
4.2.9	Paper Measuring Tap	Required for use during cable preparation / terminations.
4.3.0	Technical Particulars	Vendor shall submit Guaranteed Technical Particulars (GTP) as per Annexure A.
4.4.0	Type Tests	Termination Kit shall be of type-tested quality.
4.5.0	Testing & Inspection	
	a) Tests	All the routine and acceptance tests shall be carried out as per ESI guidelines. (Also refer Annexure -C)
	b) Inspection	1) Buyer reserves the right to witness all tests specified on individual H. S. components, Moulded components or completed Cable Termination Kit. 2)Buyer reserves the right to inspect Cable Termination Kit at the Seller's works at any time, prior to dispatch, to verify compliance with the specification. 3) In-process and final inspection call intimation shall be given in advance to purchaser.
	c) Test Certificates	Three sets of complete Test Certificates (Routine & Acceptance tests) shall be submitted along with the delivery of Cable Termination Kits.
	d) Type Test	a) End termination kit shall be of type-tested quality. b) In addition to this, vendor will be required to conduct type-testing on heat shrinkable and moulded components, stress grading mastic, etc., in line with EA TS 09-13 standard, at third party test laboratory once in every six months on randomly selected sample of each voltage rating without any commercial implication.
4.6.0	Documents	"Documents" refer to Documents, Data, Manuals, etc. (Scanned copy of signed documents also shall be part of entire soft file (e-file) or CD.)
4.6.1	Along with the Bid	Vendor shall submit signed 3 sets (plus 1 set of soft copy) of following documents: a) GTP (duly filled-in) (as per Annexure - A). b) Cross-sectional drawings for components Assembly c) Type Test Certificates d) Complete Catalogue and Instructions. e) Any other document.
4.6.2	After Award of Contract	Vendor shall submit signed 2 sets (plus 1 set of soft copy) of above mentioned documents within 15 days, for Purchaser's approval.

4.6.3	"As-Built" documents	Final signed "As-built" documents for the equipment in 3 sets (hard copy), 1 no. soft copy. These documents shall include signed Routine & Acceptance Test Certificates also.
4.7.0	Packing, Marking, Shipping, Handling and Storage	Every component/kit/box shall be properly sealed/ packed for protection against damage.
a)	Identification Label	Markings / Labels shall be on both sides of every packed box. 1) Identification number/type designation (as per manufacturer's standard) 2) Voltage grade, size, description of the Kit (including the voltage grade, size, type of the cables, for which it is to be used) 3) Batch no., lot no., etc. 4) Quantity 5) a) Purchase Order no. & date b) Purchaser's name BSES Yamuna Power Ltd c) BSES's SAP code number 6) Weights (kg) of each Cable Termination Kit and of each box containing kits. 7) Manufacturer's name 8) Month & Year of Manufacturing 9) Date of packing, shelf life (if applicable)
b)	Transit damage	The seller shall be responsible for any transit damage due to improper packing.

5.0.0 Quality Assurance (QA)

5.1.0	Vendor's Quality Plan (QP)	To be submitted for Purchaser's approval.
5.2.0	Sampling Method	Sampling Method for quality checks shall be as per manufacturer's standard practice / ESI guidelines and Purchaser's prior approval shall be taken for the same.
5.3.0	Inspection Hold-Points	To be mutually identified, agreed and approved in Quality Plan.

6.0.0 Deviations

6.1.0.	Deviations	A) Deviations from this specification can· be acceptable, only where the Seller has listed in his quotation the requirements he cannot, or does not, wish to comply with and which deviations the Buyer has agreed to in writing, before any order is placed. B) In the absence of any list of deviations from the Seller, it will be assumed by the Buyer that the Seller complies with the Specification fully.

7.0.0 Delivery

7.1.0.	Delivery	Despatch of Material: Vendor shall despatch the material, only after the Routine Tests/Final Acceptance Tests (FAT) of the material witnessed/waived by the Purchaser, and after receiving written Material Despatch Clearance (MDC) from the Purchaser.

Annexure – A: Guaranteed Technical Particulars (GTP)

The Seller is deemed to have examined all parts of the Specification documents and to have been fully informed, as to the nature of work and the conditions related to its performance.

S No.	Description	Purchase requirement	Vendor's data
1	Manufacturer's name		
2	Purchase Order no. & date		
3	Guarantee Period (minimum)	60 Months (from date of commissioning) / 66 Months (from date of receipt at Purchaser's store), whichever is earlier	
4	Applicable IS / IEC Standard followed by Vendor (incl. type test standard)		
5	Voltage Grade (kV)		
5.1	Lightning Impulse Voltage Withstand Test		
5.2	4Uo AC voltage withstand test for 4 hours	Test report submitted	
6	Continuous operating temperature	90 deg. C	
7	Functional Requirements		
7.1	Method of Stress Control and Discharge Suppression		
7.2	Method of Insulation build-up and screening		
7.3	Method of earth bond a) Size and no. of braids b) Size of armour support c) No. of hose clips		
7.4	Method of mechanical protection a) for 3-core Cable b) for 1-core Cable		
7.5	Method of protection against corrosion (type & coating thickness of protective layer on		

	steel mat)		
7.6	Method of conductor continuity a) For crimping connector b) For mechanical connector		
8	Description of items in the Kit, which are imported /sourced From Principal /Sub-suppliers		
9	Names of items in the Kit and their respective shelf life (months l years)		
10	Kit Content Table (KCT) enclosed? (Refer Annexure — B)	Yes / No	
11	Drawing for connector (ferrule) enclosed	Yes / No (If yes, mention the document reference)	
12	Is Annexure - D (Technical Deviation Sheet) duly filled-in?		
13	Packing (Qty) i) Packing of every Kit h) Group Packing	1 no -- No. of Kits per Box -- No. of Boxes	
14	Installation Procedure enclosed?	Yes / No (If yes, mention the document reference)	
15	Quality Assurance Plan (QAP for raw materials, in-process inspection, factory testing) is enclosed?	Yes / No	
16	Whether all heat-shrinkable and moulded components of the kit meet the requirements of and have been tested in accordance with EA TS -09-1 3.(for heat-shrinkable joints)	Yes / No (If yes, details of test report no. /Date /name of test laboratory to be mentioned.)	

17	Type Test Reports (TTR) (Relevant test report no. & date, With type, size, other details of each type of Kit.) a) Prepared Joint: CPRI TTR as per BIS / IEC enclosed? b) Loose Components: CPRI TTR as per EA TS 09-13 enclosed?	 Yes/No Yes/No	
18	Printing details on each of the Heat- shrinkable and Moulded components	(Mention the text, presently printed on each of the component)	

Annexure – B: Kit Content Table (KCT)

Vendor shall submit KCT as a consolidated table, consisting of all data, such as:

A. Heading

1. Voltage grade, size, description of the Kit
(Including the voltage grade, size, type of the cables, for which it is to be used)

2. Type designation (as per manufacturer's standard)

B. Details / Parameters

(For each component/item of the KCT)
1. Lot no. /Batch no., etc.
2. Item number (manufacturer's standard)
3. Description
a) Material, type, make and grade
b) Dimensions cross sectional area
c) Colour,
d) Other description, if any
4. Function of the item
5. Quantity
6. Make/Name/Location of manufacturer/sub-vendor
7. a) Minimum supplied (or in expanded form) diameter
   b) Maximum freely recovered diameter
8. a) Minimum supplied (or in expanded form) thickness
   b) Maximum freely recovered thickness

C. Notes on the KCT

Markings, printings, other details for individual/group of components are to be mentioned on KCT. For example:
a) Printing of item code, size, batch no., etc.
b) Printing on components
c) Other embossing or engraving, it any.

(Note: Vendor may attach an Annexure, for any additional information, if required.)

Annexure – C: Routine and Acceptance Test

A. Visual Examination
Condition of selected items / components, as per sampling method, shall be recorded. Some of the normal check-points can be as follows:
1. Every component shall be verified in quantity and description as per KCT.
2. All items shall be free from any defects, pin holes, cracks, etc.
3. Metallic components to be free from sharp edges.

B. Measurements of Dimensions
(Required / observed dimension — length, diameter, etc.)
1. Supplied dimensions
2. Recovered dimensions

C. Destructive Testing
On various heat-shrinkable / moulded components of ready Kits
(Items 3 and 4 are applicable only for heat-shrinkable components)
1. Tensile Strength
2. Wall Thickness Ratio
3. Heat Shock
4. Longitudinal Change, after full recovery
5. Ultimate Elongation
6. Low Temperature Flexibility
7. Dielectric Strength
8. Volume Resistivity

D. Routine Test Reports (RTR)
(Typical)

Each RTR shall clearly indicate P.O. no. & date and also BSES's SAP code no. RTR shall record the serial numbers of the kits selected, as per vendor's sampling method. Following details, besides vendor's/manufacturers standard check-points, shall appear in every RTR.

Annexure – D: Technical Deviation Sheet

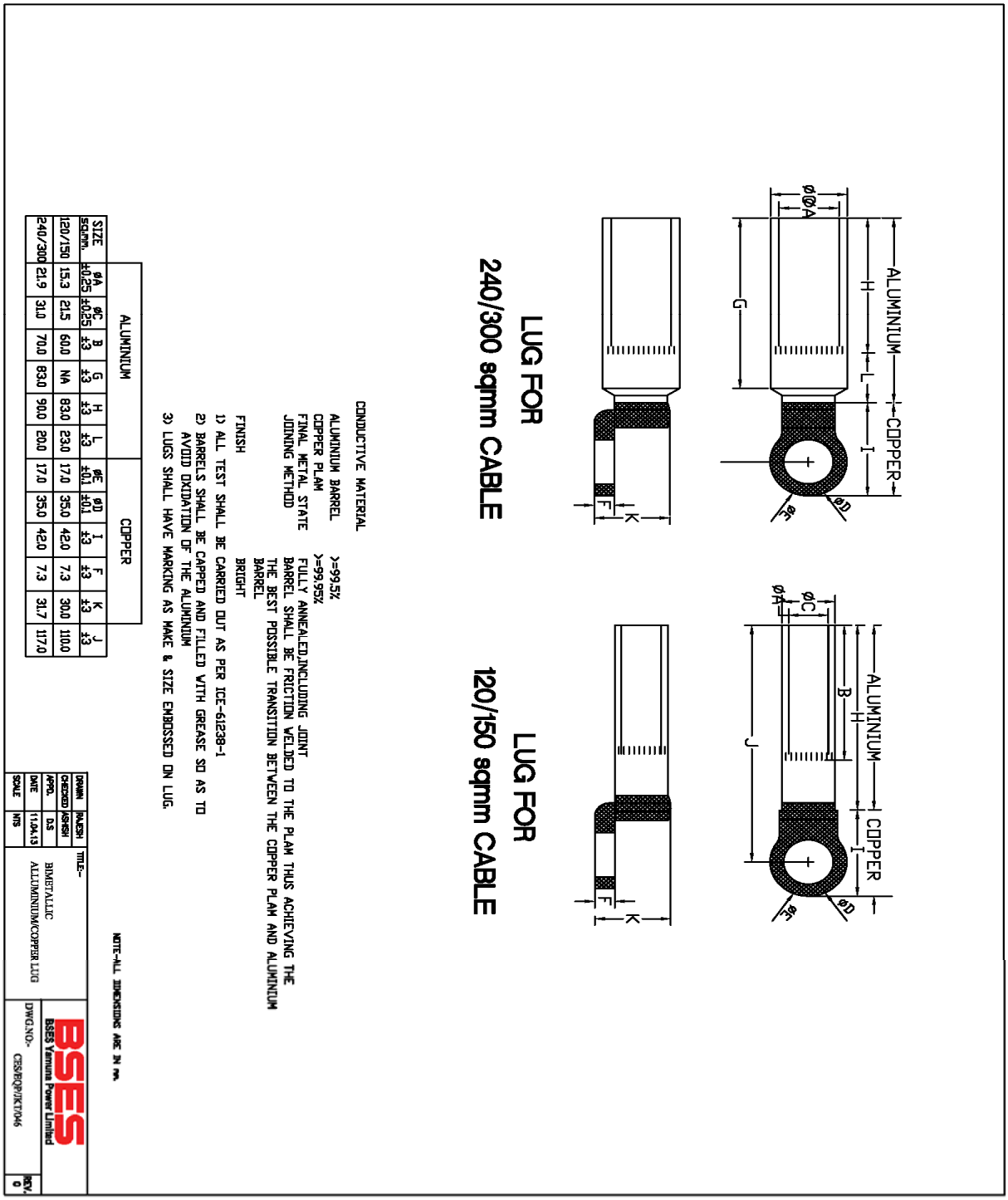
Sr No.	Clause No.	Deviation

Annexure – E: Service Conditions

(Atmospheric conditions at Site)

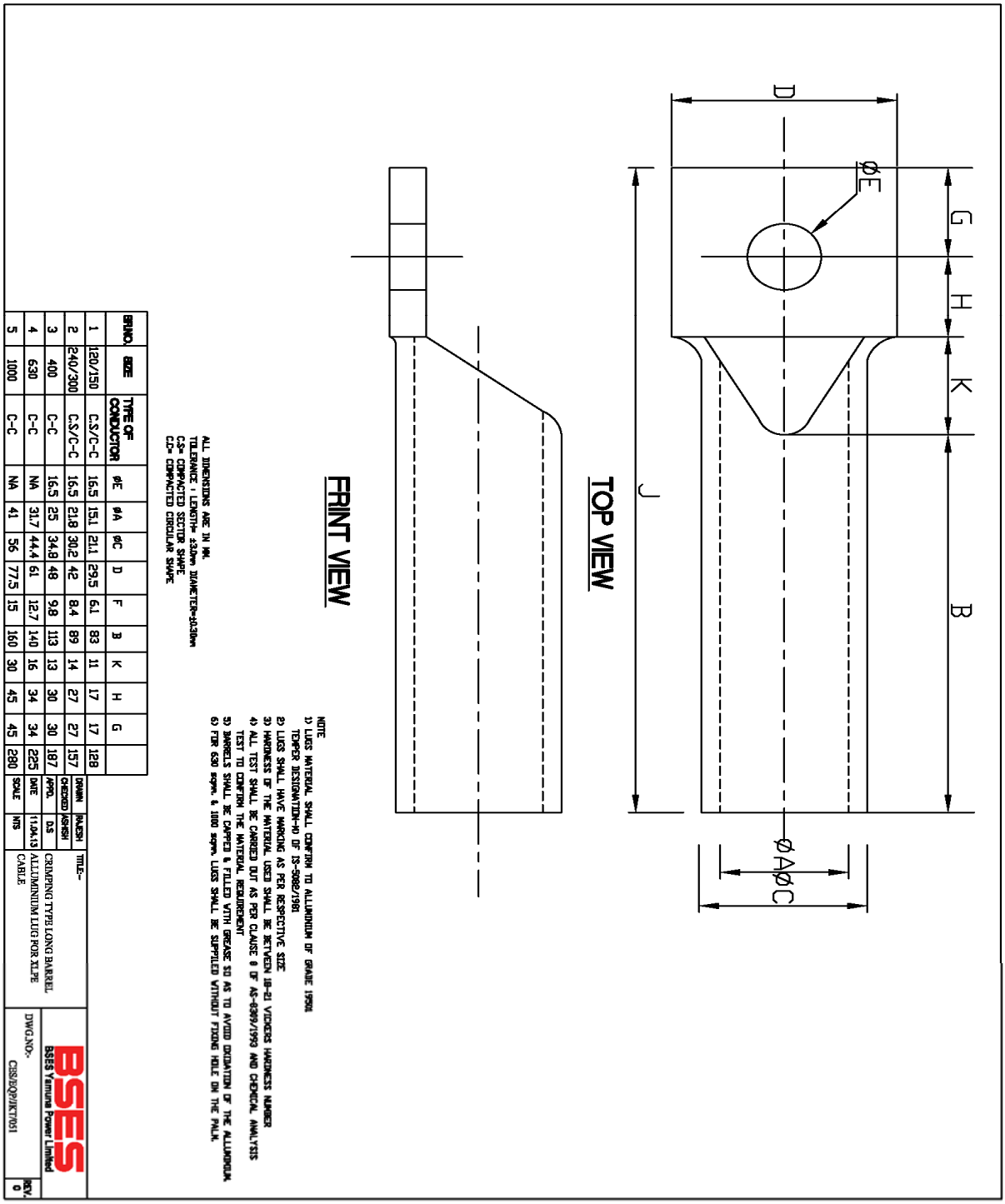
1	Delhi	
a)	Average grade Atmospheric Condition:	Heavily Polluted, Dry
b)	Maximum altitude above sea level	1000 M
c)	Ambient Air temperature	Highest 50 deg C, Average 40 deg C
d)	Minimum ambient air temperature	0 deg C
e)	Relative Humidity	90 % Max
f)	Thermal Resistivity of Soil	150 Deg. C cmm
g)	Seismic Zone	4
h)	Rainfall	750 mm concentrated in four months

Annexure – F: Bimetallic Aluminium / Copper Lug



SIZE SQMM.	ALUMINIUM							COPPER				
	øA ±0.25	øC ±0.25	B ±3	G ±3	H ±3	L ±3	øE ±0.1	øD ±0.1	I ±3	F ±3	K ±3	J ±3
120/150	15.3	21.5	60.0	NA	83.0	23.0	17.0	35.0	42.0	7.3	30.0	110.0
240/300	21.9	31.0	70.0	83.0	90.0	20.0	17.0	35.0	42.0	7.3	31.7	117.0

Annexure – G: Aluminum Lug For XLPE Cable



NOTE
1) LUGS MATERIAL SHALL CONFIRM TO ALUMINIUM OF GRADE 19201 TEMPER DESIGNATION-H0 OF IS-5082/1981
2) LUGS SHALL HAVE MARKING AS PER RESPECTIVE SIZE
3) HARDNESS OF THE MATERIAL USED SHALL BE BETWEEN 18-21 VICKERS HARDNESS NUMBER
4) ALL TEST SHALL BE CARRIED OUT AS PER CLAUSE 8 OF AS-6309/1993 AND CHEMICAL ANALYSIS TEST TO CONFIRM THE MATERIAL REQUIREMENT
5) BARRELS SHALL BE CAPPED & FILLED WITH GREASE SO AS TO AVOID OXIDATION OF THE ALUMINIUM.
6) FOR 630 sqmm & 1000 sqmm, LUGS SHALL BE SUPPLIED WITHOUT FIXING HOLE ON THE PALM.

ALL DIMENSIONS ARE IN MM.
TOLERANCE : LENGTH= ±3.0mm DIAMETER=±0.30mm
C.S= COMPACTED SECTOR SHAPE
C.C= COMPACTED CIRCULAR SHAPE

SR.NO.	SIZE	TYPE OF CONDUCTOR	ØE	ØA	ØC	D	F	B	K	H	G
1	120/150	C.S/C-C	16.5	15.1	21.1	29.5	6.1	83	11	17	17	128
2	240/300	C.S/C-C	16.5	21.8	30.2	42	8.4	89	14	27	27	157
3	400	C-C	16.5	25	34.8	48	9.8	113	13	30	30	187
4	630	C-C	NA	31.7	44.4	61	12.7	140	16	34	34	225
5	1000	C-C	NA	41	56	77.5	15	160	30	45	45	280

DRAWN	RAJESH	TITLE:-	BSES Yamuna Power Limited
CHECKED	ASHISH	CRIMPING TYPE LONG BARREL ALLUMINIUM LUG FOR XLPE CABLE	
APPD.	DJS		
DATE	11.04.13		
SCALE	NTS	DWG.NO:- CBS/SQP/ELT/051	REV. 0

SPECIFICATION
FOR
400/630/1000/1600/2000KVA,11/0.433 KV
OIL FILLED DISTRIBUTION TRANSFORMER

Specification No – SP-TRDU-01-R6

PREPARED BY	REVIEWED BY	APPROVED BY	REV	06
SG	GS	AA	DATE	18.05.2017
			PAGE	01 OF 53

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Record of Revision

SI No.	Revision No	Item/Clause No.	Nature of change	Approved by
1	R1	2.0	Codes & standards updated.	DG/KR
2	R1	4.2.7.1	Transformer oil indicated as per annexure C and sample test included	DG/KR
3	R1	5.21	MOG and terminal box included	DG/KR
4	R1	5.22	Metering box included	DG/KR
5	R1	10.2	Additional description indicated for IR and PI measurement. Temperature rise test included for any lot	DG/KR
6	R1		Annexure C1 included for transformer oil specification	DG/KR
7	R1		Annexure C2 included for additional requirement for hermetically sealed transformer	DG/KR
8	R1		Annexure D updated	DG/KR
9	R1		Annexure D1 data for transformer oil included	DG/KR
10	R2	5.23	Steel support structure for cables added	MDB/KKA
11	R2	Cl 25.3 of Annexure C	Length reduced to 2100	MDB/KKA
12	R2	Cl 33.0 of Annexure C	Capitalization figure revised	MDB/KKA
13	R2	1.1.5 of Annexure A	Steel support for cables added	MDB/KKA
14	R2	10.5	Customer Hold Points added	MDB/KKA
15	R3	6.0	List of make Approved make updated	MDB/KKA
16	R3	6.2	Current density at all taps included	MDB/KKA
17	R4	2.0	BIS certification required	SR/KKA
18	R4	3.25 &3.26	Losses revised	SR/KKA
19	R4	10.4	Special tests revised	SR/KKA

20	R4	4.2.5.2&4.2.5.3	Core grade & thickness revised	SR/KKA
21	R4	3.37	Noise level specified	SR/KKA
22	R4	4.2.2.4	Silica gel type changed.	SR/KKA
23	R4	4.2.10.5	CT burden revised	SR/KKA
24	R4	10.1.1	Vacuum & pressure test shall be as per IS	SR/KKA
25	R4	10.2	Routine test revised	SR/KKA
26	R5	3.23	990kVA Transformer rating revised to 1000kV	DS
27	R5	3.24.1	400 & 630kVA percentage impedance changed to 4.5%	DS
28	R5	3.41 & 4.2.11.1	Tapping range revised	DS
29	R5	4.2.5.5	Flux density at over fluxing changed	DS
30	R6	3.23, 3.24, 3.27, 3.30, 3.31& 3.41	1600 & 2000 kVA ratings included	AA
31	R6	3.32	Transformer dimensions	AA
32	R6	3.25 & 3.26	Losses revised	AA

1.0 Scope of supply

For scope of supply, refer annexure – A.

2.0 Codes & standards

a) Materials, equipment and methods used in the manufacture of Transformer shall conform to the latest edition of below mentioned standards.

b) Vendor shall possess valid BIS Certification.

IEC Standards

IEC 60034	Rotating Electrical Machines. (e.g. For Cooler Fan Motors.)
IEC 60071	Co-ordination of Insulation.
IEC 60076	Power transformers.
IEC 60156	Method for Determination of the Electric Strength for Insulating Oils.
IEC 60044	Current Transformers.
IEC 60214	On Load Tap Changers
IEC 60296	Specification for Unused Mineral Insulating Oils for Transformers and Switchgear.
IEC 60354	Loading Guide for Oil-Immersed Power Transformers.
IEC 60445	Basic& Safety principles for man-machine interface, marking and identification, Identification of Equipment Terminals and conductor terminals
IEC 60529	Degrees of Protection Provided by Enclosures (IP Code).
IEC 60551	Determination of Transformer and Reactor Sound Levels.
IEC 60606	Application Guide for Power Transformers.
IEC 60616	Terminal and Tapping Markings for Power Transformers.
IEC 60947	Low-Voltage Switchgear and Control gear.
IEC 60947	Bushing for alternating voltage above 1000V

British Standard

BS 148	Determination of Transformer and Reactor Sound Levels.
BS 223	Application Guide for Power Transformers.
BS 2562	Terminal and Tapping Markings for Power Transformers.

Indian Standards

IS:335	Insulating oil
IS:1271	Thermal evaluation and classification of electrical insulation
IS:2099	Bushing for Alternating voltage above 1000V
IS:2705	Current Transformers
IS:3347	Dimensions for Porcelain Transformer bushing
IS:3637	Gas operated relays
IS:3639	Fitting & Accessories for power transformers
IS:4201	Application guide for CT's
IS:6600	Guide for loading of oil immersed transformers
IS:8478	Application guide for On-load tap changer
IS:8468	On-load tap changer
IS:10028	Code of practice for selection, installation & maintenance of transformers
IS:13947	LV switchgear and Controlgear-Part1
IS 2026	Power Transformers
IS 1180	Outdoor type oil immersed distribution transformer upto and including 2.5MVA,33kV
IS 5561	Electrical Power Connectors
IS 5	Colors for ready mix paints
IS 6272	Industrial cooling fans
IS 325	Three phase induction motors
	Indian Electricity Rules
	Indian Electricity Act
	CBIP manual

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. This Specification

iii Indian Standards / IEC standards

iv Approved Vendor Drawings

iv. Other documents

3.0 Major Design Criteria & Parameters of the Transformer

Sr No	Description	Data by purchaser
3.1	Voltage variation on supply side	+ / - 10 %
3.2	Frequency variation on supply side	+/ - 5 %
3.3	Transient condition	- 20 % or + 10 % combined variation of voltage and frequency
3.4	Service Condition	Refer Annexure B
3.5	Insulation level	Class A
3.6	Location of equipment	Generally Outdoor but may be located indoor also with poor ventilation
3.7	Reference design ambient temperature	50 deg C
3.8	Type	Oil immersed, core type, step down
3.9	Type of cooling	ONAN
3.10	Reference standard	IS 2026/IS 1180
3.11	No. of phases	3
3.12	No. of windings per phase	2
3.13	Rated frequency (Hz)	50 Hz
3.14	Highest system voltage HV side	12 kv
3.15	Highest system voltage LV side	460 volt
3.16	Lightning Impulse withstand voltage , kV peak	
3.16.1	For nominal system voltage of 11 kV	75
3.17	Power Frequency Withstand Voltage kV rms	
3.17.1	For nominal system voltage of 11 kV	28
3.17.2	For nominal system voltage of 415 V	3
3.18	Clearances Phase to Phase , mm	
3.18.1	For nominal system voltage of 11 kV	180
3.18.2	For nominal system voltage of 415 V	25
3.19	Clearances Phase to Earth , mm	
3.19.1	For nominal system voltage of 11 kV	120
3.19.2	For nominal system voltage of 415 V	25
3.20	System Fault Level , HV side	350 MVA

3.21	System Fault Level , LV side	35 MVA
3.22	System earthing	
3.22.1	HV	Solidly earthed
3.22.2	LV	Solidly earthed
3.23	Ratings	400/630/1000/1600/2000 kVA
3.24	Percentage Impedance at 75 deg C	
3.24.1	400/630 kVA	4.5 % with IS tolerance
3.24.2	1000 kVA	5.0 % with IS tolerance
3.24.3	1600/2000 kVA	6.25% with IS tolerance
3.25	Max Total losses(No Load+ Load Losses at 75ºC) at 50% of the rated load , kW	
3.25.2	400 kVA	1.225
3.25.3	630 kVA	1.86
3.25.4	1000 kVA	2.79
3.25.5	1600 kVA	4.2
3.25.6	2000 kVA	5.05
3.26	Max Total losses(No Load+ Load Losses at 75ºC) at 100% of the rated load , kW	
3.26.1	400 kVA	3.45
3.26.2	630 kVA	5.3
3.26.3	1000 kVA	7.7
3.26.4	1600 kVA	11.8
3.26.5	2000 kVA	15
3.27	Phase CT Ratio , Amp	
3.27.1	400 kVA	600/5
3.27.2	630 kVA	1000/5
3.27.3	1000 kVA	1500/5
3.27.4	1600 kVA	2500/5
3.27.5	2000 kVA	3000/5

3.28	HV cable size for all sizes / Conductor size	11 kV (E) grade , A2XCEWY 3C x 150 sqmm
3.29	Tinned Copper Busbar size on HV side for cable termination, mm x mm	50x6
3.30	LV cable size, 650 /1100 V grade , A2XY cable single core 630 sqmm unarmoured (approx cable dia 40 mm)	Cable
3.30.1	400 kVA	2 runs per phase + 2 runs in Neutral
3.30.2	630 kVA	3 runs per phase + 2 runs in Neutral
3.30.3	1000 kVA	4 runs per phase + 3 runs in Neutral
3.30.4	1600 KVA	6 runs per phase + 3 runs in Neutral
3.30.5	2000 kVA	7 runs per phase + 4 runs in Neutral
3.31	Tinned Copper Busbar size on LV side for cable termination, mm x mm	
3.31.1	400/630/1000kVA	
3.31.1.1	Phase	100 x 12
3.31.1.2	Neutral	100 x 12
3.31.2	1600kVA	
3.31.2.1	Phase	160 x 12
3.31.2.2	Neutral	160 x 12
3.31.3	2000kVA	
3.31.3.1	Phase	2 runs 100 x 12
3.31.3.2	Neutral	2 runs 100 x 12
3.32	Maximum Overall Dimension Acceptable (length x width x height), mm x mm x mm	
3.32.1	400 kVA	1500X1500X2000
3.32.2	630 kVA	1700X1700X2200
3.32.3	1000 kVA	1900X1900X2500
3.32.4	1600 kVA	2300X2000X2600
3.32.5	2000 kVA	2500X2000X2600
3.33	Short Circuit withstand Capacity of the transformer	

3.34	Three phase dead short circuit at secondary terminal with rated voltage maintained on the other side	For 3 secs.
3.35	Single phase short circuit at secondary terminal with rated voltage maintained on other side	For 3 secs.
3.36	Overload Capability	As per IS 6600/IEC 60905
3.37	Noise Level	400/630/1000/1600/2000 KVA-56/57/58/60/61 Db respectively
3.38	Radio Influence Voltage	Maximum 250 microvolt
3.39	Harmonic suppression	Transformer to be designed for suppression of 3rd, 5th, 7th harmonic voltages and high frequency disturbances.
3.40	Partial Discharge	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
3.41	Tappings	Off Circuit taps on HV winding , +5% to - 10% in steps of 2.5 % , change of taps by externally operated switch
3.41.1	Rotary tap switch operating voltage	11 kV
3.41.2	Rotary tap switch current rating, Amp.	
3.41.2.1	400 kVA	60 Amp
3.41.2.2	630 / 1000 kVA	100 Amp
3.41.2.3	1600/2000 kVA	150 Amp

4.0 Construction & Design

4.1	Type	Double Copper wound, three phase, oil immersed, with ONAN cooling, with off circuit tap changer

4.2	**Major Parts**	
4.2.1	**Tank**	
4.2.1.1	Type	Non sealed type with conservator as per manufacturer's standard.
4.2.1.2	Material of Construction	Robust mild steel plate without pitting and low carbon content
4.2.1.3	Plate Thickness	Adequate for meeting the requirements of pressure and vacuum type tests as per IS
4.2.1.4	Welding features	i) All seams and joints shall be double welded ii) All welding shall be stress relieved for sheet thickness greater than 35 mm iii) All pipes, radiators, stiffeners, welded to the tank shall be welded externally
4.2.1.5	Tank features	i) Adequate space at bottom for collection of sediments ii) Stiffeners provided for rigidity and designed to prevent accumulation of water iii) No internal pockets in which gas/air can accumulate iv) No external pocket in which water can lodge v) Tank bottom with welded skid base vi) Tank cover sloped to prevent retention of rain water vii) Minimum disconnection of pipe work and accessories for cover lifting viii) Tanks shall be of a strength to prevent permanent deformation

		during lifting , jacking, transportation with oil filled. ix) Tank to be designed for oil filling under vacuum x) Tank cover fitted with lifting lug xi) Tank cover bent at all the ends xii) Minimum disconnection of pipe work and accessories for cover lifting
4.2.1.5	Flanged type adequately sized inspection cover rectangular in shape required for	i) HV line bushing ii) LV line bushing iii) LV neutral bushing iv) Core / Winding
4.2.1.6	Fittings and accessories on main tank	See under fittings and accessories.
4.2.2	**Conservator for the main tank**	
4.2.2.1	Capacity	Adequate between highest and lowest visible levels to meet the requirement of expansion of oil volume in the transformer and cooling equipment from minimum ambient temperature to maximum operating temperatures.
4.2.2.2	Conservator oil preservation system	Conventional
4.2.2.3	Conservator features	i) Conservator shall be bolted into position so that it can be removed for cleaning / other maintenance purposes ii) Main pipe from tank shall project about 20 mm above conservator bottom for creating a sump for collection of impurities iii) Conservator minimum oil level corresponding to minimum temperature shall be well above the sump level.

		iv) Conservator to main tank piping shall be supported at minimum two points.
4.2.2.4	Fittings and accessories on main tank conservator	i) Prismatic oil gauge with MINIMUM , NORMAL and MAXIMUM marking ii) End Cover iii) Oil Filling Hole with cap iv) Silica Gel Dehydrating Breather with oil seal and dust filter with clear acrylic single piece clearly transparent cover resistant to UV rays**(1kg).** Breather shall be of Flanged type in circular shape with 4 no.holes of ½ inches with hardware of M10 bolts. vi) Drain Plug vii) Air release plug as required viii) Pressure/ Vacuum gauge ix) Magnetic Oil Gauge with LOW LEVEL ALARM x) Silica gel shall be of round ball type of 2.5mm dia.
4.2.3	**Radiators**	Detachable type
4.2.3.1	Thickness	Minimum 1.2 mm
4.2.4.2	Features	With lifting lugs, air release plug, drain plug
4.2.5	**Core**	
4.2.5.1	Material	High grade , non ageing, low loss, high permeability, grain oriented, cold rolled silicon steel lamination
4.2.5.2	Grade	Premium Grade minimum M3 or better
4.2.5.3	Lamination thickness	0.23 mm Max.
4.2.5.4	Design Flux Density at rated conditions at principal tap	As per Manufacturer design.

4.2.5.5	Maximum Flux Density at 12.5 % over excitation / over fluxing	1.9 T
4.2.5.6	Core Design Features	i) Magnetic circuit designed to avoid short circuit paths within core or to the earthed clamping structures ii) Magnetic circuit shall not produce flux components at right angles to the plane of lamination to avoid local heating iii) Least possible air gap and rigid clamping for minimum core loss and noise generation iv) Adequately braced to withstand bolted faults on secondary terminals without mechanical damage and damage/ displacement during transportation and positioning. v) Percentage harmonic potential with the maximum flux density under any condition limited to avoid capacitor overloading in the system vi) All steel sections used for supporting the core shall be thoroughly sand blasted after cutting , drilling, welding vii) Provision of lifting lugs for core coil assembly viii) Supporting framework designed not to obstruct complete drainage of oil from transformer
4.2.6	**Winding**	
4.2.6.1	Material	Electrolytic Copper

4.2.6.2	Maximum Current Density allowed	3 Amp per sq mm at all taps.
4.2.6.3	Winding Insulating material	Class A , non catalytic, inert to transformer oil, free from compounds liable to ooze out, shrink or collapse.
4.2.6.4	Winding Insulation	Uniform
4.2.6.5	Design features	i) Stacks of winding to receive adequate shrinkage treatment ii) Connections braced to withstand shock during transport, switching, short circuit, or other transients. iii) Minimum out of balance force in the transformer winding at all voltage ratios. iv) Conductor width on edge exceeding six times its thickness v) Transposed at sufficient intervals. vi) Coil assembly shall be suitably supported between adjacent sections by insulating spacers + barriers vii) Winding leads rigidly supported , using guide tubes if practicable viii) Winding structure and major insulation not to obstruct free flow of oil through ducts ix) Provision of taps as per clause 3.41
4.2.7	**Transformer Oil**	
4.2.7.1	Type	Should be in accordance with specification as per Annex C of this document One sample of oil drawn from every lot of transformer offered for inspection should be tested at NABL accredited lab

		for tests as listed under Table-1 of IS:1866 (2000). The cost of this testing should be included within the cost of transformer. The results shall be confirming to BSES specification Annex C
4.2.8	**Bushings and Terminations**	
4.2.8.1	Type of HV side bushing	HV bushing should be top mounted. Oudoor, Epoxy Resin cast, rated voltage and creepage as per 31mm/kV with voltage class of 12kV respectively
4.2.8.2	Type of LV side bushing	LV bushing should be top mounted. Outdoor, Epoxy resin cast, rated voltage and creepage as per 31mm/kV with voltage class of 1.1 kV respectively Additional neutral bushing shall be provided of porcelain.
4.2.8.2.1	Essential provision for LV side line bushing	It shall be complete with copper palm complete with tinned copper busbar of size shall be as per clause 3.31.
4.2.8.2.2	Essential provision for LV side neutral bushing	In case of neutral bushing the stem and busbar shall be integral without bolted, threaded, brazed joints. Busbar size shall be as per clause 3.31
4.2.8.3	Arcing Horns	Not required
4.2.8.4	Support insulators inside HV cable box if provided	Epoxy resin cast, rated voltage 12 kV
4.2.8.5	Termination on HV side bushing	By bimetallic terminal connectors suitable for ACSR/AAAC conductor / Cable connection through cable box with disconnecting link suitable for 11kV(E) grade,A2XFY 3Cx 150sqmm
4.2.8.6	Termination of LV side bushing	By bimetallic terminal connectors

		suitable for LV Cable size of 650/1100VGrade, A2XY Cable single core 630sqmm(Approx dia 40mm)
4.2.8.7	Minimum creepage distance of all bushings and support insulators.	31mm/KV
4.2.8.8	Protected creepage distance	At least 50 % of total creepage distance
4.2.8.9	Continuous Current rating	Minimum 20 % higher than the current corresponding to the minimum tap of the transformer
4.2.8.10	Rated thermal short time current	25 times the rated current for 2 sec
4.2.8.11	Atmospheric protection for clamp and fitting of iron and steel	Hot dip galvanizing as per IS 2633
4.2.8.12	Bushing terminal lugs in oil and air	Tinned copper
4.2.8.13	Sealing washers /Gasket ring	Nitrile cork rubber(RC70C)/ Expanded TEFLON(PTFE) as applicable.
4.2.9	**HV & LV cable box**	Required
4.2.9.1	Material of Construction	Sheet Steel min. 2.5 mm thick
4.2.9.2	Cable entry	At bottom through detachable gland plate with cable clamps of non magnetic material
4.2.9.3	Cable size for HV	11 kV (E) grade , A2XFY 3C x 150 sqmm
4.2.9.4	Cable size for LV	LV cable size, 650 /1100 V grade, A2XY cable single core 630 sqmm unarmoured (approx cable dia 40 mm)
4.2.9.5	Cable size for LV Neutral	LV cable size, 650 /1100 V grade ,A2XY cable single core 630 sqmm unarmoured (approx cable dia 40 mm)
4.2.9.6	Detachable Gland Plate material for HV, LV, LV Neutral box	MS for HV cable box Al for LV cable box.
4.2.9.7	Gland plate thickness for HV, LV, LV Neutral box	3 mm for HV side cable box 5 mm for LV cable box.
4.2.9.8	Cable gland for HV cables	Nickel plated brass double compression weatherproof cable gland

4.2.9.9	Cable lug for HV, LV, LV Neutral cables	Double hole Aluminium lugs
4.2.9.10	Essential parts	i) Flange type removable front cover with handles min two nos. ii) Tinned Copper Busbar of adequate size for Purchaser's cable termination with busbar supports iii) Earthing boss for the cable box iv) Earthing link for the gasketted joints at two point for each joint v) Earthing provision for cable Armour/ Screen vi) Flanged type inspection cover on top for bushing inspection and maintenance with handle vii) Drain plug viii) Rainhood on gasketted vertical joint ix) Danger / caution plate
4.2.9.11	Terminal Clearances	700mm, Minimum
4.2.9.12	Termination height required for cable termination	1000mm, Minimum
4.2.10	**Current Transformers**	
4.2.10.1	Provision	On all three phases on LV side
4.2.10.2	Mounting	On LV side bushings on all three phases with the help of fibre glass mounting plate affixed to main tank by nut bolt arrangement
4.2.10.3	Maintenance requirements	Replacement should be possible by removing fixing nut of mounting plate after removal of LT cable without disturbing LT bushing
4.2.10.4	Accuracy Class	0.5

4.2.10.5	Burden	10VA
4.2.10.6	Type	Resin Cast Ring type suitable for outdoor use.
4.2.10.7	CT ratio	
	400kVA	600/5
	630kVA	1000/5
	1000kVA	1500/5
	1600kVA	2500/5
	2000kVA	3000/5
4.2.10.8	**CT terminal Box**	
4.2.10.8.1	Size	650 mm height x 450 mm width x 275 mm depth.
4.2.10.8.2	Fixing of instrument / meters within box	On slotted channel 40 x 12 mm size, channel fixed on vertical slotted angle 40 x 40 mm size at two ends
4.2.10.8.3	No of horizontal channels to be provided	Four
4.2.10.8.4	Fixing of terminals within the box	On horizontal slotted channel with the help of C channel available with the terminals
4.2.10.8.5	Location	On tank wall
4.2.10.8.6	Box door design	Openable from outside with antitheft hinge, padlock facility, door fixed by stainless steel allen screw M6 size , door shall have canopy for rain protection
4.2.10.8.7	Terminal strip	Nylon 66 material, minimum 4 sq mm, screw type for control wiring and potential circuit.
4.2.10.8.8	Cables and wires	PVC insulated, extruded PVC inner sheathed, armoured, extruded PVC outer sheathed 1100 V grade control cable as per latest edition of IS 1554 part 1 minimum 2.5 sq mm for signals

		and 4 sq mm for CT with multi strand copper conductor
4.2.10.8.9	Cable Glands	Nickel plated brass double compression weatherproof cable gland
4.2.10.8.10	Lugs on wires	Tinned copper pre insulated Pin, Ring, Fork type as applicable
4.2.10.8.11	Potential signal in CT box	i)Tapped from main LV busbar ii)Neutral Link and Fuse to be provided by bidder for PT
4.2.10.8.12	Essential provision	Wiring diagram to be fixed on the back of door along with CT spec. on Aluminum engraved plate fixed by rivet.
4.2.11	**Off Circuit tap Switch**	
4.2.11.1	Range /Step	Off circuit taps on HV winding, +5% to -10% in steps of 2.5%, change of taps by externally operated switch.
4.2.11.2	Type	Rotary type, 3 pole gang operated, draw out type
4.2.11.3	Operating Voltage	11kV
4.2.11.4	Rated Current for tap Switch	400 kVA - 60 Amps 630/1000 kVA - 100 Amps 1600/2000kVA-150 Amps
4.2.11.5	Operating Handle	External at suitable height to be operated from ground level.
4.2.11.6	Essential provision	Tap position indicator, direction changing facility, locking arrangement, and caution plate metallic fixed by rivet.
4.2.12	**Pressure Relief Device**	
4.2.12.1	Type	Explosion vent
4.2.12.2	Provision on explosion vent	Double diaphragm & sight glass
4.3	**Hardware**	
4.3.1	External	Stainless Steel

4.3.2	Internal	Cadmium plated except special hardware for frame parts and core assembly as per manufacturer's design
4.4	**Gasket**	
4.4.1	For Transformer , surfaces interfacing with oil like inspection cover etc.	Nitrile cork rubber RC70C grade
4.4.2	For Cable boxes, Marshalling box, etc.	Neoprene rubber based/ cork nitrile
4.5	**Valves**	
4.5.1	Material of construction	Brass / gun metal
4.5.2	Type	Both end flanged gate valve / butterfly valve depending on application
4.5.3	Size	As per manufacturer's standard
4.5.4	Essential provision	Position indicator, locking rod, padlocking facility, valve guard, cover plate.
4.6	**Cable routing on Transformer**	Control cables for accessories on transformer tank shall be routed through perforated GI trays
4.6.1	Control cable specification	PVC insulated, extruded PVC inner sheathed, armoured, extruded PVC outer sheathed 1100 V grade control cable as per latest edition of IS 1554 part 1 minimum 2.5 sq mm for signals and 4 sq mm for CT with multi strand copper conductor
4.6.2	Specification of wires to be used inside marshalling box , OLTC drive mechanism	PVC insulated multi-strand flexible copper wires of minimum 2.5 sq mm size, 1100 V grade as per latest edition of relevant IS
4.7	**Terminal Blocks to be used by the vendor**	Nylon 66 material, minimum 4 sq mm, screw type for control wiring and potential circuit.
4.7.1	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
4.8	**Cable glands to be used by the vendor**	Nickel plated brass double compression weatherproof cable gland
4.9	**Cable lugs to be used by the vendor**	
4.9.1	For power cables	Long barrel medium duty Aluminium lug with knurling on inside surface.
4.9.2	For Control Cable	Tinned copper pre insulated Pin, Ring, Fork type as applicable
4.10	**Painting of transformer, Radiator, marshalling box for CT, cable boxes etc.**	
4.10.1	Surface preparation	By 7 tank pretreatment process or shot blasting method
4.10.2	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.
4.10.3	Finish on inner surface of the CT terminal box, HV/LV/LVN cable box	White Polyurethane paint anti condensation type two coats , minimum dry film thickness 80 microns
4.10.4	Finish on outer surface of the transformer, radiator, CT terminal box, HV/LV/LVN cable box	Battle ship Grey shade 632 Polyurethane paint two coats , minimum dry film thickness 80 microns
4.10.5	Frame parts	Battle ship grey shade 632 IS 5, 80 micron minimum insulating oil resistant paint. Paint shall neither react nor dissolve in hot transformer insulating oil.

5.0 Fittings and Accessories on Transformer

5.1	Rating and Diagram Plate	Required
5.1.1	Material	Anodized aluminum 16SWG

5.1.2	Background	SATIN SILVER
5.1.3	Letters, diagram & border	Black
5.1.4	Process	Etching
5.1.5	Rating and Diagram Plate details	Following details shall be provided on rating and diagram plate as a minimum i) type/kind of transformer with winding material ii) standard to which it is manufactured iii) manufacturer's name; iv) transformer serial number; v) month and year of manufacture vi) rated frequency in Hz vii) rated voltages in kV viii) number of phases ix) rated power in kVA x) type of cooling (ONAN) xi) rated currents in A xii) vector group connection symbol xiii) 1.2/50µs wave impulse voltage withstand level in kV xiv) power frequency withstand voltage in kV xv) impedance voltage at rated current and frequency in percentage at principal, minimum and maximum tap xvi) Max. Total losses at 50 % rated load xvii) Max. Total losses at 100 % rated load xviii) Load loss at 50% & 100% rated load xix) No-load loss at rated voltage and frequency

		xx) Energy efficiency level. xxi) continuous ambient temperature at which ratings apply in deg C xxii) top oil and winding temperature rise at rated load in deg C; xxiii) winding connection diagram with taps and table of tapping voltage, current and power xxiv) transport weight of transformer xxv) weight of core and windings xxvi) total weight xxvii) volume of oil xxviii) weight of oil xxix) name of the purchaser xxx) PO no and date xxxi) Guarantee period
5.2	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
5.3	Company Monogram Plate fixed by rivet	Required
5.4	Lifting Lug to lift complete transformer with oil	Required
5.5	Lifting lug for top cover	Required
5.6	Lashing Lug	Required
5.7	Jacking Pad with Haulage hole to raise or lower complete transformer with oil	Required
5.8	Detachable Bidirectional flat roller Assembly	Required
5.8.1	Roller center to center distance	Minimum 900 mm on the side of HV

		and LV cable box Maximum 800 mm on the other side (perpendicular to HV, LV cable box).
5.8.2	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.
5.9	Pockets for ordinary thermometer on tank cover with metallic identification plate fixed by rivet.	Required
5.10	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.	Required
5.11	Filter valve (gate valve) at top with padlocking and valve guard with metallic identification plate fixed by rivet.	Required
5.12	Air Release Plug on tank cover with metallic identification plate fixed by rivet.	Required
5.13	Equalizer pipe connection between conservator and explosion vent	Required
5.14	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
5.15	Rainhood for vertical gasketted joints , in cable boxes, Conservator	Required Not required as per Annexure A Scope of supply
5.16	Earthing bridge by copper strip	Required

	jumpers on all gasketted joints at at least two points for electrical continuity	
5.17	Skid base welded type with haulage hole	Required
5.18	Core , Frame to tank Earthing	Required
5.19	Danger plate made of Anodized aluminum with white letters on red background on Transformer, cable boxes (all fixed by rivet)	Required
5.20	Caution plate for Off Circuit tap changer fixed by rivet.	Required
5.21	MOG with auxillary contact wired upto Terminal Box	Required
5.22	Buchholz relay for transformer above 1000kVA	Required

6.0 Approved make of components

6.1	CT	Pragati / ECS / Kappa
6.2	Bushings	Baroda Bushing/CJI/Jaipur
6.3	Tap Changer	Alwaye /Paragon
6.4	MOG	Sukrut/Atvus
6.5	Valves	Newman
6.6	CRGO	Nippon/JFE/Posco
6.7	Copper	Birla copper/Sterlite
6.8	Pre compressed Pressboard	Raman Board, Mysore/ Senapathy Whiteley
6.9	Laminated Wood	Permalli Wallance / Rochling Engineers
6.10	Oil	Apar/Savita/Raj
6.11	Steel	TATA/Jindal/SAIL
6.12	Lugs/Glands	Jainson/Dowells/Comet
6.13	Radiators	CTR/Hi-Tech Radiators /Tarang Engineers

Note – Any other make of component to be approved by purchaser

7.0 Quality assurance

7.1	Quality Assurance program	To be submitted before contract award. Program shall contain following i) The structure of the organisation ii) The duties and responsibilities assigned to staff ensuring quality of work. iii) The bidder should have qualified technical & dedicated QA personnel at various stages of manufacture & testing. iv) Factory inspection of bidder may be carried out to ascertain the quality system and process in place at manufacturing facility. The same is applicable to bidders not approved with BSES. v) The system for purchasing, taking delivery and verification of materials vi) The system for ensuring quality of workmanship vii) The system for control of documentation viii) The system for the retention of records ix) The arrangements for the Supplier's internal auditing x) A list of the administration and work procedures required to achieve and verify Contract's quality requirements. These procedures shall be made readily available to the Purchaser for inspection on request
7.2	Quality Plan	To be submitted by the successful bidder for approval. Plan shall contain following as a minimum i) An outline of the proposed work and programme sequence ii) The structure of the Supplier's organisation for the contract

		iii) The duties and responsibilities assigned to staff ensuring quality of work for the contract iv) Inspection Hold and notification points mutually agreed. v) Submission of engineering documents required by the specification vi) The inspection of materials and components on receipt vii) Reference to the Supplier's work procedures appropriate to each activity viii) Inspection during fabrication/construction ix) Final inspection and test x) Successful bidder shall include submittal of Mills invoice, Bill of lading, Mill's test certificate for grade, physical tests, dimension, specific watt loss per kG for the core material to the purchaser for verification in the quality plan suitably

8.0 Progress Reporting

8.1	Outline Document	To be submitted for purchaser approval for outline of production, inspection, testing, packing, dispatch, documentation programme
8.2	Detailed Progress report	To be submitted to Purchaser once a month containing i) Progress on material procurement ii) Progress on fabrication iii) Progress on assembly iv) Progress on internal stage inspection v) Reason for any delay in total programme vi) Details of test failures if any in manufacturing stages vii) Progress on final box up viii) Constraints ix) Forward path

9.0 Submittals

9.1	Submittals required with bid	i) Completed technical data schedule ii) Descriptive literature giving full technical details of equipment offered; iii) Outline dimension drawing for each major component, general arrangement drawing showing component layout and general schematic diagrams; iv) Type test certificates, where available, and sample routine test reports; v) Detailed reference list of customers already using equipment offered during the last 5 years with particular emphasis on units of similar design and rating; vi) Details of manufacturer's quality assurance programme and ISO 9000 series or equivalent national certification; vii) Deviations from this specification. Only deviations approved in writing before award of contract shall be accepted; viii) Recommended spare parts and consumable items for five years of operation with prices and spare parts catalogue with price list for future requirements ix) Transport / Shipping dimension and weights, space required for handling parts for maintenance x) Write up on oil preservation system xi) Write up on OLTC xii) Quality Assurance Program
9.2	Submittals required after award for Approval (A), Reference (R), and subsequent distribution	i) Programme for production and testing (A) ii) Guaranteed Technical Particulars

		(A) iii) General description of the equipment and all components, including brochures (R) iv) Calculations to substantiate choice of electrical, structural, mechanical component size/ratings (A) v) Detailed loading drawing to enable the Purchaser to design and construct foundations for the transformer (R) vi) Transport / shipping dimensions with weights, wheel base details, untanking height etc (R) vii) Terminal arrangements and cable box details (A) viii) Flow diagram of cooling system showing no of cooling banks (A) ix) Drawings of major components like Bushing , CT etc (A) x) PT fixing arrangement xi) List of makes of all fittings and accessories (A) xii) Statement drawing attention to all exposed points in the equipment at which contact with or in close proximity to other metals and stating clearly what protection is employed to prevent corrosion at each point (A) xiii) Detailed installation and commissioning instructions xiv) Quality Plan.
9.3	Submittals required at the final hold point prior to despatch	i) Inspection and test reports carried out in manufacturer's works (A) ii) Test certificates of all bought out items iii) Operation and maintenance Insrtrction as well as trouble shooting charts/ manual
9.4	Drawing and document sizes	Standard size paper A1, A2, A3, A4

9.5	No of drgs /Documents required at different stages	As per Annexure A Scope of Supply

10.0 Inspection & testing

10.1	Inspection and Testing during manufacture	Only type tested equipment shall be acceptable
10.1.1	Tank and Conservator	i) Check correct dimensions between wheels demonstrate turning of wheels through 90 deg and further dimensional check. ii) Check for physical properties of materials for lifting lugs, jacking pads etc. All load bearing welds, including lifting lug welds shall be subjected to required load tests. iii) Leakage test of the conservator. iv) Certification of all test results. v) Oil leakage test . vi) Vacuum and Pressure test on tank as type test as per IS
10.1.2	Core	i) Sample testing of core material for checking specific loss, bend properties, magnetization characteristics and thickness. ii) Check on the quality of varnish if used on the stampings. a) Measurement of thickness and hardness of varnish on stampings. b) Solvent resistance test to check that varnish does not react in hot oil. c) Check over all quality of varnish by sampling to ensure uniform hipping colour, no bare spots. No ever burnt varnish layer and no bubbles on varnished surface. iii) Check on the amount of burns. iv) Bow check on stampings. v) Check for the overlapping of stampings. Corners of the sheet are to be apart. vi) Visual and dimensional check during assembly stage.

		vii) Check on complete core for measurements of iron-loss and check for any hot spot by exciting the core so as to induce the designed value of flux density in the core. viii) Check for inter laminar insulation between core sectors before and after pressing. ix) Visual and dimensional checks for straightness and roundness of core, thickness of limbs and suitability of clamps. x) High voltage test (2 KV for one minute) between core and clamps. xi) Certification of all test results.
10.1.3	Insulating Materials	i) Sample check for physical properties of materials. ii) Check for dielectric strength. iii) Visual and dimensional checks. iv) Check for the reaction of hot oil on insulating materials. v) Certification of all test results.
10.1.4	Windings	i) Sample check on winding conductor for mechanical properties and electrical conductivity. ii) Visual and dimensional check on conductor for scratches, dept. mark etc. iii) Sample check on insulating paper for PE value, Bursting strength, Electric strength. iv) Check for the reaction of hot oil on insulating paper. v) Check for the bending of the insulating paper on conductor. vi) Check and ensure that physical condition of all materials taken for winding is satisfactory and free of dust. vii) Check for absence of short circuit between parallel strands. viii) Check for Brazed joints wherever applicable. ix) Measurement of voltage ratio to be carried out when core/ yoke is

		completely restocked and all connections are ready. x) Certification of all test results.
10.1.4.1	Checks before drying process	i) Check conditions of insulation on the conductor and between the windings. ii) Check insulation distance between high voltage connection distance between high voltage connection cables and earthed and other live parts. iii) Check insulation distance between low voltage connection and earthed and other parts. iv) Insulation test of core earthing. v) Check for proper cleanliness vi) Check tightness of coils i.e. no free movement. vii) Certification of all test results.
10.1.4.2	Checks during drying process	i) Measurement and recording of temperature and drying time during vacuum treatment. ii) Check for completeness of drying. iii) Certification of all test results.
10.1.5	Oil	As per IS 335
10.1.6	Test on fittings and accessories	As per manufacturer's standard
10.2	Routine tests	The sequence of routine testing shall be as follows i) Visual and dimension check for completely assembled transformer ii) Measurements of voltage ratio iii) Measurements of winding resistance at principal tap and two extreme taps. iv) Vector Group and polarity test v) Measurements of insulation resistance* vi) Separate sources voltage withstand test. vii) Measurement of iron losses and exciting current at rated frequency and 90%, 100% and 110% rated voltage. viii) Induced voltage withstand test. ix) Load losses measurement at 50 % & 100 % of load.

		x) Impedance measurement of principal tap (HV and LV) of the transformer. x) Routine test of tanks xi) Induced voltage withstand test (to be repeated if type tests are conducted). xii) Measurement of Iron loss (to be repeated if type test are conducted). xiii) Measurement of capacitance and Tan Delta for transformer winding and Tan Delta for transformer oil (for all transformers). xiv) Ratio of CT xv) Oil leakage test on completely assembled transformer xvi) Magnetic balance test xvii) Power frequency voltage withstand test on all auxiliary circuits xviii) Certification of all test results. xix) Temperature Rise Test # a) *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 = IR_{10min}/IR_{1min}) 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.) b) #Temperature rise test may be necessary to be carried one unit/lot. Purchaser's engineer, will at its discretion, select transformer for temp. rise test from any lot offered for inspection at manufacturer's works and witness the same for comparison with ERDA/CPRI type test results
10.3	Type Tests	On one transformer of each rating and type at CPRI/ERDA. i) Impulse withstand test on all three HV limbs of the transformers for chopped wave as per standard ii) Temperature rise test as per IS iii) Dissolved gas analysis before and

		after Temperature Rise Test iv) Air pressure test for sealed transformers v) Pressure and Vacuum test on tank Note – Purchaser may choose to carry out short circuit, impulse & temperature rise test on one unit from a lot offered from inspection at CPRI/ERDA
10.3.2	Notification to bidders	The product offered must be of type tested quality. In case the product offered is never type tested the same as per above list to be conducted by bidder at his own cost at CPRI/ERDA. The test report shall not be more 5 years old
10.4	Special Tests	On one transformer of each rating and type i) Dynamic & Thermal (3 sec) Short Circuit Test as per IS 2026 ii) Measure of zero seq. impedance (Cl. 16.10 IS 2026 Part I). iii) Measurement of acoustic noise level (Cl. 16.12 of IS 2026 Part I). iv) Measurement of harmonic level on no load current. v) Paint adhesion test. vi) High voltage withstand test shall be performed on the auxiliary equipment and wiring after complete assembly. Cost of such tests, if extra, shall be quoted separately by the Bidder.
10.4.1	Note for special test	In case the product offered is never tested for short circuit (Dynamic & Thermal) , same to be conducted by bidder at his own cost at CPRI/ERDA. The test report shall not be more 5 years old.
10.5	Customer Hold Point	i) GTP & Drawings approval ii) Core Inspection(See Cl No 10.1.2) Sample to be tested at CPRI/ERDA for each lot. iii) Tank Pressure & vacuum Test iv) Core & Coil Stage inspection of each

		lot to be offered for final testing.

11.0 Packing , Shipping, Handling and Storage

11.1	Packing	
11.1.1	Packing protection	Against corrosion, dampness, heavy rains, breakage and vibration
11.1.2	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection
11.1.3	Packing details	On each packing case details required as follows i) Individual serial number; ii) Purchaser's name; iii) PO number; iv) Destination; v) Supplier's name; vi) Name and address of supplier's agent vii) Description and quantity viii) Manufacturer's name ix) Country of origin x) Case measurements xi) Gross and net weights in kilograms xii) All necessary slinging and stacking instructions.
11.2	Shipping	The bidder shall ascertain at an early date and definitely before the commencement of manufacture, any transport limitations such as weights, dimensions, road culverts, overhead lines, free access etc. from the manufacturing plant to the project site; and furnish to the Purchaser confirmation that the proposed packages can be safely transported, as normal or oversize packages, upto the plant site. Any modifications required in the infrastructure and cost thereof in this connection shall be brought to the notice

		of the Purchaser
11.3	Handling and Storage	As per manufacturer's instruction

12.0 Deviations

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, requirements of the Specification shall be met without exception.

Annexure A Scope of supply

1.0 The scope of supply shall include following

1.1 Design, manufacture, assembly, testing at stages of manufacture as per Cl. 10 of this specification, final testing at manufacturer works on completely assembled transformer before dispatch, packing, transportation, delivery and submission of all documentation for the Power transformer with all accessories as below

Sr. No	Description	Scope of Supply
1.1.1	Fully assembled transformer with all major parts like conservator, Radiators, CT box, Fittings and accessories as per Clause 5.0 of this specification	YES
1.1.2	Off circuit tap changer as per this specification	YES
1.1.3	HV, LV, cable boxes	YES
1.1.4	Support steel material for support of cable boxes from ground	YES
1.1.5	Foundation Bolts for complete transformer	YES
1.1.6	Support structure to support of cable from the transformer tank	YES
1.1.7	Nickel Plated brass double compression glands for HV and LV, LVN cables (in case of termination by cable)	YES
1.1.8	Long barrel medium duty Aluminium lugs for power cables (in case of termination by cable)	YES
1.1.9	Nickel Plated brass double compression glands and tinned copper lugs for control cable termination in CT box for vendor's cables	YES
1.1.10	Cables and wires for transformer accessories and internal wiring of CT box	YES
1.1.11	Touch up paint, minimum 2 litres	YES
1.1.12	Extra Transformer oil 10 % in non returnable drums	YES
1.1.13	One spare complete set of gaskets	YES
1.1.14	Routine testing as per Cl. 10.2 of this specification	YES
1.1.15	Type testing as per Cl. 10.3 of this specification	YES
1.1.16	Special testing as per Cl. 10.4 of this specification	YES

1.1.17	Submission of Documentation as detailed below	YES

2.0 Submission of documents

Submission of of drawings, calculations, catalogues, manuals, test reports shall be as follows

	Along with offer	For Approval after award of contract	Final after approval	Remarks
Drawings	3 copies (Typical drgs)	4 copies	12 copies + 1 soft copy in CD	See Clause 9 for various drawings required
Calculations	3 copies (Typical)	4 copies	6 copies + 1 soft copy in CD	See Clause 9 for details
Catalogues	1 copy		12 copies + 1 soft copy in CD	
Instruction manual for the transformer	1 copy		12 copies + 1 soft copy in CD	
Test Report	2 copies (Type test ans sample Routine Test)		12 copies + 1 soft copy in CD	Type test and sample routine test reports

3.0 Delivery schedule

3.1 Delivery period start date -

3.2 Delivery period end date -

3.3 Material dispatch clearance - after inspection by purchaser & written dispatch clearances from purchaser

Annexure B Service Conditions

1.0.0	Delhi Atmospheric conditions	
a)	Average grade atmosphere :	Heavily polluted, dry
	Maximum altitude above sea level	1000 M
b)	Ambient Air temperature	Highest 50 deg C, Average 40 deg C
	Design ambient temperature	50 deg C
c)	Relative Humidity	90 % Max
d)	Seismic Zone	4
e)	Rainfall	750 mm concentrated in four months

Annexure – C Technical Particulars of 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

2.0 Properties

The insulating material shall have following features

Sr No	Item description	Specification requirement
2.1	Appearance of oil	Clear, transparent and free from suspended matter or sediments
2.2	Density at 29.5^{0}C Max.	0.89 g/cm^3
2.3	Kinematics viscosity Max.	16 cSt at 27^{0}C 11 cSt at 40^{0}C
2.4	Interfacial tension at 27^{0}C	0.04 N/m min
2.5	Flash point Pensky-Marten (Closed), Min.	140^{0}C
2.6	Pour Point, Max	- 15^{0}C
2.7	Neutralization value	
	i) Total acidity, Max.	0.03 mg KOH/g
	ii) Inorganic acidity/ Alkalinity	Nil
2.8	Corrosive sulfur	Non-corrosive
2.9	Electric strength breakdown voltage	Average value of six samples
	i) New unfiltered oil. Min.	30 kV (rms) min.
	ii) After filtration Min.	60 kV (rms)
2.10	Dielectric dissipation factor (tan δ).	0.002 at 90^{0}C, Max 0.0005 at 27^{0}C, Max
2.11	Specific resistance	(resistivity)
	i) At 90^{0}C, Min	150 X 10^{12} ohm-cm
	ii) At 27^{0}C, Min	3000 X 10^{12} ohm-cm
2.12	Oxidation stability	
	i) Neutralization value after oxidation, Max.	0.15 mg KOH/g
	ii) Total sludge, after oxidation, Max.	0.03 % by weight
	iii) Max Tan delta	0.1 at 70^{0}C
2.13	Ageing characteristics after accelerated ageing	(open breaker method with copper catalyst)
	i) Specific resistance (resistivity)	
	a) At 27^{0}C Min.	27 X 10^{12} ohm-cm
	b) At 90^{0}C Min	2 X 10^{12} ohm-cm
	ii) Dielectric dissipation factor (tan δ)	0.10 at 90^{0}C Max

Sr No	Item description	Specification requirement
	iii) Total acidity, Max	0.05 mg KOH/g
	iv) Total sludge, Max	0.05 % by weight
2.14	Presence of oxidation inhibitor	no antioxidant additives
2.15	Water content, Max	40 ppm
2.16	List of clients	To be enclosed
2.17	PCA content	3% max
2.18	PCB content	Not detectable

Annexure D Guaranteed Technical Particulars (Data by Seller)

Sr.	Particulars	Specified / Required	Offered
1.0	General		
1.1	Make		
1.2	Type	Oil immersed, core type, step down located generally outdoor but may be located indoor also with poor ventilation. Bidder shall confirm full rating available in indoor location also	
2.0	Nominal Continuous Rating, KVA		
2.1	HV winding	400/630/1000/1600/2000kVA	
2.2	LV winding	400/630/1000/1600/2000kVA	
3.0	Rated voltage (kV)		
3.1	HV Winding	11 kv	
3.2	LV Winding	433 volt	
4.0	Rated current (Amps)	400/630/1000/1600/2000kVA	
4.1	HV Winding		
4.2	LV Winding		
5.0	Connections		
5.1	HV Winding	Delta	
5.2	LV Winding	Star with neutral	
5.3	Vector Group reference	Dyn11	
6.0	Impedance at principal tap rated current and frequency, ohm @75 deg C		
6.1	Impedance	4.5% / 4.5%/ 5.0/6.25/6.25 % with IS tolerance	
6.2	Reactance		
6.3	Resistance		
6.4	Impedance at lowest tap at rated current and frequency		

6.5	Impedance at highest tap at rated current and frequency		
7.0	Resistance of the winding at 75^0 C in ohm		
7.1	a) HV		
7.2	b) LV		
8.0	Zero sequence impedance in ohm		
8.1	a) HV		
8.2	b) LV		
9.0	Guaranteed maximum Total losses at principal tap at 75°C, kW		
9.1	50 % of Load	as per Spec Cl 3.25	
9.2	100% of Load	as per Spec Cl 3.26	
9.3	No Load Loss (Max)		
9.4	Total I^2R losses of windings @ 75 deg C, KW		
9.5	Total stray loses @ 75 deg C, KW		
9.6	Total Load losses (Max.), KW		
9.7	No load loss at maximum permissible voltage and frequency (approx.),kW		
10.0	Temperature rise over reference ambient of 40 ^{0}C		
10.1	Top oil by thermometer ^{0} C	40 ^{0}C	
10.2	Winding by resistance^0 C	45 ^{0}C	
11.0	Efficiency		
11.1	Efficiency at 75^0C and unity power factor %		
11.1.1	at 110% load		
11.1.2	at 100% load		
11.1.3	at 80% load	Not Less than 99.5%	
11.1.4	at 60% load		
11.1.5	at 40% load		
11.1.6	at 20% load		

11.2	Efficiency at 75^0C and 0.8 power factor lag %		
11.2.1	at 110% load		
11.2.2	at 100% load		
11.2.3	at 80% load		
11.2.4	at 60% load		
11.2.5	at 40% load		
11.2.6	at 20% load		
11.3	Maximum efficiency at 75^0C %		
11.4	Load and power factor at which it occurs		
12.0	Regulation , (%)		
12.1	Regulation at full load at 75^0 C		
12.1.1	at unity power factor		
12.1.2	at 0.8 power factor lagging		
12.2	Regulation at 110% load at 75^0 C		
12.2.1	at unity power factor		
12.2.2	at 0.8 power factor lagging		
13.0	Tappings		
13.1	Type		
13.2	Capacity		
13.3	Range-steps x % variation		
13.4	Taps provided on HV winding (Yes / No)		
13.5	Rated current of rotary switch		
14.0	Cooling system		
14.1	Type of cooling	ONAN	
14.2	No. of cooling unit Groups		
14.3	Capacity of cooling units		
14.4	Mounting of radiators		
14.5	Number of Radiators		
14.8	Total radiating surface , sqmm		
14.9	Thickness of radiator tubes, mm	Minimum 1.2 mm	
15.0	Details of Tank		

15.1	Material	Robust mild steel plate without pitting and low carbon content	
15.2	Thickness of sides mm		
15.3	Thickness of bottom mm		
15.4	Thickness of cover mm		
15.5	Confirmation of Tank designed and tested for Vacuum, Pressure (Ref: CBIP Manual) , (Yes/ No)		
15.5.1	Vacuum mm of Hg. / (kN/m^2)	As per IS	
15.5.2	Pressure mm of Hg.		
15.6	Is the tank lid sloped?	Yes	
15.7	Inspection cover provided (Yes / No)	as per spec	
15.8	Location of inspection cover (Yes / No)		
15.9	Min. dimensions of inspection cover (provide list of all inspection cover with dimension), mm x mm		
16.0	Core		
16.1	Type:	Core	
16.2	Core material grade	Premium grade minimum M3 or better	
16.3	Core lamination thickness in mm		
16.4	Insulation of lamination	With insulation coating on both sides	
16.5	Design flux density at rated condition at principal tap, Tesla		
16.6	Maximum flux density at 12.5 % overexcitation /overfluxing, Tesla	1.9 Tesla Max allowed	
16.7	Equivalent cross section area mm^2		
16.8	Guaranteed No Load current at		

	100% rated voltage , Amps		
16.8.1	HV		
16.8.2	LV		
16.9	Guaranteed No Load current At 110% rated voltage, Amps		
16.9.1	HV		
16.9.2	LV		
17.0	Type of Winding		
17.1	HV		
17.2	LV		
17.3	Conductor material	Electrolytic Copper	
17.4	Current density (HV/LV)	Maximum allowed 3.0 A per sq mm.at all taps	
17.5	Gauge/area of cross section of conductor		
17.5.1	a) HV		
17.5.1	b) LV		
17.6	Insulating material		
17.6.1	HV Turn		
17.6.2	LV Turn		
17.6.3	LV Core		
17.6.4	HV - LV		
17.7	Insulating material thickness, mm		
17.7.1	HV Turn		
17.7.2	LV Turn	-	
17.7.3	LV to Core		
17.7.4	HV to LV		
18.0	Minimum design clearance, mm		
18.1	HV to earth in Air		
18.2	HV to earth in oil		
18.3	LV to earth in Air		
18.4	LV to earth in oil		
18.5	Between HV & LV in Air		
18.6	Between HV & LV in oil		

18.7	Top winding and yoke		
18.8	Bottom winding and yoke		
19.0	**Insulating oil**		
19.1	Quantity of oil Ltrs		
19.1.1	In the Transformer tank		
19.1.2	In each radiator		
19.1.4	Total quantity		
19.2	10% excess oil furnished?	Yes	
19.3	Type of Oil	As per cl 4.2.7	
20.0	**Bushing / Support Insulator**		
20.1	Make	-	
20.2	Type		
20.2.1	HV side	As per Cl. 4.2.8.1 of the spec	
20.2.2	LV side	As per Cl. 4.2.8.2 of the spec	
20.3	Reference Standard		
20.4	Voltage class, kV		
20.4.1	HV side Bushing/ Support Insulator	12 kV	
20.4.2	LV side line and neutral bushing/ Support Insulator	1.1 kV	
20.5	Creepage factor for all bushing / Support Insulator mm/KV	31 mm / kV	
20.6	Rated thermal short time current		
20.6.1	HV bushing	25 times rated current for 2 secs.	
20.6.2	LV line and neutral bushing	25 times rated current for 2 secs.	
20.7	Weight, Kg		
20.7.1	HV bushing		
20.7.2	LV line and neutral bushing		
20.8	Free space required for bushing removal, mm		
20.8.1	HV bushing		
20.8.2	LV line and neutral bushing		
21.0	**Terminal connections**		
21.1	HV	Cable size as per Cl no 3.28	

21.2	LV	Cable size as per Cl no 3.30	
21.3	LV Neutral	Cable size as per Cl no 3.30	
22.0	**HV cable box**	Required	
22.1	Suitable for cable type,size	Cable size as per Cl no 3.28	
22.2	Termination height	750 mm min.	
22.3	Gland plate dimension, mm x mm		
22.4	Gland plate Material	MS	
22.5	Gland plate thickness	3 mm min.	
22.6	Phase to phase clearance inside box,mm	180 mm	
22.7	Phase to earth inside box,mm	120 mm	
23.0	**LV Cable box**	Required	
23.1	Suitable for cable type , size	Cable size as per Cl no 3.30	
23.2	Termination height	1000 mm, min.	
23.3	Gland plate dimension, mmxmm		
23.4	Gland plate material	Aluminium	
23.5	Gland plate thickness	5 mm min.	
23.6	Phase to phase	25 mm	
23.7	Phase to earth	25 mm	
24.0	L.V neutral Cable termination arrangement	Separate cable box not required (LV-N to be provided in LV cable box.)	
25.0	Current Transformer on LV phases		
25.1	Type		
25.2	Make		
25.3	Reference Standard		
25.4	CT Ratio		
25.5	Burden, VA		
25.6	Class of Accuracy		
25.7	CT terminal box size		
26.0	Pressure release device		
26.1	Minimum pressure the device is		

	set to rupture		
26.1.1	For Main Tank		
27.0	Fittings Accessories Each Transformer furnished as per Clause No 5. (Bidder shall attach separate sheet giving details, make and bill of materials)		
28.0	Painting: as per clause for the transformer, cable boxes, radiator, Marshalling box (Yes/No)		
29.0	Max over all transformer dimensions	**As per Clause 3.32**	
29.1	Length, mm		
29.2	Breadth, mm		
29.3	Height, mm		
30.0	Transformer Tank Dimensions		
30.1	Length, mm		
30.2	Breadth, mm		
30.3	Height, mm		
31.0	Weight data		
31.1	Core, kG		
31.2	Frame parts, kG		
31.3	Core and frame, kG		
31.4	Total Winding, kG		
31.5	Core , Frame, Winding, kG		
31.6	Tank, kG		
31.7	Tank lid, kG		
31.8	Empty conservator tank, kG		
31.9	Each radiator empty, kG		
31.10	Total weight of all radiators empty, kG		
31.11	Weight of oil in Tank, kG		
31.12	Weight of oil in Conservator, kG		
41.13	Weight of oil in each Radiators,		

	kG		
31.14	Total weight of oil in Radiators, kG		
31.16	Total Transport weight of the transformer, kG		
32.0	Volume Data		
32.1	Volume of oil in main tank, litres		
32.2	Volume of oil between highest and lowest levels of main conservator, litres		
32.4	Volume of oil in each radiator, litres		
32.5	Total volume of oil in radiators, litres		
32.7	Transformer total oil volume, litres		
33.0	Shipping Data		
33.1	Weight of heaviest package, kG		
33.2	Dimensions of the largest package (L x B x H) mm		
34.3	Tests		
34.1	All in process tests confirmed as per Cl. (Yes/ No)		
34.2	All Type Tests confirmed as per Cl. (Yes / No)		
34.3	All Routine Tests confirmed as per Cl. (Yes/ No)		
34.4	All Special Tests confirmed as per Cl. (Yes/ No)		

Annexure E Guaranteed Technical Particulars of Transformer Oil

Bidder to submit hard copy duly filled & signed along with techno commercial offer.
Bidder to submit separate GTP for each type of insulating oil –

Sr No	Item description	Specification requirement	Data by Vendor
1	Manufacturer Name		
1.1	Address		
1.2	Contact person		
1.3	Contact telephone no		
2	Appearance of oil	Clear, transparent and free from suspended matter or sediments	Yes / No
3	Density at 29.5^{0}C Max.	0.89 g/cm^3	
4	Kinematics viscosity Max.	16 cSt at 27^{0}C 11 cSt at 40^{0}C	
5	Interfacial tension at 27^{0}C	0.04 N/m min	
6	Flash point Pensky-Marten (Closed), Min.	140^{0}C	
7	Pour Point, Max	- 15^{0}C	
8	Neutralization value		
	i) Total acidity, Max.	0.03 mg KOH/g	
	ii) Inorganic acidity/ Alkalinity	Nil	
9	Corrosive sulfur	Non-corrosive	
10	Electric strength breakdown voltage	Average value of six samples	
	i) New unfiltered oil. Min.	30 kV (rms) min.	
	ii) After filtration Min.	60 kV (rms)	
11	Dielectric dissipation factor (tan δ).	0.002 at 90^{0}C, Max 0.0005 at 27^{0}C, Max	
12	Specific resistance	(resistivity)	
	i) At 90^{0}C, Min	150 X 10^{12} ohm-cm	
	ii) At 27^{0}C, Min	3000 X 10^{12} ohm-cm	
13	Oxidation stability		
	i) Neutralization value after oxidation, Max.	0.15 mg KOH/g	
	ii) Total sludge, after oxidation, Max.	0.03 % by weight	
	iii) Max Tan delta	0.1 at 70^{0}C	
14	Ageing characteristics after accelerated ageing	(open breaker method with copper catalyst)	
	i) Specific resistance (resistivity)		
	a) At 27^{0}C Min.	27 X 10^{12} ohm-cm	
	b) At 90^{0}C Min	2 X 10^{12} ohm-cm	
	ii) Dielectric dissipation factor (tan δ)	0.10 at 90^{0}C Max	
	iii) Total acidity, Max	0.05 mg KOH/g	

Sr No	Item description	Specification requirement	Data by Vendor
	iv) Total sludge, Max	0.05 % by weight	
15	Presence of oxidation inhibitor	no antioxidant additives	
16	Water content, Max	40 ppm	
17	List of clients	To be enclosed	
18	PCA content	3% max	
19	PCB content	Not detectable	

Annexure – F Recommended Spares (Data by Supplier)

List of recommended spares as following –

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

TECHNICAL SPECIFICATION

FOR

415V AC DISTRIBUTION BOARD

PREPARED BY	REVIEWED BY	APPROVED BY	REV	0
Srinivas Gopu	Gaurav Sharma	Ashwani Aggarwal	DATE	04/12/2017
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1.0 SCOPE

This specification covers the design, engineering, manufacture, assembly and testing at manufacturer's works and supply of 415V AC Distribution board (ACDB) along with all hardware and accessories required for installation and operation.

2.0 STANDARDS & CODES

2.1	IS:8623	Specification for factory built assemblies of switchgear & control gear for voltages up to and including 1000V AC/1200 V DC.
2.2	IS 60947-1	Specification for Low-voltage Switchgear and Controlgear - Part 2 : Circuit Breakers
2.3	IS:10118	Code of practice for selection, installation and maintenance switchgear and controlgear
2.4	IS:2705	Current transformers
2.5	IS:3231	Electrical relays for power system protection
2.6	IS:1248	Electrical Indicating instruments
2.7	IS:4794	Switches and push buttons
2.8	IS:6005	Code of practice of phosphating iron and steel
2.9	IS:5082	Wrought Aluminium and aluminium alloys for electrical purposes
2.10	IS 3043	Code of practice for Earthing

3.0 SERVICE CONDITIONS

3.1	System Configuration	3 Phase 4 Wire with neutral solidly grounded
3.2	Supply Voltage	415 volt +/- 10%
3.3	Supply frequency	50Hz
3.4	Location	Indoor
3.5	Average grade atmosphere	Heavily polluted, Dry
3.6	Maximum altitude above sea level	1000M
3.7	Ambient air temperature	Highest 50Deg C Average 40Deg C
3.8	Minimum ambient air temperature	0 Deg C
3.9	Relative Humidity	100%
3.10	Rainfall	750mm concentrated in four months

4.0 CONFIGURATION

4.1	Incomers	Two incomers, each having motorized 630A MCCB. MCCBs shall have microprocessor based over current and earth fault release. Auto changeover shall be provided between the two incomers alongwith necessary electrical interlocks in event of

		failure of either of the two			
4.2	Outgoing feeders	The number of outgoing feeders from AC boards shall be such that each substation equipment is fed by separate feeder (refer below).			
	Application	**Type of Switchgear**	**No of Poles**	**Rating (A)**	**Quantity**
	Transformer Oil filtration	MCCB	4	100	2
	Welding(Outdoor)	MCB	2	63	4
	Power Socket(Indoor)	MCB	4	32	5
	Outdoor Lighting	MCB	4	32	2
	Indoor Lighting	MCB	4	32	2
	Battery Charger	MCB	4	32	2
	BMK	MCB	4	32	8
	Marshalling Box(PTR)	MCB	4	32	3
	AC Supply	MCB	4	32	2
	UPS	MCB	2	16	1
	11kV Switchgear	MCB	2	16	3
	CRP	MCB	2	16	2
	RTU/SCADA	MCB	2	16	2
	Fire Fighting	MCB	2	16	2
	EPAX	MCB	2	16	1
	Power Socket	MCB	2	16	4

5.0 CONSTRUCTION

5.1	General construction	Board shall be of modular construction with provision for complete compartmentalization of all feeders. It shall be free-standing type comprising dust-tight and vermin-proof sheet steel cabinets suitable for indoor installation with IP-54 degree of protection. Necessary busbar support insulators, cable glands, cable supports and terminal blocks etc. The board shall preferably be of single front type.
5.2	Material	The Board shall be made out of at least 2.0 mm thick cold rolled steel sheet, suitably reinforced to provide flat level surfaces. No welds, rivets, hinges or bolts shall be visible from outside.
5.3	Equipment Mounting	All switches provided on the distribution board shall be on front side of the cabinets, operable from outside. All instruments and control devices shall be mounted on the front of cabinets and fully wired to the terminal blocks.
5.4	Busbar housing	The busbars shall be housed in totally enclosed busbar chambers. Incoming connections from the busbar to various feeders shall be designed so as not to disturb cable connections. Busbar arrangement should ensure safety of the operation/maintenance personnel and facilitate working on any outgoing module without the need for switching off in-feed to the adjacent modules, as far as possible
5.5	Cable alleys	A cable alley preferably 230 mm wide shall be provided in each vertical section for taking cables into the compartments. Cable alleys shall be provided on sides of busbar chamber
5.6	Cable glands	Compression type cable glands shall be provided to hold the cables to avoid any pressure or tension on the terminal block connections.
5.7	Gland Plate	Gland plate shall be 3.0mm thick.
5.8	Doors	The doors of cabinets shall be lockable and shall be fitted with double lipped gaskets.

6.0 BUSBAR

6.1	Material	Busbar shall be of tinned electrolytic copper or aluminium.
6.2	Size	Busbar shall be of tinned electrolytic copper or aluminium.
6.3	Supports	The busbar shall be supported by means of durable non-hygroscopic, non-combustible and non-tracking polyester fibreglass material or porcelain. Supports shall be capable of withstanding the maximum short circuit stresses
6.4	Sleeves and shrouds	Busbars shall be encased in heat-shrinkable sleeves of insulating material which shall be suitable for the operating temperature of busbars during normal service. The busbar joints shall be provided with removable thermosetting plastic shrouds.

7.0 CURRENT TRANSFORMER

7.1	Type	Cast-resin type, Class-E insulation, rated for 120% current continuous
7.2	Provision	Shall be provided in incomer for metering. Separate Neutral CT hall be connected in the neutral for detecting earth fault for both the incomer.
7.3	Secondary current	5A
7.4	Metering CT Class	1.0
7.5	Burden	Based on requirement

8.0 TERMINALS AND WIRING

8.1	Secondary Wiring	
8.1.1	Grade and type	1100 V grade, PVC insulated, FRLS type stranded flexible copper wire.
8.1.2	Ferruling	Each wire shall bear an identifying ferrule or tag at each end or connecting point.
8.1.3	Size	2.5sqmm copper (miminum)
8.2	Terminals	Terminals of appropriate size shall be provided inside each cabinet for incoming and outgoing cables.
8.2.1	Grade	1100 V grade, moulded piece terminals complete with insulated barriers, washers, nuts and lock nuts.
8.2.2	Power Terminals type	Stud type, nut driver operated
8.2.3	Control terminals type	Stud type, screw driver operated suitable for minimum 6sqmm wire.
8.2.4	Spare terminals	20% spare terminals should be provided in each terminal block.
8.2.5	Accessibility	Placement of terminals shall enable proper cable termination. Terminals shall be readily accessible for inspection and maintenance.
8.2.6	Marking	The terminals shall be serially numbered to facilitate installation and maintenance.

9.0 METERS, INDICATIONS AND PUSH BUTTONS

9.1	Meters	
9.1.1	Multifunction Meter	For incomer feeders. Meter should have facility to store peak load current in memory.
9.1.2	Type	Digital with inbuilt phase selector
9.1.3	Accuracy Class	1.0
9.1.4	Auxiliary supply	240VAC with 10 % tolerance

9.2	Indicating lamps	Indicating lamps shall be of low wattage cluster LED type.
9.2.1	Incomer/ Outgoing On	Red
9.2.2	Incomer/ Outgoing Off	Green
9.2.3	Incomer/ Outgoing Trip	Amber
9.3	Push buttons	For manual operation of incomer

10.0 NAME PLATES & MARKINGS

10.1	Panel nameplate	Panel shall have a nameplate clearly indicating the following: a. Panel Serial No.- b. Customer Name - BSES Yamuna Power Ltd c. PO No. & date - d. Type of Panel - e. Current rating - f. Guarantee period -
10.2	Feeder nameplate	Large and bold name plate carrying the feeder identification shall be provided on the top of each module. Blank insert type name plates shall be provided on each outgoing feeder.
10.3	Equipment nameplate	a. All equipment mounted on front side as well as equipment mounted inside the panels shall be provided with individual name plates with equipment designation engraved. b. All front mounted equipment shall also be provided at the rear with individual name plates engraved with tag numbers corresponding to the one shown in the panel internal wiring to facilitate easy tracing of the wiring.
10.4	Danger plate	Panel shall have a danger plate of anodized Aluminium clearly indicating the danger logo and voltage details.
10.5	Material	Non-rusting metal or 3 ply lamicoid. Nameplates shall be black with white engraving lettering. Stickers are not allowed.
10.6	Fixing	All nameplates/rating plates shall be riveted to the panels at all four corners. Bolting/screwing is not acceptable.
10.7	Markings	Each switch shall bear clear inscription identifying its function. Similar inscription shall also be provided on each device whose function is not otherwise identified. If any switch or device does not bear this inscription separate nameplate giving its function shall be provided for it. Switch shall also have clear inscription for each position indicating e.g. Trip-Neutral close, ON-OFF etc.

11.0 FINISHING

11.1	Primer	Two coats
11.2	Finish	Powder Coating
11.3	Colour shade	RAL 7032 (Siemens Grey)

11.4	Paint thickness	70 microns (minimum)

12.0 APPROVED MAKE OF COMPONENTS

12.1	Switch	Siemens / L&T (Salzer)
12.2	HRC Fuse Links	GE/ Siemens/ L&T
12.3	Meters	Rishabh/Schneider/AE
12.4	AC Contractors	L&T/Siemens/Telemechanique/GE/ABB
12.5	Terminals	Connectwell/Elmex/Wago/Phoenix
12.6	Push buttons / Actuator	L&T/Siemens/Vaishno/Schneider
12.7	MCCB	L&T/Siemens/ ABB/GE/Schneider
12.8	MCB	Datar/Legrand/Hager/Schneider/ABB
12.9	Indicating lamps	Vaishno/Binay/Teknic/Siemens/Mimic/C&S

13.0 INSPECTION AND TESTING

13.1	Type test	Equipment should be of type tested quality only, type test certificate to be submitted along with offer. If the manufacturer's lab is accredited by govt. / authorized body then it shall be acceptable for type testing.
13.2	Acceptance & Routine tests	As per relevant Indian standard

14.0 PACKING, SHIPPING, HANDLING & SITE SUPPORT

14.1	Packing Protection	The packing shall be fit to withstand rough handling during transit and storage at destination. The test set should be properly protected against corrosion, dampness & damage.
14.2	Packing for accessories and spares	Robust non-returnable packing case with all the above protection & identification Label. The bidder should get the packing list approved before dispatching the material.
14.3	Packing Identification Label	On each packing case, following details are required:
14.3.1	Individual serial number	
14.3.2	Purchaser's name	
14.3.3	PO number (along with SAP item code, if any) & date	
14.3.4	Equipment Tag no. (if any)	

14.3.5	Destination	
14.3.6	Manufacturer / Supplier's name	
14.3.7	Address of Manufacturer / Supplier / it's agent	
14.3.8	Description	
14.3.9	Country of origin	
14.3.10	Month & year of Manufacturing	
14.3.11	Case measurements	
14.3.12	Gross and net weight	
14.3.13	All necessary slinging and stacking instructions	
14.4	Shipping	The seller shall be responsible for all transit damage due to improper packing.
14.5	Handling and Storage	Manufacturer instruction shall be followed.
14.6	Detail handling & storage instruction sheet / manual to be furnished before commencement of supply.	

15.0 DEVIATIONS

15.1	Deviation	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. No deviation will be acceptable post order.

16.0 DOCUMENTS SUBMISSION

The bidder has to submit the following documents along with bid:-

16.1	List of major customers using the offered product from last 5 years specifying details like customer name, PO no. and PO date, year of supply and supply quantity
16.2	Completely filled compliance GTP sheet as per clause 16.0 of this specification
16.3	Complete product catalogue, Manual and calibration certificate of the equipment
16.4	Type test reports
16.5	Deviation Sheet (if any)

17.0 GUARANTEED TECHNICAL PARTICULARS

S. No.	Description	Specification requirement	Bidder's Data
1	**GENERAL FEATURES**		
1.1	Make		
1.2	Type		
1.3	Reference Standard		
1.4	Rated Operational voltage	415V AC ± 10%	
1.5	Rated Nominal Current	630A	
1.6	Rated frequency	50 Hz (+3%, -5%)	
1.7	Rated Insulation voltage	1100V	
1.8	Rated Impulse withstand voltage	8kV	
1.9	Service supply for heating, lighting and power sockets	240VAC±10%,	
1.10	Mounting	Floor (Free standing)	
1.11	Connections	Cable entry – Bottom	
1.12	Configuration	Single front	
1.13	Enclosure thickness		
1.13.1	Load Bearing Member	>=2.5mm	
1.13.2	Doors and Covers	>=2 mm	
1.14	Enclosure Material	CRCA Sheet	
1.15	Enclosure degree of protection	IP 54	
1.16	Mechanical safety interlocks	As specified in technical specification	
1.17	Power Cable Termination	Shall be as per the specification	
1.18	Paint shade	RAL 7032 (Siemens Grey)	
1.19	Typical vertical section (Overall dimension (mm) and weight (Kg))	Required	
1.19.1	Incomer		
1.19.2	Outgoings		
1.20	Dimensions of the ACDB Panel	L (mm) X D (mm) X H (mm)	
1.21	Weights of the ACDB Panel	(in kg.)	
1.22	Marking on the panel	As per the specification	
2	**INCOMER MCCB**		
2.1	Make & Model of MCCB	Required	
2.2	Catalogue of MCCB	Required	

2.3	Continuous Current at 40 deg C/ 50 deg C	630A	
2.4	Rated ultimate breaking capacity at rated voltage	50kA	
2.5	Rated service breaking capacity Ics	Ics = 100% Icu at rated voltage	
2.6	Rated making current	Icm = 220% Icu	
2.7	Utilization Category	A	
2.8	Overload setting	50 -100% (Inverse time characteristics)	
2.9	Overcurrent setting	200-1000% (Instantaneous characteristics)	
2.10	Earthfault setting	20-100% (Instantaneous)	
2.11	Dimension(HxWxD)	Required	
2.12	Weight	Required	
4	**BUS AND BUS TAPS**		
4.1	Make		
4.2	Material and grade of buses and joints	High conductivity electrolytic grade aluminium	
4.3	Reference standard		
4.4	Continuous Current (at site condition, 50°C ambient) within cubicle	630A	
4.5	Cross sectional Area		
4.6	DC resistance	ohm/m/ph	
4.7	Skin-effect ratio		
4.8	Reactance	ohm/m/ph	
4.9	Losses-middle phase	w/m/ph	
4.10	Minimum clearance of bus bar and joints	Required	
4.10.1	Phase to phase (mm)		
4.10.2	Phase to earth (mm)		
4.11	Bus bar insulation	i. Heat shrinkable sleeves rated for maximum operating voltage	
		ii. Cast resin shrouds for joint	
4.12	Bus joints	Silver	
4.13	Bus bar support insulator	Required	
4.13.1	Spacing (mm)		
4.13.2	Make		
4.13.3	Type		
4.13.4	Reference standard		

4.13.5	Voltage class (kV)		
4.13.6	Minimum creepage distance (mm)		
4.13.7	Cantilever strength (Kg/sq.cm.)		
5	**CURRENT TRANSFORMER**		
5.1	Make		
5.2	Type	Resin Cast	
5.3	Reference standard		
5.4	CT ratios		
5.5	Class of Insulation	Class-E	
5.6	Protection class	5P20	
5.7	Metering class	5	
5.8	VA burden for Relaying CT-Incomer	Based on requirement.	
6.0	**AMMETERS/MULTIFUNCTION METERS AND VOLTMETERS**		
6.1	Make & Model no.		
6.2	Type	Digital	
6.3	Accuracy class	1	
7.0	**CONTROL & INDICATIONS**		
7.1	Push button		
7.1.1	Make and model no.		
7.1.2	Type	Flush mounted type with touch proof terminals	
7.2	LEDs		
7.2.1	Make & Model no.		
7.2.2	Type	Flush mounted type with touch proof terminals	
8.0	**TERMINAL BLOCKS**		
8.1	Make & Model no.		
8.2	Spare terminals	Equal to 20% of active terminals in each TB	
8.3	Power terminals	Stud type, nut driver operated	
8.4	Control terminals	Stud type, screw driver operated suitable for minimum 6sqmm wire.	
9.0	**TESTS**		
9.1	Confirmation of routine tests to be performed as per IS 60947	Yes/No	
9.2	IP 55 test shall be carried out during inspection	Yes/No	
9.3	Confirmation of Type tests to be performed (or report submitted)	Type test report no./date	

	as per IS 60947		
9.4	Confirmation of Acceptance tests to be performed during inspection as per IS 60947	Yes/No	
9.5	Temperature rise test to be carried out at NABL accredited lab.	Yes/No	
10.0	Deviation sheet against each clause of the specification	To be submitted	

TECHNICAL SPECIFICATION

FOR

50VDC/220VDC

DISTRIBUTION BOARD

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1 SCOPE

This specification covers the design, engineering, manufacture, assembly and testing at Manufacturer's works and supply of 220 VDC/50 VDC Distribution board (DCDB) along with all hardware and accessories required for installation and operation.

2 STANDARDS AND CODES

2.1	IS:8623	Specification for factory built assemblies of switchgear & control gear for voltages up to and including 1000V AC/1200 V DC.
2.2	IS 60947-1	Specification for Low-voltage Switchgear and Controlgear - Part 2 :Circuit Breakers
2.3	IS:10118	Code of practice for selection, installation and maintenance switchgear and control gear
2.4	IS:2705	Current transformers
2.5	IS:3231	Electrical relays for power system protection
2.6	IS:1248	Electrical Indicating instruments
2.7	IS:4794	Switches and push buttons
2.8	IS:6005	Code of practice of phosphating iron and steel
2.9	IS:5082	Wrought Aluminium and aluminium alloys for electrical purposes
2.10	IS 3043	Code of practice for Earthing

3 SERVICE CONDITION

3.1	Location	Indoor
3.2	Average grade atmosphere	Heavily polluted, Dry
3.3	Maximum altitude above sea level	1000M
3.4	Ambient air temperature	Highest 50Deg C Average 40Deg C
3.5	Minimum ambient air temperature	0 Deg C
3.6	Relative Humidity	100%
3.7	Rainfall	750mm concentrated in four months
3.8	Seismic Zone	IV

4 CONSTRUCTION

4.1	General construction	It shall be free-standing type comprising dust-tight and vermin-proof sheet steel cabinets suitable for indoor installation with IP-54 degree of protection. Necessary busbar support insulators, cable glands, cable supports and terminal blocks etc. The board shall preferably be of single front type.
4.2	Material	The Board shall be made cold rolled steel sheet having Thickness of 2.5 mm of load bearing member and 2 mm for Doors and covers , suitably reinforced to provide flat level surfaces. No welds, rivets, hinges or bolts shall be visible from outside.
4.3	Equipment Mounting	All switches provided on the distribution board shall be on front side of the cabinets, operable from outside. All instruments and control devices shall be mounted on the front of cabinets and fully wired to the terminal blocks.
4.4	Busbar housing	The busbars shall be housed in totally enclosed busbar chambers. Incoming connections from the busbar to various feeders shall be designed so as not to disturb cable connections. Busbar arrangement should ensure safety of the operation/maintenance personnel and facilitate working on any outgoing module without the need for switching off in-feed to the adjacent modules, as far as possible
4.5	Cable alleys	A cable alley preferably 230 mm wide shall be provided in each vertical section for taking cables into the compartments. Cable alleys shall be provided on sides of busbar chamber.
4.6	Cable entry	Cable entry should be from bottom
4.7	Cable glands	Compression type cable glands shall be provided to hold the cables to avoid any pressure or tension on the terminal block connections.
4.8	Gland Plate	Gland plate shall be 3.0mm thick.
4.9	Doors	The doors of cabinets shall be lockable and shall be fitted with double lipped gaskets.
4.10	Gasket	All doors, removable covers and panels shall be gasketed all around with neoprene gaskets. Gaskets shall be embedded through machine only.
4.11	Ventilating louvers	Ventilating louvers shall have screens and filters. The screens shall be made of either brass or GI wires mesh.
4.12	Foundation	The panels shall be fixed on the embedded foundation channels with intervening layers anti vibration strips made of shock absorbing materials.
4.13	Base Frame	Base frames shall be supplied along with panels. 100mm channel painted black.

4.14	Mounting	Equipment on front of panel shall be flush mounted. No equipment shall be mounted on the doors.
4.15	Working level	The center lines of switches, push buttons and indicating lamps shall not be less than 750mm and higher than 1600mm from panel base.
4.16	Dimension	500(L)X500(D)X1800(H) mm^3

5 CONFIGURATION

5.1	Incomers	One incomers having Double Pole DC MCB with Aux Switch.		
5.2	Outgoing feeders	All outgoing feeders shall have MCB. Number of outgoing feeders shall be as per table attached		
Application		**No of Poles**	**Rating of DP MCB(In Amp)**	**Quantity**
Incomer		2	100	1
Emergency Lighting DB		2	32	1
Fire Alarm System		2	32	1
SCADA		2	32	2
CRP		2	32	4
11 kV Switchgear		2	32	4
Testing Purpose		2	32	1
NIFPS		2	32	4
Spare 1		2	100	1
Spare 2		2	32	8

6 BUSBARS

6.1	Material	Busbar shall be of tinned electrolytic copper or Aluminium
6.2	Size	Suitable for carrying the rated continuous current of 100 A and short circuit current of 15 kA. Busbars shall be continuous throughout the panel. Temperature rise should be limited to 40 degrees over ambient.
6.3	Supports	The busbar shall be supported by means of durable non-hygroscopic, non-combustible and non-tracking polyester fiberglass material or porcelain. Supports shall be capable of withstanding the maximum short circuit stresses.
6.4	Sleeves and shrouds	Busbars shall be encased in heat-shrinkable sleeves of insulating material which shall be suitable for the operating temperature of busbars during normal service. The busbar joints shall be provided with removable thermosetting plastic shrouds.

7 TERMINALS AND WIRING

7.1	Wiring	
7.1.1	Grade and type	1100 V grade, PVC insulated, FRLS type stranded flexible copper wire.
7.1.2	Ferruling	Each wire shall bear an identifying ferrule or tag at each end or connecting point.
7.1.3	Spare	20% Spare Wiring
7.2	Terminals	Terminals of appropriate size shall be provided inside each cabinet for incoming and outgoing cables.
7.2.1	Grade	1100 V grade, moulded piece terminals complete with insulated barriers, washers, nuts and lock nuts.
7.2.2	Power Terminals type	Stud type, nut driver operated
7.2.3	Control terminals type	Stud type, screw driver operated
7.2.4	Spare terminals	20% spare terminals should be provided in each terminal block.
7.2.5	Accessibility	Placement of terminals shall enable proper cable termination. Terminals shall be readily accessible for inspection and maintenance.
7.2.6	Marking	The terminals shall be serially numbered to facilitate installation and maintenance.

8 METERS, INDICATIONS, PUSH BUTTONS & HEATERS

8.1	Meters	
8.1.1	Ammeter	DC Moving coil ammeter of size 96 sq.mm. with external shunt. Rating of Ammeter shall be 0-100A DC.
8.1.2	Voltmeter	DC Moving coil voltmeter of size 96.sq.mm to read the DC Bus voltage. Rating of Voltmeter shall be 0-300VDC
8.1.3	Type	Digital type, connected through instruments transformers of suitable rating.
8.2	Indicating lamps	Indicating lamps shall be of low wattage cluster LED type.
8.2.1	Incomer/ Outgoing On	Red
8.2.2	Incomer/ Outgoing Off	Green
8.2.3	Incomer/ Outgoing Trip	Amber
8.3	Push buttons	For manual operation of incomer MCB
8.4	Heaters	Cubicle space heater having rating of 100W. Thermostat for space heater shall be provided with temperature range 0-90^0
8.5	CFL	Cubicle lamp shall be provided in DCDB having rating of 11 W.

9 NAME PLATES & MARKINGS

9.1	Panel nameplate	Panel shall have a nameplate clearly indicating the following: a. Panel Serial No.- b. Customer Name - BSES Yamuna Power Ltd c. PO No. & date - d. Type of Panel - e. Current rating - f. Guarantee period -
9.2	Feeder nameplate	Large and bold name plate carrying the feeder identification shall be provided on the top.
9.3	Equipment nameplate	a. All equipment mounted on front side as well as equipment mounted inside the panels shall be provided with individual name plates with equipment designation engraved. b. All front mounted equipment shall be also provided at the rear with individual name plates engraved with tag numbers corresponding to the

		one shown in the panel internal wiring to facilitate easy tracing of the wiring.
9.4	Material	Non-rusting metal or 3 ply lamicoid. Nameplates shall be black with white engraving lettering. Stickers are not allowed.
9.5	Fixing	All nameplates/rating plates shall be riveted to the panels at all four corners. Bolting/screwing is not acceptable.
9.6	Markings	Each switch shall bear clear inscription identifying its function. Similar inscription shall also be provided on each device whose function is not other wise identified. If any switch or device does not bear this inscription separate nameplate giving its function shall be provided for it. Switch shall also have clear inscription for each position indicating e.g. Trip-Neutral close, ON-OFF etc.

10 FINISH

10.1	Primer	Two coats
10.2	Paint	Two finishing coats of epoxy based paint of Shade RAL 7032 with glossy finish.
10.3	Paint thickness	50 microns (minimum)

11 APPROVED MAKES OF COMPONENTS

11.1	Switch	Siemens / L&T (Salzer)
11.2	HRC Fuse Links	GE/ Siemens/ L&T
11.3	Meters	Rishabh/Schneider/AE
11.4	Terminals	Connectwell/Elmex/Wago/Phoenix
11.5	Push buttons / Actuator	L&T/Siemens/Vaishno/Schneider
11.6	MCB	Datar/Legrand/Hager/Schneider/ABB
11.7	Indicating lamps	Vaishno/Binay/Teknic/Siemens/Mimic/C&S

12 INSPECTION AND TESTING

12.1	Type test	Equipment should be of type tested quality only, type test certificate to be submitted along with offer. If the manufacturer's lab is accredited by govt. / authorized body then it shall be acceptable for type testing.
12.2	Acceptance & Routine tests	As per relevant Indian standard

13 PACKING, SHIPPING, HANDLING AND SITE SUPPORT

13.1	Packing Protection	The packing shall be fit to withstand rough handling during transit and storage at destination. The test set should be properly protected against corrosion, dampness & damage.
13.2	Packing for accessories and spares	Robust non-returnable packing case with all the above protection & identification Label. The bidder should get the packing list approved before dispatching the material.
13.3	Packing Identification Label	On each packing case, following details are required:
13.3.1	Individual serial number	
13.3.2	Purchaser's name	
13.3.3	PO number (along with SAP item code, if any) & date	
13.3.4	Equipment Tag no. (if any)	
13.3.5	Destination	
13.3.6	Manufacturer / Supplier's name	
13.3.7	Address of Manufacturer / Supplier / it's agent	
13.3.8	Description	
13.3.9	Country of origin	
13.3.10	Month & year of Manufacturing	
13.3.11	Case measurements	
13.3.12	Gross and net weight	

13.3.13	All necessary slinging and stacking instructions	
13.4	Shipping	The seller shall be responsible for all transit damage due to improper packing.
13.5	Handling and Storage	Manufacturer instruction shall be followed.
13.6	Detail handling & storage instruction sheet / manual to be furnished before commencement of supply.	

14 DEVIATIONS

14.1	Deviation	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. No deviation will be acceptable post order.

15 DOCUMENT SUBMISSION

Drawing submission shall be as per the matrix given below. All documents/ drawing shall be provided on A3/A4 sheet in box file with separators for each section. Also provide USB containing pdf with bid for soft copy. Language of the documents shall be English only. Deficient/ improper document/ drawing submission may liable for rejection

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
15.1	Contact Person Name, Email ID and Mobile Number	Required			
15.2	Deviation Sheet	Required	Required		
15.3	Type Test	Required			
15.4	Any Technological Advancement in DCDB	Required			
15.5	Manufacturer's quality assurance plan and certification for quality standards				
15.6	General Arrangement		Required		
15.7	Door Layout		Required		
15.8	Internal Layout		Required		

15.9	SLD		Required		
15.10	Schematic Circuit diagram		Required		
15.11	Bus Bar Arrangement		Required		
15.12	Cable Alley Arrangement		Required		
15.13	GTP	Required	Required		
15.14	QAP		Required		
15.15	BOQ		Required		
15.16	Foundation diagram		Required		
15.17	TB Detail		Required		
15.18	Name Plate Detail		Required		
15.19	Make of all Component as per specification		Required		
15.20	Inspection Report			Required	
15.21	As manufacturing Drawings			Required	
15.22	Operation and Maintenance Manual			Required	Required
15.23	Trouble shooting manual			Required	Required
15.24	As built Drawings				Required
15.25	Test Report				Required

16 GUARANTEED TECHNICAL PARTICULARS

S. No.	Description	Specification requirement	Bidder's Data
16.1	**GENERAL FEATURES**		
16.1.1	Make		
16.1.2	Type		
16.1.3	Reference Standard		
16.1.4	Rated Operational voltage	220 VDC/50 VDC	
16.1.5	Rated Nominal Current	100	

16.1.6	Rated Insulation voltage	1100V	
16.1.7	Rated Impulse withstand voltage	8kV	
16.1.8	Service supply for heating, lighting and power sockets	240VAC±10%	
16.1.9	Mounting	Floor (Free standing)	
16.1.10	Connections	Cable entry – Bottom	
16.1.11	Configuration	Single front	
16.1.12	Enclosure thickness		
a	Load Bearing Member	>=2.5mm	
b	Doors and Covers	>=2 mm	
c	Gland Plate	3 mm	
16.1.13	Enclosure Material	CRCA Sheet	
16.1.14	Enclosure degree of protection	IP 54	
16.1.15	Power Cable Termination	Suitable for 4CX50 Sq.mm Al	
16.1.16	Paint shade	RAL 7032 (Siemens Grey)	
16.1.17	Typical vertical section (Overall dimension (mm) and weight (Kg))	Required	
16.1.18	Incomer		
16.1.19	Outgoings		
16.1.20	Dimensions of the DCDB Panel	500(L)X500(D)X1800(H) mm3	
16.1.21	Weights of the DCDB Panel	(in kg.)	
16.1.22	Marking on the panel	As per the specification	
16.1.23	Cable Alley Width	230 mm	
16.1.24	Cable Gland	Compression Type	
16.1.25	Gasket Material	Neoprene	
16.1.26	Ventilating louvers	Required	
16.1.27	Base Frame	100mm channel	

16.2	**MCB**		
16.2.1	Make	**Datar/Legrand/Hager/Schneider/ABB**	
16.2.2	Incomer	100A	
16.2.3	Emergency Lighting DB	32A	
16.2.4	Fire Alarm System	32A	
16.2.5	SCADA	32A	
16.2.6	CRP	32A	
16.2.7	11 kV Switchgear	32A	
16.2.8	Testing Purpose	32A	
16.2.9	NIFPS	32A	
16.2.10	Spare 1	32A	
16.2.11	Spare 2	32A	
16.3	**BUS AND BUS TAPS**		
16.3.1	Make		
16.3.2	Material	Tinned electrolytic copper or Aluminium	
16.3.3	Reference standard		
16.3.4	Continuous Current (at site condition, 50°C ambient) within cubicle		
16.3.5	Short Circuit withstand Current for 1 sec	15 KA	
16.3.6	Cross sectional Area		
16.3.7	DC resistance	ohm/m/ph	
16.3.8	Reactance	ohm/m/ph	
16.3.9	Losses-middle phase	w/m/ph	
16.3.10	Minimum clearance of bus bar and joints	Required	

16.3.11	Phase to phase (mm)		
16.3.12	Phase to earth (mm)		
16.3.13	Bus bar insulation	i. Heat shrinkable sleeves rated for maximum operating voltage	
		ii. Cast resin shrouds for joint	
16.3.14	Bus joints	Silver	
16.3.15	Bus bar support insulator	Required	
16.3.16	Spacing (mm)		
16.3.17	Make		
16.3.18	Type		
16.3.19	Reference standard		
16.3.20	Voltage class (kV)		
16.3.21	Minimum creepage distance (mm)		
16.3.22	Cantilever strength (Kg/sq.cm.)		
16.4	**Wiring and Terminals**		
16.4.1	**Wiring**		
a	Grade and type	1100 V grade, PVC insulated, FRLS type stranded flexible copper wire.	
b	Ferruling	Each wire shall bear an identifying ferrule or tag at each end or connecting point.	
c	Spare	20% Spare Wiring	
16.4.2	**Terminals**		
a	Grade	1100 V grade, moulded piece terminals complete with insulated barriers, washers, nuts and lock nuts.	
b	Power Terminals type	Stud type, nut driver operated	
c	Control terminals type	Stud type, screw driver operated	
d	Spare terminals	20% spare	
e	Accessibility	Placement of terminals shall enable proper cable termination. Terminals shall be readily accessible for inspection and maintenance.	
f	Marking	The terminals shall be serially numbered to facilitate installation and maintenance.	
16.5	**METERS, INDICATIONS, PUSH BUTTONS & HEATERS**		

16.5.1	Ammeter	DC Moving coil ammeter of size 96 sq.mm. with external shunt. Rating of Ammeter shall be 0-100A DC.	
a	Model No Ammeter		
b	Make of Ammeter		
16.5.2	Voltmeter	DC Moving coil voltmeter of size 96.sq.mm to read the DC Bus voltage. Rating of Voltmeter shall be 0-300VDC	
a	Model No Voltmeter		
b	Make of Voltmeter	Rishabh/Schneider/AE	
c	Type	Digital type	
16.5.3	Indicating lamps	Cluster LED type.	
a	Make of Indicating lamps	Vaishno/Binay/Teknic/Siemens/Mimic/C&S	
b	Incomer/ Outgoing On	Red	
c	Incomer/ Outgoing Off	Green	
d	Incomer/ Outgoing Trip	Amber	
e	Push buttons Make	L&T/Siemens/Vaishno/Schneider	
16.5.4	Heaters	Cubicle space heater having rating of 100W. Thermostat for space heater shall be provided with temperature range 0-90^0	
16.5.5	CFL	Cubicle lamp shall be provided in DCDB having rating of 11 W.	
16.6	**NAME PLATES & MARKINGS**		
a	Panel nameplate	Panel Serial No.-	
b		Customer Name - BSES Yamuna Power Ltd	
c		PO No. & date -	
d		Type of Panel -	
e		Current rating -	
f		Guarantee period -	

16.6.1	Feeder nameplate	As per Spec	
a	Equipment nameplate	As per Spec	
b	Material	As per Spec	
c	Fixing	As per Spec	
d	Markings	As per Spec	
16.7	**FINISH**		
a	Primer	Two coats	
b	Paint	Two finishing coats of epoxy based paint of Shade RAL 7032 with glossy finish.	
c	Paint thickness	50 microns (minimum)	

TECHNICAL SPECIFICATION

FOR

SMPS BASED BATTERY CHARGER

Prepared by	Reviewed by	Approved by	Rev	00
			Date	12 Apr 2019
AH	GS	AA	Page	1 of 11

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1 SCOPE OF SUPPLY

This specification covers the design, manufacturing, testing, supply, erection & commissioning of 220 VDC/ 50 VDC SMPS based 2X100% Float Cum Boost Charger at site for indoor installation with all necessary accessories associated with it.

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2 CODES & STANDARDS

Material, equipment and methods used in the manufacture of battery charger shall confirm to the latest edition of following

Indian Electricity Rules	
Indian electricity act	
CBIP manual	
IS 3895	Specification for rectifier equipment in general
IS 5921	Printed circuit boards
IS 6619	Safety code for semiconductor devices
IS 4540	Semiconductor rectifier assemblies and equipment
IS 694	PVC Insulated Cables for Working Voltage up to and including 1100V
IS 1248	Direct Acting Electrical indicating instruments
IS 2705	Current transformer
IS 3156	Voltage transformer
IS 3231	Electric relay for power system protection
IS 5578	Guide for making of insulated conductors
IS 8623	Low voltage switchgear and control gear assemblies
IS 13703	Low voltage fuses for voltages not exceeding 1000AC
IS 12063	Degree of enclosure protection
IS5	Color of mixed paints
IS 6297	Transformer & inductors for electronic equipment
IS 6553	Environment requirements for semiconductor device
IS 4007	Terminals for electronic equipment

3 SERVICE CONDITIONS

3.1	Max Ambient Temperature	50 deg C
3.2	Max Daily average ambient temp	40 deg C
3.3	Min Ambient Temp	0 deg C
3.4	Maximum Humidity	95%
3.5	Minimum Humidity	10%
3.6	Maximum annual rainfall	750 mm
3.7	Average no of rainy days per annum	60

3.8	Rainy months	June to Oct
3.9	Altitude above MSL	300 M
3.10	Seismic Zone	IV

4 CHARGER DESIGN FEATURES

4.1	Type	SMPS Based
4.2	Rating	a. 70 A for 50 V b. 35 A for 220 V
4.3	Configuration	2X100% Float cum Boost Charger.
4.4	Incoming Supply	Provision of Two Incoming Supply with Auto Changeover Facility
4.5	Panel type	Metal enclosed frame construction
4.6	Overall Dimension	L - 1500 mm x D - 700 mm x H - 1900 mm
4.7	Cable Entry	Bottom
4.8	Location	Indoor, non air conditioned environment
4.9	Doors for front access	With anti theft hinge &handle
4.10	Cover for rear access	With Allen screw M6 size & handle
4.11	Construction	Sheet metal 2.0mm thick CRCA
4.12	Base frame	75mm ISMC
4.13	Lifting lugs	Four number
4.14	Gland plate	3mm metallic, un drilled & removable type
4.15	Enclosure protection	IP42 Minimum
4.16	Power terminal	Bus bar type, minimum 300mm above gland plate
4.17	Control terminal	Nylon66 with brass clamp
4.18	Bus bar	Tinned copper with insulation sleeve
4.19	Earth bus bar	Aluminum sized for rated fault duty for 1sec
4.20	Earth bus internal connection to all non current carrying metal parts	By copper flexible wire 2.5 sqmm
4.21	Earth bus external connection to owner earth	Al bus on both sides of panel with two holes for M10 bolt
4.22	Cooling	Natural ventilation without fan
4.23	Panel heater	Thermostatically controlled through MCB
4.24	Panel internal wiring	Multi strand flexible color coded PVC insulated copper wire 1.5 sqmm 1100volt grade with 1.5 sqmm ferruling (other than circuit wiring related to PCB cards)
4.25	Input isolation transformer	Dry type
4.26	Isolation & protection device	Mounted at height minimum 1000mm from bottom
4.26.1	MCCB	For charger input, output & battery input
4.26.2	Battery & test resistor load	Lockable change over switch with one position for charger, second for ‘OFF’ & third position for external test resistor.
4.27	Hardware (Nut, bolts & handle)	Stainless steel
4.28	Essential provision	Surge suppression, harmonic suppression, blocking

		diodes, filters for ripple control
4.29	Insulating shrouds	On all live parts, power semi conductors & electronic components
4.30	Ripple content in DC output	0.5 % maximum
4.31	DC output voltage regulation	Maximum ±1% of rating with AC input supply variation of ±10% from 415 volts, frequency variation of ±5% from 50 HZ and simultaneous load variation of 0-100%
4.32	Reverse polarity connection	Protected against reversed battery polarity
4.33	Charger efficiency	90% minimum at Rated Load
4.34	Noise output	65DB maximum
4.35	Charger selector switch	For auto/manual and float/boost selection, lockable type inside panel
4.36	Charging current settings	25% to 100% of rating
4.37	Charging current accuracy	2% of set current with input voltage variation of ±10% and frequency variation of ±5%
4.38	Auto and Manual DC output adjustment range for float & boost charge (voltage & current)	By potentiometers inside panel, range suitable for battery bank. Charger suitable for other type of batteries if offered, shall be subject to buyer's approval.
4.39	Louvers	With stainless steel wire mesh
4.40	Gasket	Neoprene rubber
4.41	Panel illumination lamp with door switch	MCB controlled, with 5/15amp switch socket
4.42	Panel door keys	4 no. per panel, identical key for all panels
4.43	PCBs for electronic circuitry	With protective layer finish at back
4.44	PCB soldering	Preferably by wave soldering process
4.45	PCB/ electronic card mounting	With press fit type locking arrangement
4.46	Semiconductor component mounting	Shall not be on bakelite sheet

5 METERING, ANNUNCIATION & INDICATION

5.1	Ammeter (96x96mm)	Digital type, for AC input, DC output & battery current. Auxiliary supply for meters should be 48V to 230V AC/DC (Universal type)
5.2	Voltmeter (96x96mm)	Digital type, with selector switch for AC input, DC output & battery voltage. Auxiliary supply for meters should be 48V to 230V AC/DC (Universal type)
5.3	LED indication on panel front	
5.3.1	Status	
5.3.1.1	Input AC supply available on R,Y & B phase	Red/yellow/blue color LED
5.3.1.2	Float cum Boost charger AC MCCB 'ON'	Red color LED for each charger module
5.3.1.3	Charger output DC 'ON'	Red color LED for each charger module
5.3.1.4	Outgoing DCDB feeder ON	Red color LED for each other
5.3.2	Fault	

5.3.2.1	DC earth fault	Amber color LED
5.3.2.2	Battery MCCB OFF	Amber color LED
5.3.2.3	Charger output DC under/ over voltage	Amber color LED
5.3.2.4	AC mains undervoltage	Amber color LED
5.4	Annunciation	Hooter with isolating switch for fault annunciation.
5.5	Potential free contacts for remote indication to be wired upto terminal block	a. AC under voltage b. AC over voltage c. CH-A AC MCCB trip/OFF d. CH-B AC MCCB trip/OFF e. CH-A Rect/Cond. fuse fail f. CH-B Rect/Cond. fuse fail g. CH-A DC MCCB trip/OFF h. CH-B DC MCCB trip/OFF i. Battery MCCB trip/OFF j. CH-A DC under voltage k. CH-B DC under voltage l. CH-A DC over voltage m. CH-B DC over voltage n. Battery DC under voltage o. Battery DC over voltage p. DC Bus over voltage q. DC Earth fault r. Battery Charger in boost mode
5.6	Microprocessor based monitoring unit cum controller	Charger should have a microprocessor based controller
5.6.1	Analog signals to be monitored by controller	a. AC Input Voltage and current b. DC output voltage and current for Charger -1 and Charger -2 c. Battery voltage and current
5.6.2	Alarms/Faults signals to be monitored by controller	a. AC under voltage b. AC over voltage c. CH-A AC MCCB trip/OFF d. CH-B AC MCCB trip/OFF e. CH-A Rect/Cond. fuse fail f. CH-B Rect/Cond. fuse fail g. CH-A DC MCCB trip/OFF h. CH-B DC MCCB trip/OFF i. Battery MCCB trip/OFF j. CH-A DC under voltage k. CH-B DC under voltage l. CH-A DC over voltage m. CH-B DC over voltage n. Battery DC under voltage o. Battery DC over voltage p. DC Bus over voltage q. DC Earth fault r. Battery Charger in boost mode

5.6.3	SCADA Interfacing	Microprocessor controller should have RS485 port capable of transmitting all analog and alarm/fault signal to RTU on open MODBUS protocol. Any hardware/software required to achieve the said compatibility shall be in bidder's scope.
5.6.4	Display	Backlit display capable of displaying all the analog and fault/alarm signals mentioned above.

6 APPROVED MAKE OF COMPONENTS

6.1	Switch	Siemens / L&T (Salzer)
6.2	HRC Fuse Links	GE/ Siemens/ L&T
6.3	Diodes & SCR	Hirect/USHA/IOR
6.4	Meters	AE/Rishabh
6.5	AC Contractors &O/L Relay	L&T/Siemens/Telemechanique/GE/ABB
6.6	Terminals	Connectwell/Elmex/Wago/Phoenix
6.7	Push buttons / Actuator	L&T/Siemens/Vaishno
6.8	MCCB	L&T/Siemens/ ABB/GE
6.9	MCB	Datar/Legrand/Hager/Schneider
6.10	Indicating lamps LED type	Vaishno/Binay/Teknic/Siemens/Mimic

7 MIMIC DIAGRAM, LABEL & FINISH

7.1	Mimic diagram	To be provided
7.2	Name plate on panel front	
7.2.1	Material	Anodized aluminum 16SWG
7.2.2	Background	SATIN SILVER
7.2.3	Letter, diagram & boder	Black
7.2.4	Process	Etching
7.2.5	Name plate details	a. Manufacturer name b. Month & year of manufacture c. Equipment type d. Input & Output rating e. Owner name & order number f. Guarantee period g. Weight of panel h. Degree of protection i. Sr. No.
7.3	Labels for meters, indication & all cards / sub assemblies in panel	Anodized aluminum with white character on black background
7.4	Danger plate on front & rear side	Anodized aluminum with white letters on red background
7.5	Painting surface preparation	Shot blasting or chemical 7 tank process
7.6	Painting external finish	Powder coated polyester base grade A, shade –RAL 7032, uniform
7.7	Painting internal finish	Powder coated polyester base grade A, shade – white, uniform thickness 50 micron minimum

7.8	Labels for all components in panel	Anodized aluminum with white character on black background, fixed by rivets only
7.9	SLD	SLD of charges shall be provided at backside of the main door of Charger on Aluminium plate

8 QUALITY ASSURANCE, INSPECTION & TESTING

8.1	Vendor quality plan	To be submitted for purchaser approval
8.2	Inspection points	To be mutually identified & agreed in quality plan
8.3	Type test	Equipment should be of type tested quality only, type test certificate to be submitted along with offer. If the manufacturer's lab is accredited by govt. / authorized body then it shall be acceptable for type testing.
8.4	Routine test	As per relevant Indian standard
8.5	Acceptance test	To be performed in presence of Owner at manufacturer works a. Physical inspection & BOM, wiring check b. Insulation resistance test c. HV test for one minute d. Voltage regulation test e. Heat run test for 12 hours f. Measurement of efficiency, power factor & ripple content

9 DEVIATIONS

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

10 GTP

Vendor must submit clause wise compliance against specification at the time of drawing approval clearly highlighting the deviations from specification against each clause.

11 DRAWING AND DATA SUBMISSION MATRIX

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
11.1	Contact Person Name, Email ID and Mobile Number	Required	Required		
11.2	Deviation Sheet (as per "Deviations" Clause)	Required			
11.3	GTP		Required		
11.4	Relevant Type Test as per IS/IEC/UL	Required	Required		
11.5	Manufacturer's quality assurance plan and certification for quality standards		Required		
11.6	Sizing Calculation of Associated Equipment		Required		
11.7	Recommended Spares for five years of operation)		Required		
11.8	**Battery Charger Drawing**				
11.8.1	General Arrangement	Required	Required		
11.8.2	Sectional Layout		Required		
11.8.3	Cabinet Layout		Required		
11.8.4	SLD	Required	Required		
11.8.5	Schematic Circuit diagram and Scheme of Each type of Panel		Required		
11.8.6	Communication Architecture		Required		
11.8.7	QAP		Required		
11.8.8	BOQ		Required		
11.8.9	Plan		Required		
11.8.10	Foundation Diagram		Required		
11.8.11	Make of all Component as per specification		Required		
11.8.12	Drawing of Substation Room		Required		
11.9	Installation, erection and commissioning manual		Required		
11.10	Inspection Reports			Required	
11.11	As manufacturing Drawings			Required	

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
11.12	Operation and Maintenance Manual			Required	
11.13	Trouble shooting manual			Required	
11.14	As built Drawings				Required

12 PACKING

12.1	Packing Protection	Against corrosion, dampness, heavy rains, breakage and vibration. During transportation/ transit and storage, module may be subjected to outdoor conditions. Hence, packing of each panel shall be weatherproof.
12.2	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection & identification Label
12.3	Packing Identification Label to be provided on each packing case with the following details	
12.3.1	Individual serial number	
12.3.2	Purchaser's name	
12.3.3	PO number (along with SAP item code, if any) & date	
12.3.4	Equipment Tag no. (if any)	
12.3.5	Destination	
12.3.6	Project Details	
12.3.7	Manufacturer / Supplier's name	
12.3.8	Address of Manufacturer / Supplier / it's agent	
12.3.9	Description and Quantity	
12.3.10	Country of origin	
12.3.11	Month & year of Manufacturing	
12.3.12	Case measurements	
12.3.13	Gross and net weights in kilograms	
12.3.14	All necessary slinging and stacking instructions	
12.4	Packing Protection	Against corrosion, dampness, heavy rains, breakage and vibration. During transportation/ transit and storage, module may be subjected to outdoor conditions. Hence, packing of each panel shall be weatherproof.
12.5	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection & identification Label
12.6	Packing Identification Label to be provided on each packing case with the following details	
12.6.1	Individual serial number	
12.6.2	Purchaser's name	

12.6.3	PO number (along with SAP item code, if any) & date
12.6.4	Equipment Tag no. (if any)
12.6.5	Destination
12.6.6	Project Details
12.6.7	Manufacturer / Supplier's name
12.6.8	Address of Manufacturer / Supplier / it's agent
12.6.9	Description and Quantity
12.6.10	Country of origin
12.6.11	Month & year of Manufacturing
12.6.12	Case measurements
12.6.13	Gross and net weights in kilograms
12.6.14	All necessary slinging and stacking instructions

13 SHIPPING

13.1	Shipping	The bidder shall ascertain at an early date and definitely before the commencement of manufacture, any transport limitations such as weights, dimensions, road culverts, Overhead lines, free access etc. from the Manufacturing plant to the project site. Bidder shall furnish the confirmation that the proposed Packages can be safely transported, as normal or oversize packages, up to the site. Any modifications required in the infrastructure and cost thereof in this connection shall be brought to the notice of the Purchaser.
		The seller shall be responsible for all transit damage due to improper packing.

14 HANDLING AND STORAGE

14.1	Handling and Storage	Manufacturer instruction shall be followed. Detail handling & storage instruction sheet / manual needs to be furnished before commencement of supply.

TECHNICAL SPECIFICATION

FOR

50 V & 220 V

Li-ION BATTERY BANK

Prepared by	Reviewed by	Approved by	Page 1 of 10	
			Rev	00
AH	GS	AA	Date	11 Apr 2019

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1.0 SCOPE

This specification covers the design, manufacture, testing, supply, erection & commissioning of 50 V & 220 V Li Ion Battery Bank.

2.0 CODES & STANDARDS

Material, equipment and methods used in the manufacturing of Li Ion battery shall confirm to the latest edition of following standard

Standard Name / No	Standard's Description
Indian Electricity Act	Latest Edition
CBIP manual	Latest Edition
IEC 62281	Safety of primary and secondary lithium cells and batteries during transport
UL 1642	Individual cell compliance
UL 1973	Battery module complies

3.0 SERVICE CONDITIONS

3.1	Max Ambient Temperature	50 deg C
3.2	Max Daily average ambient temp	40 deg C
3.3	Min Ambient Temp	0 deg C
3.4	Maximum Humidity	95%
3.5	Minimum Humidity	10%
3.6	Maximum annual rainfall	750 mm
3.7	Average no of rainy days per annum	60
3.8	Rainy months	June to Oct
3.9	Altitude above MSL	300 M
3.10	Seismic Zone	IV

4.0 DC DISTRIBUTION SYSTEM DATA

4.1	DC Supply	2 wire, with positive & negative polarity
4.2	Earth reference	Unearthed system
4.3	Voltage	50 VDC / 220 VDC
4.4	Application - Industrial	Standby DC back up for switchgear control supply & SCADA RTU

5.0 GENERAL FEATURES

5.1	Number of Modules	6 (Maximum)
5.2	Connection of Modules	Parallel
5.3	DC battery bank Ah rating	300 Ah for 50 V / 150 Ah for 220 V
5.4	Voltage Output	50V / 220 V
5.5	Battery Efficiency	>90%
5.6	Gas Evolution from Battery	None
5.7	DC load curve	With High discharge characteristics.
5.8	Location of Module	Indoor
5.9	Ingress Protection	IP 4X
5.10	Installation	On cabinet, painted with anti corrosive paint.
5.11	Battery type	Li Ion Battery
5.12	Cell Chemistry	Nickel Cobalt Manganese
5.13	Battery lifting/withdrawing arrangement	Suitable arrangement on Module
5.14	Battery Module marking	PO Number and Date, Customer Name- BSES Yamuna Power Limited, Manufacturer name, month & year of manufacturer, Warranty Period, Nominal voltage, rated Ah capacity & cell number , Customer Care Number
5.15	Terminal polarity marking	Positive & negative marked on Module
5.16	Battery cell shorting metal links	Nickel plated copper with protective insulating sleeve
5.17	Insulating shrouds	For all battery terminals & shorting links
5.18	Insulating pads for battery rack	At the bottom of rack supports, made from high impact material
5.19	Battery suitable for Ripple content	5% minimum in DC charger output
5.20	Key parameters	Design capacity, full charge capacity, remaining capacity, state of charge, state of health, cycle count, total voltage, current, max cell voltage, min cell voltage, max cell temp, min cell temp, max FET temp., Life Cycle, Charging Current

6.0 BATTERY MANAGEMENT SYSTEM

Module must comprise BMS(Battery Management System) which monitors battery internal vital parameters, measures and displays various alarms/warnings; establish a communication link with the external system i.e. Charger, SCADA..Commissioning and communication of the module with SCADA shall also be in Vendor's scope.

6.1	**Communication**	
6.1.1	Protocol For SCADA Interface	Modbus
6.1.2	Port	RS-485
6.1.3	Key Battery Parameters to be Integrated With SCADA	Design Capacity (DC)
6.1.4		Full Charge Capacity (FCC)
6.1.5		Remaining Capacity (RC)
6.1.6		State of Charge (SOC)
6.1.7		State of Health (SOH)
6.1.8		Cycle Count
6.1.9		Total Voltage
6.1.10		Current
6.1.11		Life Cycle
6.1.12		Charging Current
6.1.13		Max. Cell Voltage
6.1.14		Min. Cell Voltage
6.1.15		Max. Cell Temperature
6.1.16		Min. Cell Temperature
6.1.17		Max. FET Temperature
6.1.18	Status LED	Dual color type
6.1.19	SOC LED	Dual color type
6.1.20	In-built data logging	Upto 6 months
6.1.21	Protection feedback to SCADA	From S.No 6.2.7 to 6.2.13
6.2	**Safety Feature**	
6.2.1	Module reverse polarity protection	
6.2.2	Internal fuse	
6.2.3	Controllable internal fuse	
6.2.4	Protective terminal covering to avoid unintentional contact	
6.2.5	Secondary level hardware protection for overvoltage	
6.2.6	Heat propagation resistant cell holding structure	
6.2.7	Overvoltage protection	
6.2.8	Under voltage protection	

6.2.9	Over charging current protection
6.2.10	Over discharge current protection
6.2.11	Over temperature during discharge protection
6.2.12	Over temp during charge protection
6.2.13	Over internal FET temp protection
6.3	**Arrangement for Bypassing the BMS**

7.0 CABINET

7.1	Panel Type	Simplex panel with Dimension 0.6x0.6 x1.4 m^3 Max.
7.2	Pocket	Pocket for Drawing is required
7.3	Display	Local Display on Cabinet shall be provided having key battery Parameter
7.4	Ingress Protection	IP4X in accordance with IS 13947
7.5	Cooling	Natural
7.6	Enclosure material	Pre-galvanized, cold-rolled sheet steel of thickness not less than 2.0 mm. Stiffeners shall be provided wherever necessary.
7.7	Doors	Double leaf doors shall be provided at the rear. Doors shall have handles with built-in locking facility
7.8	Gland Plate	At least two separate gland plates of removable type with gasket shall be provided for each panel. They shall be of sheet steel of thickness not less than 3.0 mm.
7.9	Gaskets	All doors, removable covers and panels shall be Gasketed all around with neoprene gaskets
7.10	Foundation	The panels shall be fixed on the embedded foundation channels with intervening layers anti vibration strips made of shock absorbing materials
7.11	Base Frame	Base frames shall be supplied along with panels.

8.0 EQUIPMENT LIST

8.1	Battery Cabinet
8.2	Battery Module
8.3	Communication cable
8.4	DC power cable
8.5	Cable terminal block/bus-bar
8.6	Earth cable

8.7	Tools and Accessories for Maintenance
8.8	Mandatory and Recommended Spares if Any

9.0 INSPECTION & TESTING

9.1	Type test	Equipment shall be type tested from CPRI/ERDA/NABL accreted lab as per IEC/IS/UL standard.
9.2	Routine test	As per relevant standard
9.3	Acceptance test	To be performed in presence of Owner at manufacturer works shall be as per approved QAP
9.4	Heating Compliance	JIS C8712
9.5	ROHS Compliance	Required

10.0 GTP

Vendor Must Submit clause wise compliance against specification at the time of drawing approval.

11.0 DEVIATIONS

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

12.0 DRAWING AND DATA SUBMISSION MATRIX

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
12.1	Contact Person Name, Email ID and Mobile Number	Required	Required		
12.2	Deviation Sheet (as per “Deviations” Clause)	Required			
12.3	GTP		Required		
12.4	Relevant Type Test as per IS/IEC/UL	Required	Required		

12.5	Manufacturer's quality assurance plan and certification for quality standards		Required		
12.6	Sizing Calculation of Associated Equipment		Required		
12.7	Recommended Spares for five years of operation)		Required		
12.8	**Li Ion drawing**				
12.8.1	General Arrangement	Required	Required		
12.8.2	Sectional Layout		Required		
12.8.3	Cabinet Layout		Required		
12.8.4	Battery Layout		Required		
12.8.5	SLD	Required	Required		
12.8.6	Schematic Circuit diagram and Scheme of Each type of Panel		Required		
12.8.7	Communication Architecture		Required		
12.8.8	QAP		Required		
12.8.9	BOQ		Required		
12.8.10	Plan		Required		
12.8.11	Foundation Diagram		Required		
12.8.12	Make of all Component as per specification		Required		
12.8.13	Drawing of Substation Room		Required		
12.9	Installation, erection and commissioning manual		Required		
12.10	Inspection Reports			Required	
12.11	As manufacturing Drawings			Required	
12.12	Operation and Maintenance Manual			Required	
12.13	Trouble shooting manual			Required	
12.14	As built Drawings				Required

13.0 PACKING

13.1	Packing Protection	Against corrosion, dampness, heavy rains, breakage and vibration. During transportation/ transit and storage, module may be subjected to outdoor conditions. Hence, packing of each panel shall be weatherproof.
13.2	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection & identification Label
13.3	Packing Identification Label to be provided on each packing case with the following details	
13.3.1	Individual serial number	
13.3.2	Purchaser's name	
13.3.3	PO number (along with SAP item code, if any) & date	
13.3.4	Equipment Tag no. (if any)	
13.3.5	Destination	
13.3.6	Project Details	
13.3.7	Manufacturer / Supplier's name	
13.3.8	Address of Manufacturer / Supplier / it's agent	
13.3.9	Description and Quantity	
13.3.10	Country of origin	
13.3.11	Month & year of Manufacturing	
13.3.12	Case measurements	
13.3.13	Gross and net weights in kilograms	
13.3.14	All necessary slinging and stacking instructions	

14.0 SHIPPING

14.1	Shipping	The bidder shall ascertain at an early date and definitely before the commencement of manufacture, any transport limitations such as weights, dimensions, road culverts, Overhead lines, free access etc. from the Manufacturing plant to the project site. Bidder shall furnish the confirmation that the proposed Packages can be safely transported, as normal or oversize packages, up to the site. Any modifications required in the infrastructure and cost thereof in this connection shall be brought to the notice of the Purchaser.
		The seller shall be responsible for all transit damage due to improper packing.

15.0 HANDLING AND STORAGE

15.1	Handling and Storage	Manufacturer instruction shall be followed. Detail handling & storage instruction sheet / manual needs to be furnished before commencement of supply.

16.0 QUALITY AND ASSURANCE

16.1	Vendor quality plan	To be submitted for purchaser approval
16.2	Inspection points	To be mutually identified & agreed in quality plan

CONTROLLED COPY

BSES

Specification
Of
Control Cables

Specification no : SP-EWLP-01-R1

Prepared by		Approved by		Revision	Date
Name	Sign.	Name	Sign.		
Hemanshi Kaul		K Sheshadri		01	23, April'2012

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General Specification

1.0.0 Codes & Standards : The cables shall be designed, manufactured and tested in Accordance with the following Indian & IEC standards.

National Standards

Indian Standards	
IS- 1554 Part-1	PVC insulated Cables
IS- 5831 : 1984	PVC insulation & sheath of electric cables.
IS- 10810 : 1984	Methods of test for cables.
IS- 8130 : 1984	Conductors for insulated electric cables and flexible cords.
IS- 3975 : 1999	Mild steel wires, formed wires and tapes for armouring of cables.

International Standards

IEC 60228 Ed.3.0 b	Conductors of insulated cables.
IEC 60332-3-21 Ed.1.0 b	Tests on electric cables under fire conditions. Part 3-21. Tests on bunched wires or cables.
IEC 60502-1 Ed. 2.1 b	Power cables with extruded insulation and their accessories for rated voltage from 1kV upto 30kV –Part 1: cables for rated voltages of 1kV and 3kV
IEC 60811	Common test methods for insulating and sheathing materials of electric cables.
IEC 60885 Ed.1.0 b	Electric test methods for electric cables.
IEC 60227	PVC insulated cables of rated voltages up to and including 450/750 V.
IEC 60028 Ed. 2.0 b	International Standard of Resistance for Copper

2.0.0	Cable construction Features	Size & dimensions of each item mentioned under this clause shall be followed as detailed out in GTP, refer Annexure B
2.1.1	Conductor	
	Stranded, plain copper, circular	Shall be made from high conductivity copper rods
2.1.2	Insulation	Extruded PVC Insulation Type A as per IS 5831
2.1.3	Core Identification	As per Cl.10.1 (f) of IS-1554 Part-1
2.1.4	Inner Sheath	Extruded Inner Sheath of Black PVC type ST-2 as per IS 5831
2.1.5	Armour	a) As per Cl 13.2 of IS 1554 Part-1: Galvanized steel round wire armour. b) Minimum area of coverage of armouring shall be 90 %.
2.1.6	Outer Sheath	a) Extruded outer sheath of PVC type ST-2 as per IS 5831
		b) Colour : Black
		d) The Outer Sheath shall be embossed with:
		d-1 : The voltage designation
		d-2 : Type of construction / cable code (for e.g. AYWY)
		d-3 : Manufacturers Name or Trade mark
		d-4 : Number of Cores and nominal cross sectional area of conductors

	Continue…Outer Sheath	d-5 : The drum progressive length of cable at every metre.
		d-6 : Name of buyer i.e. BSES
		d-7 : Month & Year of Manufacturing
		d-8: P.O.No. and P.O.Date
2.1.7	Sealing of Cable end	Both ends of the cable shall be sealed with PVC Cap.
4.0.0	Testing & Inspection	Tests shall be carried out in accordance with IEC / IS standards.
		a) Routine Test: As per IS 1554 part -1
		b) Type Test
		b-1: Cables must be of type tested quality . Type test reports shall be submitted for the type, size & rating of cable offered along with bid.
		b-2 : If the manufacturer's lab is accredited by govt. /authorised body then it shall be acceptable for type testing.
		b-3 : Type test on one cable drum of each rating and type , from first lot, shall be conducted at Govt. approved / Internationally accredited labs.
		c) Acceptance test : Shall be conducted as per IS 1554 Part-1 for each lot of cable
		c1) A minimum of two samples per Purchase order shall be drawn after receipt of cable in BSES stores for chemical composition and purity test of aluminium. Bidder to bear cost of test.
		d) Inspection
		d-1 :The Buyer reserves the right to witness all tests specified on completed cables
		d-2 : The Buyer reserves the right to inspect cables at the Sellers works at any time prior to dispatch, to prove compliance with the specifications.
		d-3 : In-process and final inspection call intimation shall be given in advance to purchaser.
		e) Test certificates: Three sets of complete test certificates (routine & acceptance tests) need to be submitted along with the delivery of cables.

5.0.0	Drawing, Data & Manuals	
5.0.1	To be submitted along with bid	The seller has to submit:
		a) Cross section drawing of cable
		b) Completely filled GTP
		c) Type test certificates
		d) Complete cable catalogue and Manual
		along with the bid.
5.0.2	After award of contract	Within 15 days, the seller has to submit four sets of above-mentioned drawings for buyer's approval.
5.0.3	Final As Built	6 sets hardcopy + One Soft copy of all documents including type test certificates
6.0.0	Drum Length & tolerance	500+ - 5% Mtr.
6.0.1	Overall tolerance in cable Length	- 2 %
6.0.2	Short length of cables	a) Minimum acceptable short length shall be above 100 Mtrs. Manufacturer shall be required to take prior approval from Engineering for any short length supply.
		b) Manufacturer shall not be allowed to put two cable pieces of different short lengths in same cable drum.
7.0.0	Packing, Shipping, Handling & Storage	
	a) Drum Identification Labels	
		a-1 Drum identification number
		a-2 Cable voltage grade
		a-3 Cable code (e.g. YWY)
		a-4 Number of cores and cross sectional area
		a-5 Cable quantity (Metres)
		a-6 Purchase order number and SAP item code
		a-7 : Total weight of cable and drum (kg)
		a-8 : Manufacturer's & Buyer's name
		a-9 : Month & Year of Manufacturing
		a-10 : Direction of rotation of drum
		a-11 : Cable length initial reading & end reading shall be marked on drum. Cable starting end shall be taken out from winding to read this drum reading with proper sealing to protect against external damage.
	b) Shipping information	The seller shall give complete shipping information

		concerning the weight, size of each package.
	c) Transit damage	The seller shall be held responsible for all transit damage due to improper packing.
	d) Type of Drum	Wooden drums with anti termite treatment. (The drums shall be with M.S. spindle plate with nut-bolts)
8.0.0	Quality Assurance	
8.0.1	Vendor quality plan	To be submitted for purchaser approval
8.0.2	Inspection points	To be mutually identified & agreed in quality plan
9.0.0	Progress reporting	
9.0.1	Outline Document	To be submitted for purchaser approval for outline of production, inspection, testing, inspection, packing, dispatch, documentation programme
9.0.2	Detailed Progress report	To be submitted to Purchaser once a month containing i) Progress on material procurement ii) Progress on fabrication (As applicable) iii) Progress on assembly (As applicable) iv) Progress on internal stage inspection v) Reason for any delay in total programme vi) Details of test failures if any in manufacturing stages vii) Progress on final box up Constraints / Forward path
10.0.0	Deviation	a) Deviations from this specification are only acceptable where the Seller has listed in his quotation the requirements he cannot, or does not, wish to comply with and the Buyer has accepted, in writing, the deviations before the order is placed.
		b) In the absence of a list of deviations, it will be assumed by the Buyer that the Seller complies fully with this specification.

Annexure – A

Scope & Project Specific Details

1.0.0 Scope

1.0.0	Scope	Design, manufacture, testing & supply of Control cables
2.0.0	Delivery Schedule	To be filled up as per purchase requisition.

2.0.0 Document Submission

Submission of of drawings, calculations, catalogues, manuals, test reports shall be as follows

	Along with offer	For Approval after award of contract	Final after approval	Remarks
Drawings	2 copies (Typical drgs)	2 copies	2 copies + 1 soft copy in CD	See Clause 5.0.0 for details of required drawings
Calculations	2 copies (Typical)	2 copies		
Catalogues	1 copy			
Type Test Report	2 copies			Type test and sample routine test reports

Annexure- B

GUARANTEED TECHNICAL PARTICULARS

(Standard Cable sizes are 4c x2.5, 8c x 2.5, 12c x2.5, 16c x 2.5, 19 c x 2.5, 27c x 2.5 Sqmm & 4c x 4, 8c x 4, 10c x 4 Sqmm)

For each size separate GTP need to be furnished

Sr.	Description	Buyer's requirement	Seller's data
	Purchase Req. No.	….	
	Guarantee Period: 5 Years	60/66 Months	
1.0	Make	….	
2.0	Type (AS PER IS 1554 part -1)	YWY	
3.0	Voltage Grade (KV)	1.1	
4.0	Maximum Conductor temperature		
A	Continuos (° C)	70°C	
B	Short time (° C)	160°C	
5.0	Conductor		
A	Size (mm2)	2.5 / 4 sq mm	
B	No. of wires in each conductor Nos.	As per Manufacturer standard	
C	Dia. of wires in each conductor before compaction (mm)	As per Manufacturer standard	
D	Shape of Conductor	As per Cl.2.1.1 of specification	
E	Diameter over conductor mm	….	
F	Maximum Conductor resistance at 20 ° C (Ohm/Km)	As per Table 2 of IS 8130	
6.0	Insulation	As per Table 1 of IS:5831 – 1984	
A	Nominal thickness (mm)	As per Cl.2.1.2 of specification & Table 2 of IS 1554(Part-1)	
B	Minimum thickness (mm)		
C	Core Identification	As per Cl.10.1 (f) of IS: 1554 (Part-1)	
D	Diameter over Insulation (mm) Approx.	….	
7.0	Inner Sheath	As per Table 2 of IS:5831 – 1984	
A	Minimum thickness (mm)	As per Table 4 of IS 1554(Part-1)	

B	Approx. dia. Over sheath (mm)- Apprx.	….	
8.0	Galvanised Steel Armour	As per Cl 2.1.5 of specification	
A	Number of armour wire	As per Manufacturer Std.	
B	Nominal Dia of Round Wire	As per Table 5 of IS 1554(Part-1)	
C	Dia. over Armour – Approx.	….	
D	Lay Ratio	….	
E	Confirm minimum 90% coverage (submit calculation)		
9.0	Outer Sheath	As per Table 2 of IS:5831 – 1984	
A	Thickness (Minimum)	As per Table 7 of IS 1554(Part-1)	
B	Colour	Black	
10.0	Approx. overall dia. (mm)	….	
11.0	Drum Length & tolerance	As per Spec.Cl. 6.0.0	
12.0	End Cap	Required	
13.0	Drums provide with MS Spindle plate & Nut bolts arrangement	Required	
14.0	Net Weight of cable (Kg/Km.) – Approx.	….	
15.0	Continuous current rating for standard I.S. condition laid Direct		
	a) In ground 30° C Amps	….	
	b) In duct 30° C Amps	….	
	c) In Air 40° C Amps	….	
16.0	Short circuit current for 1 sec of conductor. (KAmp)	….	
17.0	Electrical Parameters at Maximum Operating temperature:		
A	Resistance (Ohm/Km) (AC Resistance)	….	
B	Reactance at 50 C/s (Ohm/Km)	….	
C	Impedance (Ohm/Km)	….	
D	Capacitance (Micro farad / KM)	….	
18.0	Recommended minimum bending radius	…. x O/D	

TECHNICAL SPECIFICATION
FOR
LT POWER CABLE
(Single & Multi-Core)
Specification No. : SP-LTPC-63-R0

PREPARED BY	REVIEWED BY	APPROVED BY	REV	00
Ankita Arora	Gaurav Sharma	Devender Sharma	DATE	August 19, 2015
Ankita	Gaurav		PAGE	1 of 35

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1.0 SCOPE OF SUPPLY

The specification covers design, manufacture, shop testing, packing and delivery of 1100 Volts grade, Aluminium conductor, and XLPE insulated multi core power cables.

2.0 CODES & STANDARDS

The cables shall be designed, manufactured and tested in Accordance with the following Indian & IEC standards.

2.1	IS- 7098 (Part-1)	Cross linked polyethylene insulated PVC sheathed cables for working voltages upto and including 1100V.
2.2	IS- 6474	Polyethylene insulation & sheath of electric cables.
2.3	IS- 5831	PVC insulation and sheath of electrical cables.
2.4	IS : 10810	Methods of tests for cables.
2.5	IS : 8130	Conductors for insulated electrical cables and flexible cords.
2.6	IS : 3975	Low carbon galvanized steel wires, formed wires and tapes for armouring of cables.
2.7	IS- 4026	Aluminum ingots, billets and wire bars (EC grade)
2.8	IS-5484	EC Grade aluminium rod produced by continuous casting and rolling
2.9	IS : 10418	Specification for drums for electric cables.
2.10	IS : 3961	Recommended current ratings for cables.
2.11	IS:1255	Installation and Maintenance of power cables upto and including 33 kV rating.
2.12	IS:4826	Specification for hot-dipped galvanized coatings on round steel wires
2.13	IS:1717	Metallic Materials – Wire – Simple torsion test
2.14	IEC 60228	Conductors of insulated cables. Guide to the dimensional limits of circular conductors.
2.15	IEC 60331	Fire resisting characteristics of electric cables.
2.16	IEC 60332 - 3	Tests on electric cables under fire conditions. Part 3: Tests on bunched wires or cables.

2.17	IEC 60502	Extruded solid dielectric insulated power cables for rated voltages from 1kV to 30 kV.
2.18	IEC 60754 - 1	Test on gases evolved during combustion of materials from cables. Part 1: Determination of the amount of halogen acid gas evolved during combustion of polymeric material taken from cables.
2.19	IEC 60811	Common test methods for insulating and sheathing materials of electric cables.
2.20	IEC 60885	Electric test methods for electric cables.
2.21	IEC 60304	Standard colours for insulation for low frequency cables and wires.
2.22	IEC 60227	PVC insulated cables of rated voltages up to and including 450/750 V.
2.23	IEC 1034	Measurement of smoke density of electric cables burning under defined conditions.

3.0 CABLE DESIGN

Description of each item mentioned in the specification (the text, BOQ, GTP or any site specific requirement) shall be followed along with IS:7098 – P1

3.1	Conductor	a) Electrolytic Grade Stranded Aluminium Conductor b) Grade: H2 as per IS:8130/1984 c) Class 2 d) Chemical composition as per IS 4026 e) Shape : i) Compacted Circular for sizes up to 16 sqmm and for Single core cables. ii) Sector shaped for sizes above 25Sqmm
3.2	Insulation	Extruded XLPE Insulation as per IS:7098 Part-1
3.3	Core Identification	As per Cl.10 of IS 7098 Part-1

3.4	Inner Sheath	Extruded Inner Sheath of Black PVC type ST-2 (IS:5831-1984)
3.5	Armour	a) For 2CX10Sqmm - Galvanized Steel Wire b) For all sizes above 10Sqmm – Galvanized Steel Strip. c) Not applicable for Single core cables of sizes i.e. 500 & 630 sqmm d) Minimum area of coverage of armouring shall be 90% e) The breaking load of armour joint shall not be less than 95% of that of armour wire/strip. f) Zero negative tolerance for thickness of armour strip shall be as per IS:3975. g) Zinc rich paint shall be applied on strip/wire and its joint surface.
3.6	Outer Sheath	a) Extruded outer sheath of PVC (ST-2) shall be as per IS:5831. b) Colour : Yellow (For Multi core cables) Black (For Single core 500 /630 Sqmm) c) Outer sheath of all the LT cables shall be UV resistant; as these cables are laid in air exposed to sun. Bidder to ensure the same for these requirements supported by required test. d) Shape of the cable over the outer sheath shall be circular, when manufactured /completed. Regular Ovality check shall be carried out at Factory, to detect any abnormality. Manufacturing quality shall be such that cable will retain its circular shape, even after it is laid at site.

		e) The Outer Sheath shall be embossed with following minimum text: (i) The voltage designation (ii) Type of construction / cable code (for e.g. A2XFY) (iii) Manufacturers Name / Trade mark (iv) Number of Cores and nominal cross sectional area of conductor. (v) Progressive (Sequential) length of cable at every meter, starting from zero for every drum. Colour filled in for the progressive marking, shall be with proper contrast in colouring. (vi) Name of buyer i.e. BYPL (BSES Yamuna Power Limited) (vii) Month & Year of Manufacturing (viii) IS reference, i.e. IS:7098 (ix) P.O No. and Date (x) Font size shall be 5/5mm (xi) ISI mark The embossing shall be progressive, automatic, in line and marking shall be legible and indelible.
3.7	Bending Radius	Bending Radius of cable shall comply to IS:1255.
3.8	Sealing of Cable end	Both ends of the cable shall be sealed by means of non-hygroscopic heat shrinkable HDPE caps.

4.0 CABLE DRUM

4.1	Reference Standard	Cable drums shall comply with IS: 10418.
4.2	Type of Drum	Wooden drums with anti termite treatment. (The drums shall be provided with M.S. spindle plate and nut-bolts arrangement as per IS:10418).

4.3	Drum Length & Tolerance	500 +/ - 5% Mtr
4.4	Overall Tolerance	+/-2 % for the total cable length for the entire order.
4.5	Short Length of Cables	a) Minimum acceptable short length shall be 1% of the total ordered quantity and no length shall be less than 250Mtrs. Manufacturer shall be required to take prior approval from Engineering for any short length supply. Short length will be accepted in last lot. b) Manufacturer shall not be allowed to put two cable pieces of different short lengths in same cable drum.
4.6	Preventive Measure for Cable Drum	a) The surface of the drum and the outer most cable layer shall be covered with water proof layer. b) Ferrous part of wooden drum shall be treated with suitable rust preventive paint/coating to minimize rusting during storage.
4.7	Drum Identification Labels	a) Drum identification number b) Cable voltage grade c) Cable code (eg. A2XFY/A2XWY) d) Number of cores and cross sectional area e) Cable quantity i.e. cable length (Meters) f) Purchase order number, date and SAP item code g) Total weight of cable and drum (kg) h) Manufacturer's and Buyer's name i) Month & year of manufacturing j) Direction of rotation of drum; An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled. k) Cable length final end-markings (i.e. reading at the inner end and reading at the outer end, just before packing shall be marked on the drum).

5.0 Packing, Shipping, Handling & Storage

5.1	Shipping Information	The seller shall give complete shipping information concerning the weight, size of each package.
5.2	Transit Damage	The seller shall be held responsible for all transit damage due to improper packing.
5.3	Cable Drum Handling	The drums shall be with M.S spindle plate (with nut-bolts) of adequate size to suit the spindle rods, normally required for handling the drums, according to expected weight of the cable drums as per IS:10418

6.0 Quality Assurance, Testing & Inspection

All the tests shall be carried out in accordance with IEC / IS standards.

6.1	Quality Assurance Plan	As per Annexure – E. In event of order Manufacturer has to submit the signed copy of QAP.
6.2	Inspection hold points	AS per QAP
6.3	Routine Test	a) Measurement of Electrical Resistance b) HV test with power frequency AC voltage
6.4	Type Test	a) Cables must be of type tested quality. Type test reports shall be submitted for the type, size and rating of cable offered along with bid. Type test shall not be more than 5 years old. In event of type test being older than 5 years, bidder has to conduct the same at CPRI/ERDA, NABL approved Lab without commercial implication to BSES. b) Bidder supplying cable to BSES for the first time shall have to conduct type test on sample randomly selected from lot in event of order from CPRI/ERDA. c) UV resistance test to be carried out on one sample from CPRI/ERDA as per ASTM standard (sample shall meet minimum 80% retention after exposure of 21 days as per ASTM standard).

6.5	Acceptance Test (Shall be conducted as per Cl.15.2 of IS 7098 Part-1 for each lot of cable)	a) **For cable sizes upto 50sqmm** – one sample for chemical composition and purity test of aluminium shall be conducted per 100km of ordered quantity and multiple thereof. b) **For cable sizes above 50sqmm** – one sample for chemical composition and purity test of aluminium shall be conducted per 50km of ordered quantity and multiple thereof. c) Chemical composition and purity test of aluminium shall be conducted from the lot offered to BSES on each size involved in the purchase order. Test shall be carried out at NABL accredited third party laboratory without any price implication to BSES. d) The sample will be selected either during acceptance test or after receipt of cable in BSES stores.
6.6	Inspection	a) The buyer reserves the right to witness all tests specified on completed cables. b) The buyer reserves the right to inspect cables at the seller's works at any time prior to dispatch either in finished form or during manufacturing, to prove compliance with the specifications. c) In-process and final inspection call intimation shall be given in advance to purchaser/CES.
6.7	Test Certificates	Complete test certificates (routine & acceptance tests) need to be submitted along with the delivery of cables.

7.0 Drawing, Data & Manuals

7.1	To be submitted along with bid	The vendor has to submit: a) Cross section drawing of cable b) Completely filled GTP c) Type test certificates d) Complete cable catalogue and manual along with the bid e) Copy of BIS licence
7.2	After award of contract	Within 7 days, the seller has to submit four sets of above mentioned drawings for buyer's approval along with the signed copy of QAP (Annexure – E).

7.3	Final As Built	6 sets hardcopy + One Soft copy of all documents including type test certificates

8.0 Progress Reporting

8.1	Outline Document	To be submitted for purchaser approval for outline of production-inspection, testing-inspection, packing, dispatch, documentation programme.
8.2	Detailed Progress Report	To be submitted to purchaser once a month containing (i) Progress on material procurement (ii) Progress on fabrication (As applicable) (iii) Progress on assembly (As applicable) (iv) Progress on internal stage inspection (v) Reason for any delay in total programme (vi) Details of test failures if any in manufacturing stages (vii) Progress on final box up constraints/forward path

9.0 Deviation

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. No deviation will be acceptable post order.

10.0 Technical Particulars

a. GTP - As per Annexure-B for Multi-core cables.
b. GTP - As per Annexure-C for Single-core cables (500sqmm and 630sqmm cables).
c. Armour Coverage Percentage – As per Annexure-D.
d. Quality Assurance Plan – As per Annexure-E.
e. List of sub-vendors for Raw Material – As per Annexure-F.

Annexure – A

Scope & Project Specific Details

1.0.0 Scope

1.0.0	Scope	Design, manufacture, testing & supply of L.T Power Cables
2.0.0	Delivery Schedule	To be filled up as per purchase requisition.

2.0.0 Document Submission

Submission of of drawings, calculations, catalogues, manuals, test reports shall be as follows

	Along with offer	For Approval after award of contract	Final after approval	Remarks
Drawings	2 copies (Typical Drawings)	2 Copies	2 Copies + 1 soft copy in CD	See Clause 7.0 for details of required drawings
Calculations	2 Copies (Typical)	2 Copies		
Catalogues	1 Copy			
Type Test Report	2 Copies			Type test and sample routine test reports

ANNEXURE – B

GUARANTEED TECHNICAL PARTICULARS (Multi-core)

(Standard Cable sizes are 2cx10, 2c x25, 4cx25, 4cx95 4c x50, 4c x150, 4c x 300)

For each size /rating separate GTP need to be furnished

S.No.	Description	Buyer's Requirement	Seller's data
	Purchase Req. No.	….	
	Guarantee Period: (Min)	60 Months (from date of commissioning) / 66 months (from date of receipt at purchaser's store) whichever is earlier	
	Applicable IS / IEC Standard followed by vendor	IS 7098 Part -1 / IEC 60502	
1	**Make**	….	
2	**Type (as required by purchaser)**		
A	For 2CX10Sqmm	A2XWY	
B	For Sizes above 10Sqmm	A2XFY	
3	**Voltage Grade (kV)**	1.1	
4	**Maximum Conductor temperature**		
A	Continuous	90°C	
B	Short time	250°C	
5	**Conductor**		
A	Material and Grade	As per Cl.3.1	

B	Make of Al	Ref Annexure E	
C	Size (mm^2)	…… sq mm	
D	Min no. of wires in each conductor (Nos.)	As per Manufacturer Standard	
E	Min Dia. of wires in each conductor before compaction (mm)	As per Manufacturer Standard	
F	Shape of Conductor	As per Cl.3.1 (e)	
G	Diameter over conductor (mm)	……	
H	Maximum Conductor resistance at 20 ° C (Ohm/Km)	As per Table 2 of IS 8130	
6	**Insulation**		
A	Insulation Material	As per Cl. 3.2	
B	Nominal thickness (mm)	As per Table 3 of IS 7098 Part-1	
C	Diameter over Insulation (mm) Approx.	……	
D	Make of insulation compound	Ref: Annexure E	
7	**Inner Sheath**		
A	Material and Type	As per Cl. 3.4	
B	Minimum thickness	As per Table 5 of IS 7098 Part-1	
C	Approx. dia. Over sheath (mm)	……	
8	**Galvanized Steel Armour**	As per manufacturer's standard and as per purchaser's site - specific condition	
A	Material		
a)	**For 2CX10Sqmm**	G.I.Wire	
(i)	Wire Dia (mm)	1.4+/-0.040	

(ii)	No. of wires	As per Manufacturer Standard	
b)	**For sizes above 10Sqmm**	G.I.Strip	
(i)	Strip size (Width and Thickness)	4x0.8 (Zero negative tolerance for thickness)	
(ii)	No. of Strips	As per Manufacturer Standard	
B	Area covered by Armour	Min 90% and calculations shall be strictly as per Annexure D	
C	Dia. over Armour – Approx.	……	
9	**Outer Sheath**		
A	Material and Type	As per Cl. 3.6	
B	Minimum Thickness	As per Table 8 of IS 7098 Part-1	
C	Colour	Yellow	
D	Embossing Details	As per Cl.3.6 (f)	
10	**Approx. overall dia. (mm)**	……	
11	**Overall order tolerance**	± 2 % for the total cable length for the entire order	
12	**Cable Drum**		
A	Type of Drum	Wooden	
B	Drum Length & tolerance	As per Spec.Cl. 4.3 & 4.4	
C	Marking on Drum	As per Spec.Cl. 4.7	
D	Drums provide with MS Spindle plate & nut-bolts arrangement (as per IS:10418)	Required	

13	**End Cap**	Required	
14	**Weights**	……	
a)	Net Weight of cable (Kg/Km.) – Approx		
b)	Weight of empty drum	Kg	
c)	Weight of cable with drum	Kg	
15	**Continuous current rating for standard I.S condition laid direct**		
a)	In ground 30° C	Amps	
b)	In duct 30° C	Amps	
c)	In Air 40° C	Amps	
16	**Short circuit current for 1 sec of Conductor (kAmp)**	……	
17	**Electrical Parameters at Maximum operating temperature:**		
A	AC Resistance	Ohm/Km	
B	Reactance at 50 C/s	Ohm/Km	
C	Impedance	Ohm/Km	
D	Capacitance	Micro farad / Km	
18	**Recommended minimum bending radius**	..... x O/D	
19	**Derating factor for following Ambient temperature in**	Ground / Air	
a)	At 30° C		
b)	At 35° C		
c)	At 40° C		

d)	At 45° C		
e)	At 50° C		
20	**Group factor for following Nos. of cables laid**	Touching / Trefoil	
a)	3 Nos.		
b)	4 Nos.		
c)	5 Nos.		
d)	6 Nos.		
21	**Process of Cross linking of Polyethylene**	Dry cure	
22	**Type test**	Is copy of latest valid TTR for respective sizes enclosed? Yes / No	

Annexure- C

GUARANTEED TECHNICAL PARTICULARS (Single Core)

(Separate GTP needs to be furnished for 500 & 630 sq mm cables)

S.No.	Description	Buyer's Requirement	Seller's data
	Purchase Req. No.	-	
	Guarantee Period: (Min)	60 Months (from date of commissioning) / 66 months (from date of receipt at purchaser's store) whichever is earlier	
	Applicable IS / IEC Standard followed by vendor	IS 7098 Part -1 / IEC 60502	
1	**Make**	.....	
2	**Type**	A2XY (Unarmoured)	
3	**Voltage Grade (kV)**	1.1 kV	
4	**Maximum Conductor temperature**		
A	Continuous	90°C	
B	Short time	250°C	
5	**Conductor**		
A	Material and Grade	As per Cl.2.1.1	
B	Size (mm^2)	500 / 630 sq mm	
C	Min no. of wires in each conductor (Nos.)	As per Manufacturer Standard	

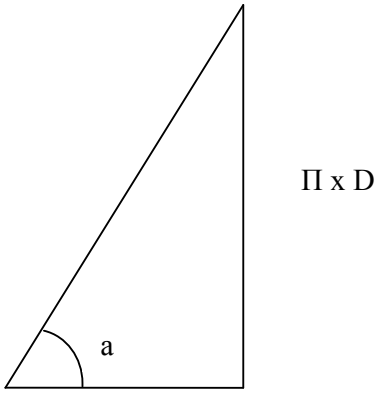
D	Min Dia. of wires in each conductor before compaction (mm)	As per Manufacturer Standard	
E	Shape of conductor	Compacted Circular	
F	Diameter over conductor	.....	
G	Maximum Conductor resistance at 20 ° C (Ohm/Km)	As per Table 2 of IS 8130	
H	Make of Al	Ref Annexure E	
6	**Insulation**	As per Table 3 of IS 7098 Part-1	
A	Insulation Material	As per Cl. 3.2	
B	Nominal thickness		
(i)	For 1Cx500sqmm	2.2mm	
(ii)	For 1Cx630sqmm	2.4mm	
C	Diameter over Insulation (mm) Approx.	.....	
D	Make of insulation compound	Refer Annexure E	
7	**Inner Sheath**	Not applicable	
8	**Armour**	Not applicable	
9	**Outer Sheath**		
A	Material and Type	As per Cl. 3.6	
B	Minimum Thickness	As per Table 8 of IS 7098 Part-1	
C	Colour	Yellow	
D	Embossing Details	As per Cl.3.6 (f)	

10	**Approx. overall dia. (mm)**	……	
11	**Overall order tolerance**	± 2 % for the total cable length for the entire order	
12	**Cable Drum**		
A	Type of Drum	Wooden	
B	Drum Length & tolerance	As per Spec.Cl. 4.3 & 4.4	
C	Marking on Drum	As per Spec.Cl. 4.7	
D	Drums provide with MS Spindle plate & nut-bolts arrangement (as per IS:10418)	Required	
13	**End Cap**	Required	
14	**Weights**	….	
a)	Net Weight of cable (Kg/Km.) – Approx		
b)	Weight of empty drum	Kg	
c)	Weight of cable with drum	Kg	
15	**Continuous current rating for standard I.S condition laid direct**		
a)	In ground 30° C	Amps	
b)	In duct 30° C	Amps	
c)	In Air 40° C	Amps	
16	**Short circuit current for 1 sec of Conductor (kAmp)**	……	
17	**Electrical Parameters at Maximum operating temperature:**		
A	AC Resistance	Ohm/Km	

B	Reactance at 50 C/s	Ohm/Km	
C	Impedance	Ohm/Km	
D	Capacitance	Micro farad / Km	
18	**Recommended minimum bending radius**	..... x O/D	
19	**Derating factor for following Ambient temperature in**	Ground / Air	
a)	At 30° C		
b)	At 35° C		
c)	At 40° C		
d)	At 45° C		
e)	At 50° C		
20	**Group factor for following Nos. of cables laid**	Touching / Trefoil	
a)	3 Nos.		
b)	4 Nos.		
c)	5 Nos.		
d)	6 Nos.		
21	**Process of Cross linking of Polyethylene**	Dry cure	
22	**Type test**	Is copy of latest valid TTR for respective sizes enclosed? Yes / No	

Annexure – D

ARMOUR COVERAGE PERCENTAGE



Percent coverage = $\frac{N \times d}{W}$ x 100

Where

N = number of parallel wires / Strips
d = diameter of wire / width of formed wires
W = π x D x Cos a,
D = diameter under armour
a = angle between armouring wire / formed wires and axis of cable
tan a = π x D/C, and
C = lay length of armouring wires / formed wires.

Min 90% armour coverage shall be provided both in case of wires and strips.

The gap between armour wires / formed wires shall not exceed one armour wire / formed wire space and there shall be no cross over / over-riding of armour wire / formed wire. So, the minimum area of coverage of armouring shall be 90%.

Annexure – E
Quality Assurance Plan

QUALITY ASSURANCE PLAN FOR XLPE INSULATED 1.1KV LT POWER CABLE											
Sl. No.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REF. DOCUMENT	ACCEPTANCE STANDARDS	FORMAT OF RECORD	AGENCY		REMARKS
									M	B	
1	2	3	4	5	6	7	8	9	10	11	12
A)	**Raw Material**										
1)	Aluminum Rod	a) Make / Type / Grade	Maj.	Vis.	100%	BSES Approved Documents/ Specifications	BSES Approved Documents/ Specifications	Reg./Sheet	P	V	
		b) Tensile strength	Cri.	Physical	1 Sample/lot	IS:5484	IS:5484	Int. Test Records	P	V	
		c) Elongation	Cri.	Physical	----do---	-- do --	-- do --	-- do --	P	V	
		d)Resistivity/Conductivity	Cri.	Elec.	----do---	-- do --	-- do --	-- do --	P	V	On drawn Wire
		e) Diameter	Cri.	Physical	100%	-- do --	-- do --	-- do --	P	V	
		f) Purity	Cri.	Chemical	1 Sample/lot	-- do --	-- do --	-- do --	V	V	Manufacturer's test certificate
		g) Surface Finish	Cri.	Vis.	100%	Smooth Surface	Smooth Surface	T.C	P	V	

2)	XLPE Compound	a) Visual checks on packing	Maj.	Vis.	100%	BSES Approved Documents /Specifications	BSES Approved Documents/ Specifications	Reg./Sheet	P	V	
		b) Hot set	Maj.	Physical	1sample/lot	IS:7098-1/88	IS:7098-1/88	-- do --	P	V	
		c) Tensile strength	Maj.	Physical	-- do --	-- do --	-- do --	-- do --	P	V	
		d) Elongation	Maj.	Physical	-- do --	-- do --	-- do --	-- do --	P	V	
		e) Volume resistivity	Maj.	Electrical	-- do --	-- do --	-- do --	-- do --	P	V	
		f) Specific gravity	Maj.	Physical	-- do --	-- do --	-- do --	-- do --	P	V	
3)	Armour Wires / Strips (G.S)	a) Dimension	Maj.	Physical	1sample / lot	IS:3975 & Data Sheet	IS:3975 & Data Sheet	Reg./Sheet	P	V	
		b) T.S & Elongation	Maj.	Physical	-- do --	IS:3975	IS:3975	-- do --	P	V	
		c) Mass & Uniformity of zinc coating	Maj.	Chemical	-- do --	IS:3975 / IS:4826	IS:3975 / IS:4826	-- do --	P	V	
		d) Torsion / winding test	Maj.	Physical	-- do --	IS:3975	IS:3975	-- do --	P	V	
		e) Wrapping test	Maj.	Physical	-- do --	IS:3975	IS:3975	-- do --	P	V	

4)	PVC Compound	a) Make / Type / Grade	Maj.	Physical	100%	BSES Approved Documents/ Specifications	BSES Approved Documents/ Specifications	Reg./Sheet	P	V	
		b) T.S & Elongation	Maj.	Physical	1sample / lot	IS:5831/84	IS:5831/84	-- do --	P	V	
		c) Thermal Stability	Maj.	Physical	-- do --	IS 5831 & IS 10810 (Part-60)	IS 5831 & IS 10810 (Part-60)	-- do --	P	V	
		d) Specific Gravity	Maj.	Chemical	-- do --	IS:5831/84	IS:5831/84	-- do --	P	V	
5)	Wooden Drum	a) Dimension	Maj.	Physical	1sample / lot	IS:10418	IS:10418	Reg./Sheet	P	V	
		b) Anti-termite treatment	Maj.	Chemical	Plant standard	Plant standard	Plant standard	-- do --	P	V	
B)	**Process & Stage Inspection**										
1)	Wire Drawing	a) Diameter	Maj.	Physical	Sample	IS:8130/84	IS:8130/84	Reg./Sheet	P	V	
		b) Surface Finish	Maj.	Vis.	100%	Smooth Surface	Smooth Surface	T.C	P	V	
		c) Tensile Strength	Maj.	Physical	1sample / lot	IS:8130/84	IS:8130/84	Reg./Sheet	P	V	

		d) Elongation test	Maj.	Physical	-- do --	IS:8130/84	IS:8130/84	-- do --	P	V	
		e) Wrapping Test	Maj.	Physical	-- do --	IS:8130/84	IS:8130/84	-- do --	P	V	
2)	Stranding	a) No. / dia of wires	Maj.	Count	At the time of m/c setting	IS:8130/84	IS:8130/84	Reg./Sheet	P	V	
		b) Diameter of conductor	Maj.	Physical	At the time of m/c setting and once in each shift	-- do --	-- do --	-- do --	P	V	
		c) Lay Length	Maj.	Physical	During m/c setting	-- do --	-- do --	-- do --	P	V	
		d) Direction of Lay	Maj.	Physical	One sample/Setting of each size	-- do --	-- do --	-- do --	P	V	
		e) Weight	Maj.	Physical	Each unloaded reel	-- do --	-- do --	-- do --	P	V	

		f) Surface Finish	Maj.	Vis.	100%	No surface defects and free from sharp edges, scratches, grease, oil etc.		T.C	P	V	
		g) Resistance	Cri.	Physical	1 sample from starting & finishing end of each length	IS:8130/84	IS:8130/84	-- do --	P	V	
3)	Insulation	a) Material	Maj.	Physical	During m/c setting	IS:7098-1/88	IS:7098-1/88	Reg./Sheet	P	V	
		b) Thickness	Cri.	Physical	During m/c setting and at standard length	-- do --	-- do --	-- do --	P	V	
		c) Surface Finish	Maj.	Vis.	100%	Surface shall be smooth and free from defects		T.C	P	V	
		d) Spark Testing	Cri.	Electrical	100%	IS:7098-1/88	IS:7098-1/88	Reg./Sheet	P	V	

		e) Colour of Cores	Maj.	Vis.	100%	-- do --	-- do --	-- do --	P	V	
		f) Thermal Stability	Cri.	Chemical	One sample/Setting of each size	-- do --	-- do --	-- do --	P	V	
		g) Core Identification	Maj.	Vis.	10%	-- do --	-- do --	-- do --	P	V	
		h) Hot set test	Maj.	Physical	1sample / lot	-- do --	-- do --	-- do --	P	V	
		i) Diameter	Maj.	Physical	-- do --	-- do --	-- do --	-- do --	P	V	
		j) Resistance	Cri.	Physical	-- do --	-- do --	-- do --	-- do --	P	V	
		k) Curing	Maj.	Vis.	100%	-- do --	-- do --	-- do --	P	V	
4)	Laying up	a) Identification of cores	Maj.	Vis.	During m/c setting	IS:7098-1/88	IS:7098-1/88	Reg./Sheet	P	V	
		b) Direction of lay & core sequence	Maj.	Vis.	-- do --	-- do --	-- do --	-- do --	P	V	
		c) Lay length	Minor	Vis.	-- do --	Once in a shift.	Once in a shift.	-- do --	P	V	
		d) Shape of laid up assembly	Minor	Vis.	-- do --	Reasonable circular	Reasonable circular	-- do --	P	V	
		e) Dia. Over laid up assembly	Maj.	Physical	-- do --	Once in a shift.	Once in a shift.	-- do --	P	V	

5)	Innersheath	a) Material & type	Maj.	Vis.	During m/c setting	BSES specifications/ IS:7098-1/88	BSES specifications/ IS:7098-1/88	Reg./Sheet	P	V	
		b) Thickness	Maj.	Physical	During m/s setting & at std. length	BSES specifications/ IS:7098-1/88	BSES specifications/ IS:7098-1/88	-- do --	P	V	
		c) Dia. Over sheath	Maj.	Physical	During m/c setting	BSES specifications/ IS:7098-1/88	BSES specifications/ IS:7098-1/88	-- do --	P	V	
		d) Surface finish	Minor	Vis.	100%	Surface shall be smooth and free from defects		T.C	P	V	
6)	Armouring	a) Dimension of armour wires/strips	Maj.	Physical	At the time of m/c setting	BSES specifications/ IS:7098-1/88	BSES specifications/ IS:7098-1/88	Reg./Sheet	P	V	
		b) No. of wires/strips	Maj.	Count	At the time of m/c setting	BSES specifications/ IS:7098-1/88	BSES specifications/ IS:7098-1/88	-- do --	P	V	

		c) Direction of lay	Maj.	Vis.	One sample/Setting of each size	IS:7098-1/88	IS:7098-1/88	-- do --	P	V	
		d) Surface finish	Maj.	Vis.	100%	Surface shall be smooth and free from defects		T.C	P	V	
		e) Lay Length	Minor	Vis.	At the time of m/c setting	IS:7098-1/88	IS:7098-1/88	Reg./Sheet	P	V	
		f) Coverage & quality of armouring	Maj.	Vis.	100%	IS:7098-1/88 and IS:3975	IS:7098-1/88 and IS:3975	-- do --	P	V	
7)	Outer Sheath	a) Material & type	Maj.	Vis.	During m/c setting	BSES specifications/ IS:7098-1/88	BSES specifications/ IS:7098-1/88	Reg./Sheet	P	V	
		b) Thickness	Maj.	Physical	During m/s setting & at std. length	BSES specifications/ IS:7098-1/88	BSES specifications/ IS:7098-1/88	-- do --	P	V	
		c) Overall diameter	Maj.	Physical	During m/s setting & at std. length	Measurement	Measurement	-- do --	P	V	

		d) Surface finish	Maj.	Vis.	100%	Surface shall be smooth and free from defects		T.C	P	V	
		e) Embossing/Marking quality	Maj.	Vis.	100%	BSES specifications/ IS:7098-1/88	BSES specifications/ IS:7098-1/88	Reg./Sheet	P	V	
		f) Colour of sheath	Maj.	Vis.	During m/c setting	BSES specifications/ IS:7098-1/88	BSES specifications/ IS:7098-1/88	-- do --	P	V	
		g) Sequential marking	Maj.	Vis.	Full Length	BSES specifications/ IS:7098-1/88	BSES specifications /IS:7098-1/88	-- do --	P	V	
C)	**Final Inspection**										
1)	Routine Tests	a) Conductor Resistance	Maj.	Elec.	100%	IS:7098-1/88	IS:7098-1/88	Test Report	P	V	
		b) High Voltage Test	Maj.	Elec.	100%	IS:7098-1/88	IS:7098-1/88	Test Report	P	V	

2)	Acceptance Tests										
	Acceptance test shall be carried out for each type and size of the cables on the cable drums randomly selected as per sampling plan mentioned in IS:7098 Part-1.										
i)	For Conductor	a) Tensile Test (for Aluminium)	Cri.	Elec.	As per IS:7098-1/88	As per IS:7098-1/88	As per IS:7098-1/88	Test Certificate	P	W	
		b) Wrapping Test (for Aluminium)	Cri.	Elec.	-- do --	-- do --	-- do --	-- do --	P	W	
		c) Resistance Test	Cri.	Elec.	-- do --	-- do --	-- do --	-- do --	P	W	
ii)	For armour wire/formed wire (as applicable)	a) Measurement of Dimensions	Cri.	Measurement	One sample of each offered lot of all offered sizes	As per IS:7098-1/88 and IS:3975	As per IS:7098-1/88 and IS:3975	Test Certificate	P	W	
		b) Tensile Test	Cri.	Physical	-- do --	-- do --	-- do --	-- do --	P	W	
		c) Elongation Test	Cri.	Physical	-- do --	-- do --	-- do --	-- do --	P	W	
		d) Torsion Test (for round wires only)	Cri.	Physical	-- do --	-- do --	-- do --	-- do --	P	W	
		e) Wrapping Test	Cri.	Physical	-- do --	-- do --	-- do --	-- do --	P	W	
		f) Resistance Test	Cri.	Electrical	-- do --	-- do --	-- do --	-- do --	P	W	
		g) Mass of zinc coating	Cri.	Chemical	-- do --	-- do --	-- do --	-- do --	P	W	
		h) Uniformity of zinc coating	Cri.	Chemical	-- do --	-- do --	-- do --	-- do --	P	W	

		l) Adhesion Test	Cri.	Physical	-- do --	-- do --	-- do --	-- do --	P	W	
		j) Freedom from defects	Cri.	Visual	-- do --	-- do --	-- do --	-- do --	P	W	
iii)	For XLPE Insulation and PVC sheath	a) Test for thickness	Cri.	Measurement	One sample of each offered lot of all offered sizes	As per IS:7098-1/88 and IS:1554-1/88	As per IS:7098-1/88 and IS:1554-1/88	Test Report	P	W	
		b) Hot set test (for insulation)	Cri.	Electrical	-- do --	-- do --	-- do --	-- do --	P	W	
		c) Tensile strength and Elongation at break	Cri.	Physical	-- do --	-- do --	-- do --	-- do --	P	W	
		d) Thermal Stability Test (for PVC sheath)	Cri.	Chemical	-- do --	-- do --	-- do --	-- do --	P	W	
iv)	For Completed Cables	a) High Voltage Test	Cri.	Electrical	-- do --	As per IS:7098-1/88 and IS:1554-1/88	As per IS:7098-1/88 and IS:1554-1/88	-- do --	P	W	
		b) Insulation Resistance Test (Volume Resistivitty Method)	Cri.	Electrical	-- do --	-- do --	-- do --	-- do --	P	W	
		c) Flammability Test	Cri.	Electrical	-- do --	As per IEC-332 (Part-3) (Category-B) and IS:7098-1/88	As per IEC-332 (Part-3) (Category-B) and IS:7098-1/88	-- do --	P	W	

		d) Surface Finish	Maj.	Physical	One length of each size	Surface shall be smooth and free from defects		T.C	P	W	
		e) Length Measurement (Rewinding)	Maj.	Physical	1 drum per lot	BSES specifications/ IS:7098-1/88	BSES specifications/IS:7098-1/88	-- do --	P	W	
		f) Armour Coverage	Maj.	Physical	-- do --	BSES specifications/ IS:7098-1/88	BSES specifications/IS:7098-1/88	-- do --	P	W	
3)	Type Tests	As per IS:7098-1/88							Review and verification of type test clearance from BSES Engg.		
D	**Packing & Marking**	a) End Sealing	Maj.	Visual	100%	BSES specifications/ IS:7098-1/88	BSES specifications/ IS:7098-1/88	_____	P	____	
		b) Stenciling/Marking	Minor	Visual	100%	BSES specifications/ IS:7098-1/88	BSES specifications/ IS:7098-1/88	_____	P	____	
		c) Packing	Maj.	Visual	100%	BSES specifications/ IS:7098-1/88	BSES specifications/ IS:7098-1/88	_____	P	____	

Note:-

1. BSES may witness raw material and in process inspection in addition to routine / acceptance / type test at any time or stage of manufacturing.

2. Checks specified above for Raw material, In process and Final inspection shall be as relevant to the specific cable construction.

Abbreviations used in the above Quality Plan :-

M	Manufacturer	P	Perform
B	BSES	V	Verification
Vis.	Visual	W	Witness
Maj.	Major	T.C	Test Certificates
Cri.	Critical	Reg.	Register
Elec.	Electrical		

Annexure - F

List of Sub-Vendors

For critical items

S. No.	Description of Material	Sub-Vendors
1	E.C Grade Aluminium Rod	Bharat Aluminium Co. Ltd. (BALCO) Hindustan Aluminium Co. Ltd. (HINDALCO) National Aluminium Co. Ltd. (NALCO)
2	XLPE Compound	Kalpena Industries Ltd. KLJ Polymers and Chemicals Ltd. Dow Chemical, U.S.A Borealis, Sweden Hanwha, Seoul, South Korea

TECHNICAL SPECIFICATION

FOR

INSULATING FLOORS IN SWITCHGEAR ROOMS

Specification No. SP-INSFLR-103-R0

DEPARTMENT	PREPARED BY	REVIEWED BY	APPROVED BY	REV	0
CES	Minita	Gaurav Sharma	Ashwani Agarwal	DATE	31/05/2017
	minita			PAGE	Page 1 of 6
SAFETY	Paridhi Bansal	Arun Raj	Umesh Purbey		
	Paridhi				

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TECHNICAL SPECIFICATION OF INSULATING FLOORS IN SWITCHGEAR ROOMS

1. SCOPE

This specification covers the basic requirement, the testing and inspection, supply and installation/fixing of insulating paints on floors in front of the switchgear panels at BYPL grid locations.

2. STANDARDS & CODES

2.1.	IS 15652:2006	Specification of Insulating mats for electrical purposes
2.2.	CEA guidelines, 2010	Measures relating to safety and Electric supply

3. SERVICE CONDITIONS

The insulating floor against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions.

3.1.	Average Grade atmosphere	Heavily polluted, Dry
3.2.	Maximum altitude above sea level	1000 meters
3.3.	Ambient air temperature	Highest 50 deg C Average 40 deg C Minimum 0 deg C
3.4.	Relative Humidity	10 to 100 %

4. GENERAL REQUIREMENTS OF INSULATING PAINTS ON FLOORS

4.1.	**General Properties**	a. The Insulating coating shall be self leveling, solvent free, and have high breakdown voltage,loaded with special insulating additives. b. The material of the insulating floor shall be epoxy resin. c. It shall be resistant to chemicals and oils. d. It shall be tough, wear & weather resistant. e. It shall exhibit high build, high adhesion with smooth and glossy finish and slip resistant. f. It shall be easy to apply/install, clean and repair on floors.
4.2.	Colour of the finished item	The insulating floors shall be light Grey in colour
4.3.	Class of the insulating floor to be used	For 11kV voltage : Class B For 33kV voltage : Class C
4.4.	Thickness of the paint on floor	For 33kV voltage : 3 mm +/- 10% For 11kV : 2.5 mm +/- 10%

4.5.	AC proof voltage	For 33kV : 36kV minimum For 11kV: 22 kV minimum
4.6.	Dielectric strength	For 33kV: 65kV rms For 11kV: 45kV rms

5. TESTING AND INSPECTION

5.1.	Routine and Acceptance tests in the factory	All the routine and acceptance tests shall be performed as per IS 15652. The purchaser reserves the right to witness the tests at the time of inspection.
5.2.	Inspection at site	The purchaser reserves the right to verify the material at the time of applying the insulating floors at site. Following tests shall also be verified at site: 1. Dielectric strength 2. Ac proof voltage 3. Thickness
5.3.	Type Test Reports	All the Type test reports of the material to be used as the insulating floors as per IS 15652 from CPRI/ERDA shall be submitted.

6. INSTALLATION

6.1.	Application of insulating paints	a. The insulating paint shall be applied in accordance with manufacturer's installation procedure. b. The purchaser may witness the painting process.

7. DEVIATIONS

7.1.	Deviations	Deviations from this Specification shall be stated in writing with the tender by reference to the Specification clause 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. No deviation will be acceptable post order.

8. DOCUMENTS SUBMISSION

The bidder has to submit the following documents along with bid:-

8.1.	Complete product catalogue, and Manual
8.2.	Type test reports from CPRI/ERDA
8.3.	P.O. copy and Performance Certificates and feedback for similar type of job done in any other power industry (distribution, transmission and generation).
8.4.	Deviation Sheet (if any)
8.5.	Filled copy of GTP (Annexure A)

ANNEXURE A- GENERAL TECHNICAL PARTICULARS OF INSULATING FLOORS

S. No.	Particulars	BYPL Requirements		Bidder's Data	
1	Make	To be Specified			
2	Application	11kV Indoor	33kV Indoor		
3	Ambient temperature range	0 to 50 deg C			
4	Standard reference	IS 15652:2006			
5	Material to be used	Epoxy Resin			
6	Surface finish	Free from harmful physical irregularities			
7	Solids	100% solvent free			
8	Colour & Appearance	Light grey , viscous liquid			
9	Class of Coating	B	C		
10	Mix Ratio				
11	Specific Gravity				
12	Pot life (in hrs)				
13	Touch dry (in hrs)				
14	Tack free (in hrs)				
15	Hard dry (in hrs)				
16	Full cure (in days)				
17	Dimensions				
17.1	Length	According to the site requirements			
17.2	Width	1000mm ± 20mm			
17.3	Thickness	2.5 mm ± 10%	3 mm ± 10%		
18	**Dielectric Properties**				
18.1	Dielectric constant (ASTM D150 - 150kHz)				
18.2	Insulation resistance with water	minimum 10^6 M Ohm with 500V megger			
18.2	Leakage current	Not more than 10µA			
18.3	AC dielectric strength	45kV rms (min)	65kV rms (min)		
18.4	AC proof voltage	22kV	36kV		
19	**Mechanical Properties**				
19.1	Abrasion resistance (ASTM D 4060)				
19.2	Hardness shore D (ASTM D 2240)				
19.3	Scratch hardness (BS 3900E-2)				
19.4	Pull-Off Adhesion (ASTM D 4541)				
19.5	Tensile strength (ASTM D 638)				

20	Temperature resistance				
21	Gloss(ASTM D523)				
22	**Ageing Properties**				
22.1	Tensile strength & elongation at break after subjection mat to ageing	not less than 75% of the corresponding values			
22.2	Durability of coating (in years)				
23	**Thermal Properties**				
23.1	Flame Retardance	Self extinguishing			
23.2	Marking : Each coating shall be marked with	Class, Lot no., Roll no., Manufacturer's name, BYPL as a customer name, BYPL PO no. and date, BIS marking			
24	**Tests**				
24.1	Type test reports to be submitted	Type test reports not older than 5 years from CPRI/ERDA lab			
24.2	QAP for Acceptance and Routine tests	To be submitted			
24.3	Acceptance test	To be carried out during inspection			

BSES Yamuna Power Limited	SP-GES-107-R0
TECHNICAL SPECIFICATION FOR EARTHING PRACTICE IN GRID SUBSTATION	

TECHNICAL SPECIFICATION

FOR

EARTHING PRACTICE IN GRID SUBSTATION

PREPARED BY	REVIEWED BY	APPROVED BY	REV	0
A.H	G.S	A.A	DATE 18/10/2017	

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TECHNICAL SPECIFICATION FOR EARTHING PRACTICE IN GRID SUBSTATION

1. SCOPE

This specification covers the guidelines of earthing at 66/11, 33/11, 66/33/11 kV Grid substation and the technical requirements of material required for earthing.

2. STANDARDS & CODES

2.1.	CEA guidelines	Technical standards for construction of electrical plants and electrical lines
2.2.		IE Rules of 1956
2.3.	IEEE Std 80	IEEE guide for safety in AC substation grounding
2.4.	CBIP :2006 – publication no. 229	Manual on substation layout
2.5.	IS 3043: 1987	Code of practice for earthing
2.6.	IS 2629 (1985)	Recommended practice for hot dip galvanizing of Iron & Steel
2.7.	IS 2633 (1986)	Method for testing uniformity of coating on zinc coated article
2.8.	IS 5358 (1969)	Specification for hot dip galvanized coating on fasteners
2.9.	IS 4759 (1996)	Specification of Hot dip zinc coatings on structural steel and other allied products
2.10.	IS 1239 (2004)	Steel tubes, tubular and other wrought steel fittings- specification
2.11.	IEC 62561-2	Requirements for conductors and earth electrodes
2.12.	IEC 62561-7	Requirements for earthing enhancing compounds
2.13.	UL 467	Standard for safety - Grounding and bonding equipment
2.14.		Handbook on Electrical Earthing (Ministry of Railways)

3. REQUIREMENT OF EARTHING

3.1.	Primary guidelines	Following are primary guidelines for a good earthing system in a Grid substation: a. The impedance to ground should be as low as possible. In general it should not exceed **0.5 ohm**. b. The step and touch potentials shall be within safe limits. c. The contractor shall do the calculation for number of earthing rods being used in a substation for achieving the desired earth resistance.
3.2.	Earthing lead size	a. The actual size of earthing lead will depend on the maximum fault current which the earthing lead will be required to carry safely. b. Please refer **Annexure A1** for HT fault level.
3.3.	Earthing type	a. Rod earthing shall be provided for the Grid substation. b. The size of the rod depends upon the current to be carried and the type of the soil. Soil resistivity testing will be carried out by vendor. c. The Earth Electrode should be embedded vertically. Wherever hard rock is encountered, the rod can be inclined at an angle of about 30deg to the horizontal as per clause 9.2.2 of IS 3043. d. The vertically driven rods shall be interconnected with each other using horizontal grid conductors.
3.4.	Earth Pit	a. As per clause 20.5.2 of IS 3043, the minimum distance between the vertical earth electrodes shall not be less than the length of rod. b. Minimum of 1m distance of earth pit from electrical equipment and structures shall be maintained. c. The earth pits shall be backfilled with earth enhancing material as per Drawing . d. Treated Earth pits shall be used where earth resistance value is getting over the prescribed value in specification i.e. 0.5 ohms.
3.5.	Horizontal Conductor	a. The entire earth rod driven in ground vertically shall be interconnected with earth grid conductors horizontally under the ground. b. The Horizontal conductors shall be laid 600 mm below FGL. c. Minimum earth coverage of 300 mm shall be provided between the Horizontal conductor and the bottom of trench/foundation/underground pipe at the crossing. d. Horizontal conductors around a building /switchyard fence shall be buried outside the boundary at a minimum distance of 2000 mm. e. Risers shall be provided 300mm above the ground level for equipment earthing. Two number earth pits shall be provided with riser for connection of transformer neutral. f. All the joints between rods flats shall be **exothermic** type for creating better electrical contact between two. Welding between rods to flat, flat to flat should be arc welding type. g. Wherever bolted connection is done, it shall be done through two bolts at each joint to ensure tightness and avoid loosening with passage of time.
3.6.	Equipment earthing	a. GI strips shall be used for the equipment earthing. b. Two separate and distinct earth connections shall be provided for earthing of electrical frameworks.

		c. The connection of GI strip with riser of earth mat shall be electric arc welding arrangement; connection of equipment with earthing end shall be double bolted arrangement. d. The transformer neutral shall be earthed with two independent grounding conductors connected to two separate earth pits. e. Fence within the earth grid shall be bonded to the plant earth system at regular interval not exceeding 10 meters. Fence gate shall be separately earthed with flexible connection to permit movement. f. Bolted connection shall be made only for earthing of equipment/devices and for some removable structures. The contact surfaces shall be thoroughly cleaned before connection to ensure good electrical contact. g. Cable armor shall be earthed at both ends for multi core cables. For single core cables, the earthing shall be at switchgear end only. h. Metallic stairs and hand rails shall be earthed as for columns. Additionally a 25x6 GI flat shall run the entire length of the stairs. The GI flat shall be welded to the stairs and hand rails at intervals of 1500 mm. i. The main earth conductor shall be securely fixed to the columns /walls/trays by welding /clamping at the intervals not exceeding 1500 mm. The earth conductors shall be interconnected between them and to the main earth grid through risers.

4. SPECIFICATION OF EARTHING MATERIALS

4.1.	GI earthing strip	a. Fully galvanized iron strips shall be used conforming to IS 2629. b. The zinc deposition shall not be less than 610gm/sqm of the galvanized surface area of the MS Earthing strips. c. The zinc coating used for the galvanization shall be of 9.99 % purity grade as per IS 209. d. All the galvanized material shall be checked for uniformity and weight as per IS. e. The standard length of galvanized iron earthing strip shall be minimum 7Mtrs.
4.2.	Vertical and Horizontal Earth Electrode	a. Copper clad steel rod driven in the earth vertically shall be a high tensile-low carbon steel rod of adequate diameter(as per the clause 6.0 of the specs) and 3 m length complying UL467, IEC62561-2 and IS 3043, molecularly bonded by 99.99% pure high conductivity copper on the outer surface with copper coating thickness 254 microns or more with sufficient amount of earth enhancement compound as per IEC 62561-7. b. Copper bonding must be UL/CPRI/ERDA certified. c. Rod shall be tested and certified from CPRI/ERDA for a short circuit current withstanding of desired value. d. There shall be following marking on the rod-Dimension Detail, product model no, Reference number of certification. e. It shall have high corrosion resistance and shall eliminate electrolytic action. f. The rod shall have thread profile at both the ends to ensure no copper is removed from the steel.

4.3.	Earth enhancing compound	a. It shall be as per IEC 62561-7. b. It shall be chemically inert to subsoil. c. It shall not pollute the environment. The RoHS certificate shall be provided from any NABL accredited lab for not having any toxic chemical in earth enhance material. d. It shall provide a stable environment in terms of physical and chemical properties and exhibit low resistivity. e. The earthing enhancing compound shall not be corrosive to the earth electrodes being used. f. It shall be maintenance free. g. The earth enhancement material shall be supplied in sealed, moisture proof bags. These bags shall be marked with manufacturer's name or trade name, quantity, batch no. & date of manufacturer, resistivity, Buyer's name, PO no. & date. h. As per IEEE 80-2013 clause 14.5 d, grounding material shall be tested and certified for resistivity less than 0.12 Ω-m.

5. SIZES OF THE EARTHING MATERIALS FOR EQUIPMENT EARTHING

S.No.	Title	Material	Sizes of the earthing	Type	UOM	No of Lead
	Main Earthing Grid					
5.1	Vertical Rods	Cu Bonded Rods	25	Rod	mm (dia)	
5.2	Above Ground risers	GI	50x10	Flat	sqmm	2
5.3	Horizontal Rods	Cu Bonded Rods	25	Rod	mm (dia)	
5.4	Treated Earth Pit	Cu Bonded Rods	25	Rod	mm (dia)	
	Power Transformers					
5.5	Frame	GI	75X10	Flat	sqmm	2
5.6	Marshalling Box	GI	50X6	Flat	sqmm	2
5.7	Radiator	GI	50X6	Flat	sqmm	2
5.8	Neutral	GI	65x10	Flat	sqmm	2
5.9	Fan	GI		As per sizes mentioned for fans		
	11 KV System					
5.10	11 KV Swithcgear	GI	50X6	Flat	sqmm	2

5.11	11 KV Bus Duct	GI	50X6	Flat	sqmm	2
5.12	11 KV Cable Box	GI	50X6	Flat	sqmm	2
	415 V System					
5.13	ACDB	GI	50X6	Flat	sqmm	2
5.14	Station Trafo Frame	GI	50X6	Flat	sqmm	2
	DC System					
5.15	Battery Charger	GI	50X6	Flat	sqmm	2
5.16	DCDB	GI	50X6	Flat	sqmm	2
	Other Electrical Items					
5.17	Three phase receptacles, welding outlet	GI	25x3	Flat	sqmm	1
5.18	C&R Panel	GI	50X6	Flat	sqmm	2
5.19	Push Button	GI	8	Wire	swg	1
5.20	Cable Trays(one run along the tray section)	GI	50X6	Flat	sqmm	1
	Other Non Electrical Items					
5.21	Railway Tracks	GI	25x6	Flat	sqmm	At suitable Points
5.22	Metallic noncurrent carrying structures like stair case	GI	25x6	Flat	sqmm	1
5.23	Columns, Structures	GI	50X6	Flat	sqmm	2
5.24	Steel pipe racks	GI	25x6	Flat	sqmm	1
5.25	Fence/Gate	GI	50X6	Flat	sqmm	At suitable Points(2 min)
5.26	Hand Rail	GI	8	Wire	swg	1

6. TESTING AND INSPECTION

6.1.	Earthing materials	a. The purchaser reserves the right to inspect the material at the time of tests. All tests shall be performed in the presence of BYPL representative. The bidder shall give intimation in advance to witness the test. b. Acceptance test for GI earthing strips – Tests for Visual examination, dimensional verification and galvanization shall be witnessed at the time of inspection. c. Acceptance test of Earth enhancement compound – Tests for leaching, sulphur determination, corrosion and resistivity shall be done as per IEC 62561-7 d. Type test reports of the earthing materials from CPRI/ERDA/Equivalent lab shall be submitted. The bidder shall submit UL-467/CPRI/ERDA test reports for copper clad steel rod.
6.2.	Measurement of Earth resistance	a. After the completion of work ground resistance of each installation shall be measured by BYPL/Contractor. b. The measurement of resistance shall be witnessed and signed by representative of BYPL as well as the contractor. The test certificates shall be generated for each installation clearly indicating the details of the transformer, name of the substation, location, district, serial no. of testing equipment and name of testing engineer. c. The desire ground resistance shall be measured after interconnection of earth pits is completed. The value of earth resistance shall not be more than **0.5 ohm**. d. In case where this value exceeds 0.5 ohms, the earthing design shall be redesigned. The pit location, earth electrode, soil treatment, earth conductor, GI strip used shall be checked whether properly used at site. If not, these shall be changed as per the redesigned plan.

7. DEVIATIONS

7.1.	Deviation	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. No deviation will be acceptable post order.

8. DOCUMENTS SUBMISSION

The bidder has to submit the following documents along with bid:-

8.1.	Complete earthing calculation
8.2.	Complete product catalogue, Manual and calibration certificate of the equipment
8.3.	Type test reports
8.4.	Deviation Sheet (if any)

9. GUARANTEED TECHNICAL PARTICULARS

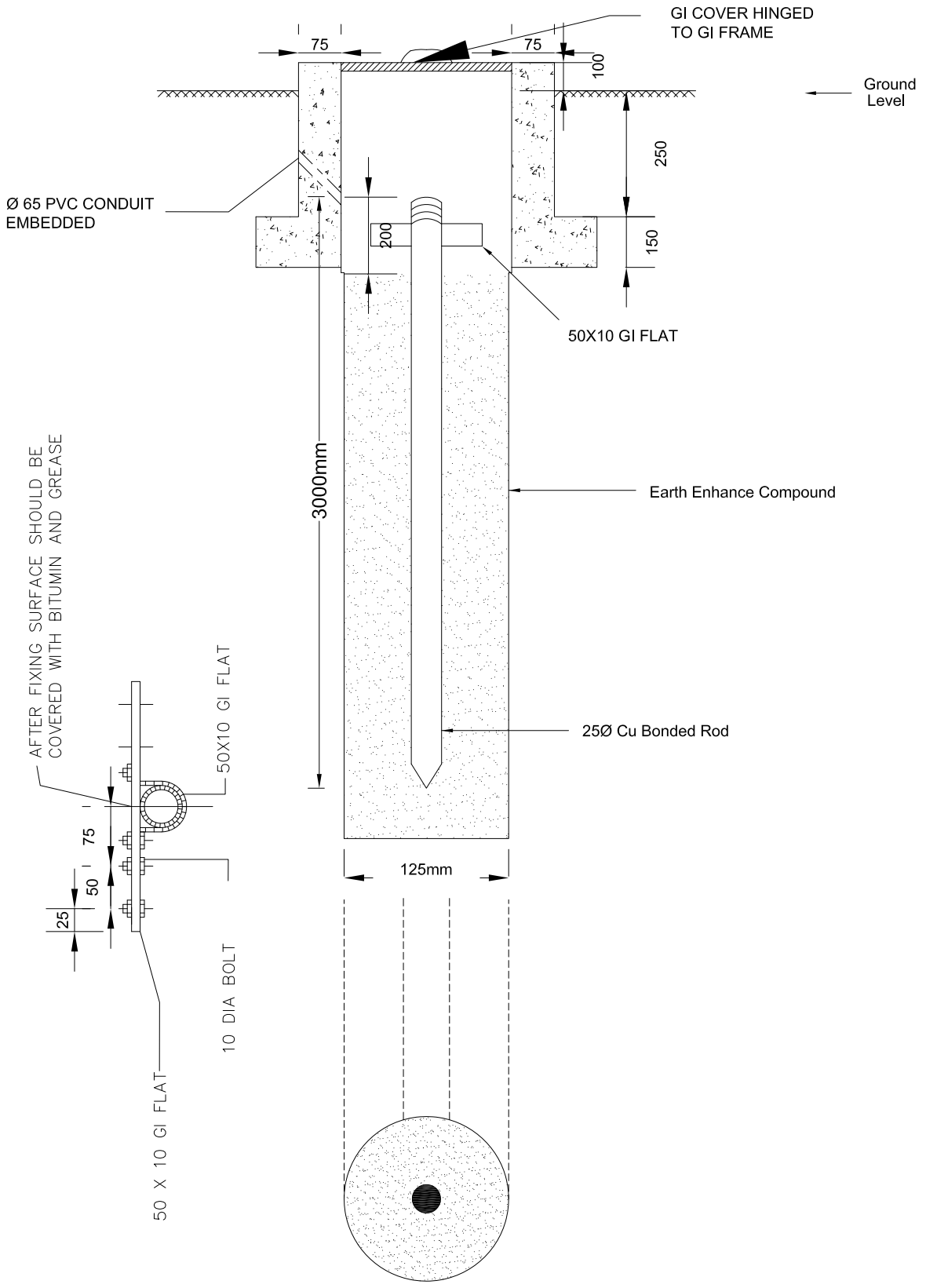
S. No	Parameter	BYPL Requirement	Vendor Data
9.1	Rod to rod welding	Exothermic	
9.2	Zinc deposition of GI earthing Strip	610gm/sqm	
9.3	Length of GI Strip	7m (Minimum)	
9.4	Diameter of Cu clad Rod	25 mm	
9.5	UL/CPRI/ERDA Certification of Cu Bonding	Test certificate to be provided	
9.6	Cu bonding	250 Micron	
9.7	Length of Copper bonded rod	3 m	
9.8	Purity of Copper	99.99%	
9.9	Short circuit withstand test of Rod	31.5kA	
9.10	Marking on the rod-Dimension Detail, product model no, Reference number of certification	Sample Required	
9.11	ROHS Certificate from NABL accredited lab for not having toxic chemical in earth enhance material	Test certificate to be provided	
9.12	Resistivity of earth enhancing material	0.12 ohm-m(Max)	

9.13	Exothermic welding material	IEEE 837 Complied	
9.14	Make of Steel	SAIL/ESSAR/TATA	

ANNEXURE A1 : REFERENCE FAULT LEVEL

Voltage Level(kV)	Design Fault Level
66/11	31.5 KA
33/11	25 KA

ANNEXURE A2: REFERENCE DRAWINGS



DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

TITLE:–

EARTH ELECTRODE

BSES Yamuna Power Limited

FILE NAME: REL–COENG–NEE–E21–P–00085 DATE:–08.09.10

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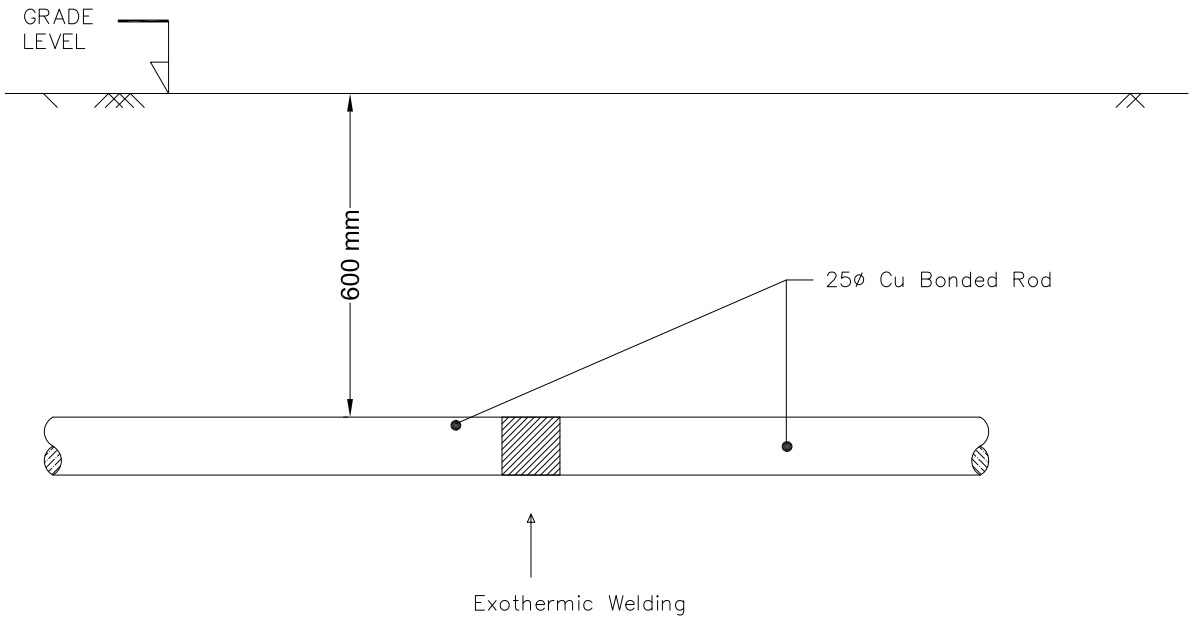

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APPD.	A.A
DATE	17.10.17
SCALE	NTS

TITLE:-

LAP JOINT BETWEEN RODS

BSES Yamuna Power Limited

FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

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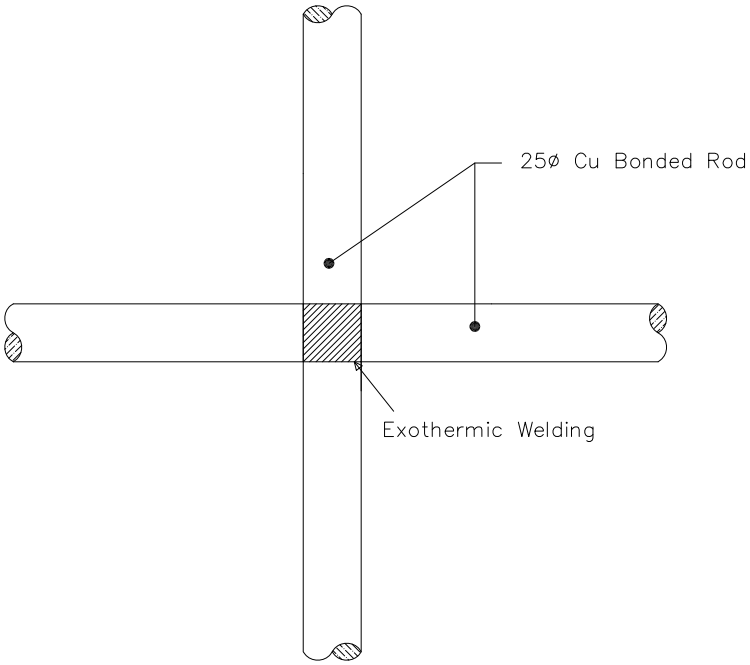

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APPD.	A.A
DATE	17.10.17
SCALE	NTS

TITLE:–

CROSS JOINT BETWEEN RODS

BSES Yamuna Power Limited

FILE NAME: REL–COENG–NEE–E21–P–00085 DATE:–08.09.10

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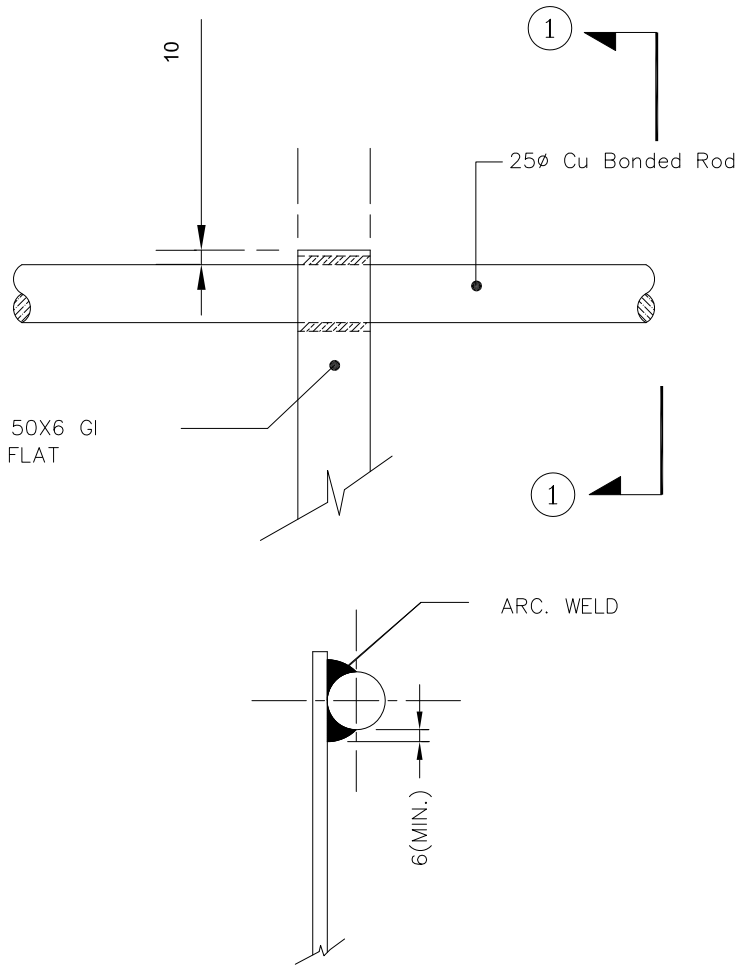

SECTION – (1)

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APPD.	A.A
DATE	17.10.17
SCALE	NTS

TITLE:–

CROSS JOINT BETWEEN ROD AND GI FLATS

BSES Yamuna Power Limited

FILE NAME: REL–COENG–NEE–E21–P–00085 DATE:–08.09.10

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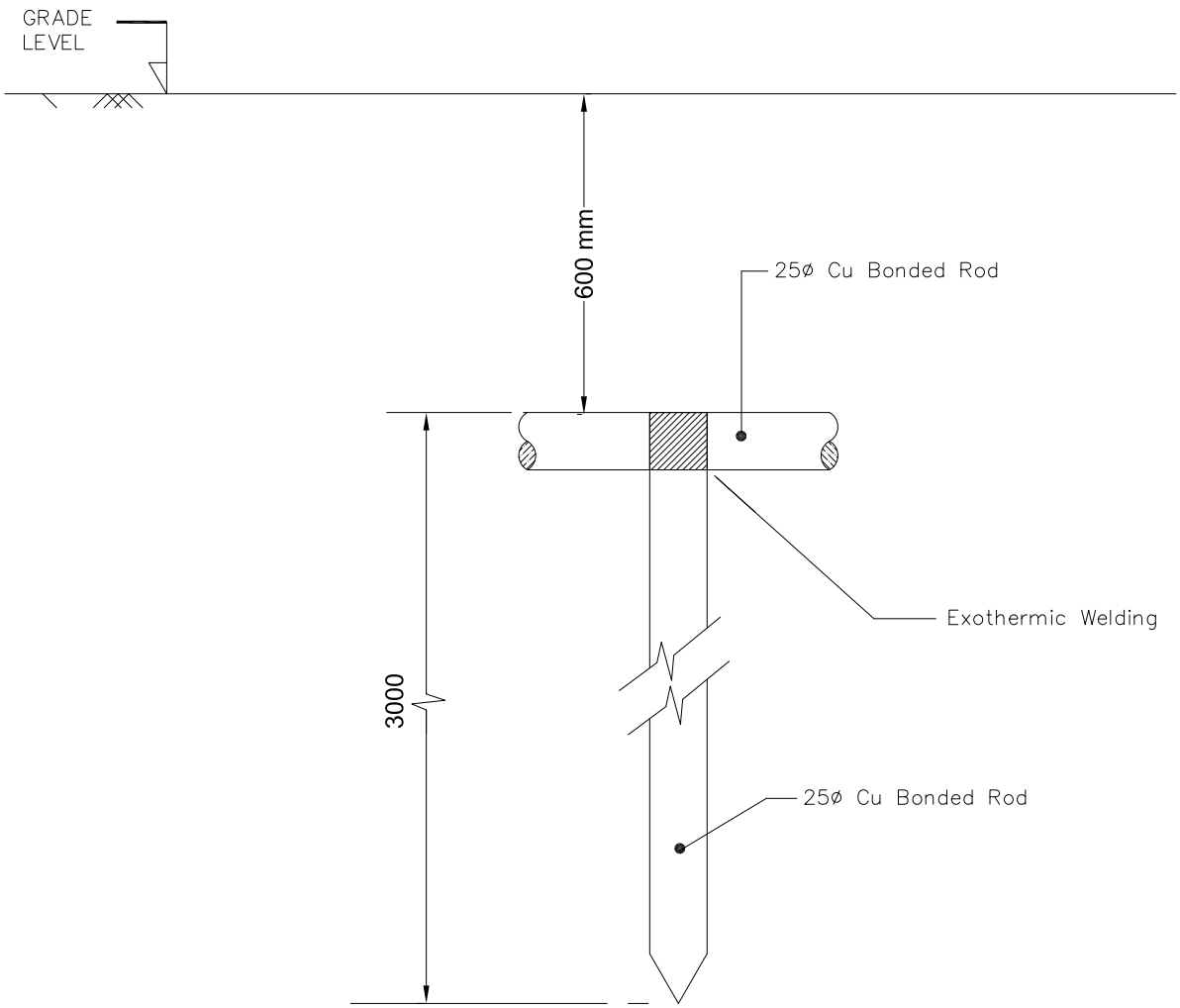

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APPD.	A.A
DATE	17.10.17
SCALE	NTS

TITLE:–

EARTH ELECTRODE

BSES Yamuna Power Limited

FILE NAME: REL–COENG–NEE–E21–P–00085 DATE:–08.09.10

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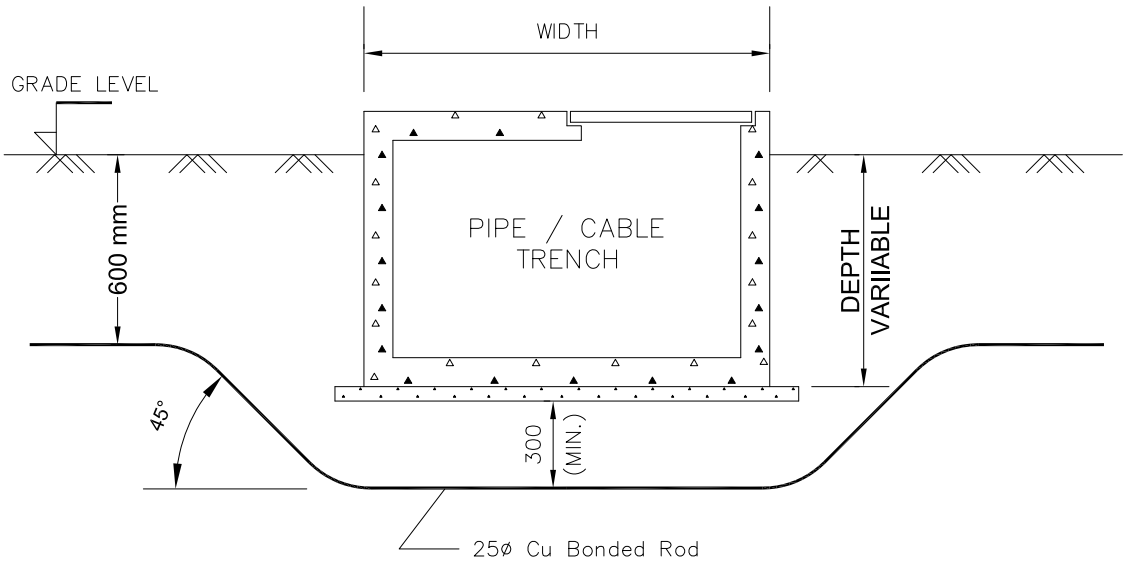

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APPD.	A.A
DATE	17.10.17
SCALE	NTS

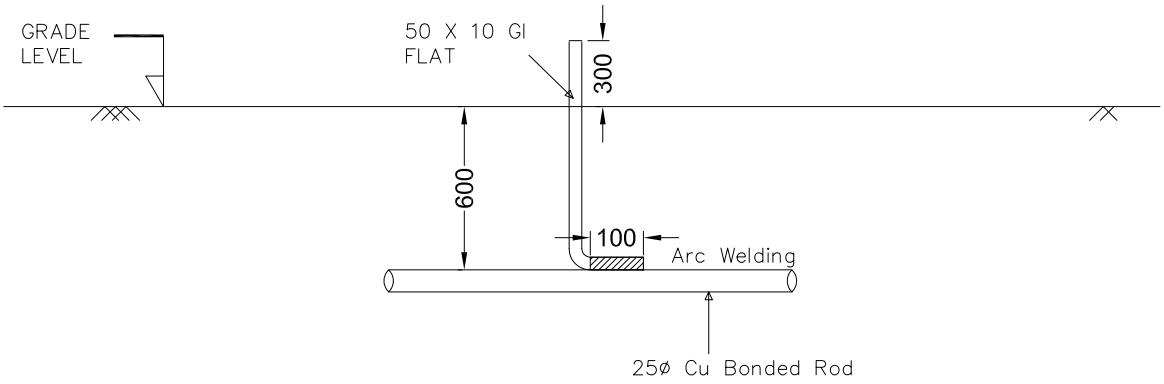
TITLE:–

TRENCH CROSSING OF
EARTHING CONDUCTOR

BSES Yamuna Power Limited

FILE NAME: REL–COENG–NEE–E21–P–00085 DATE:–08.09.10

A4 [210x297]



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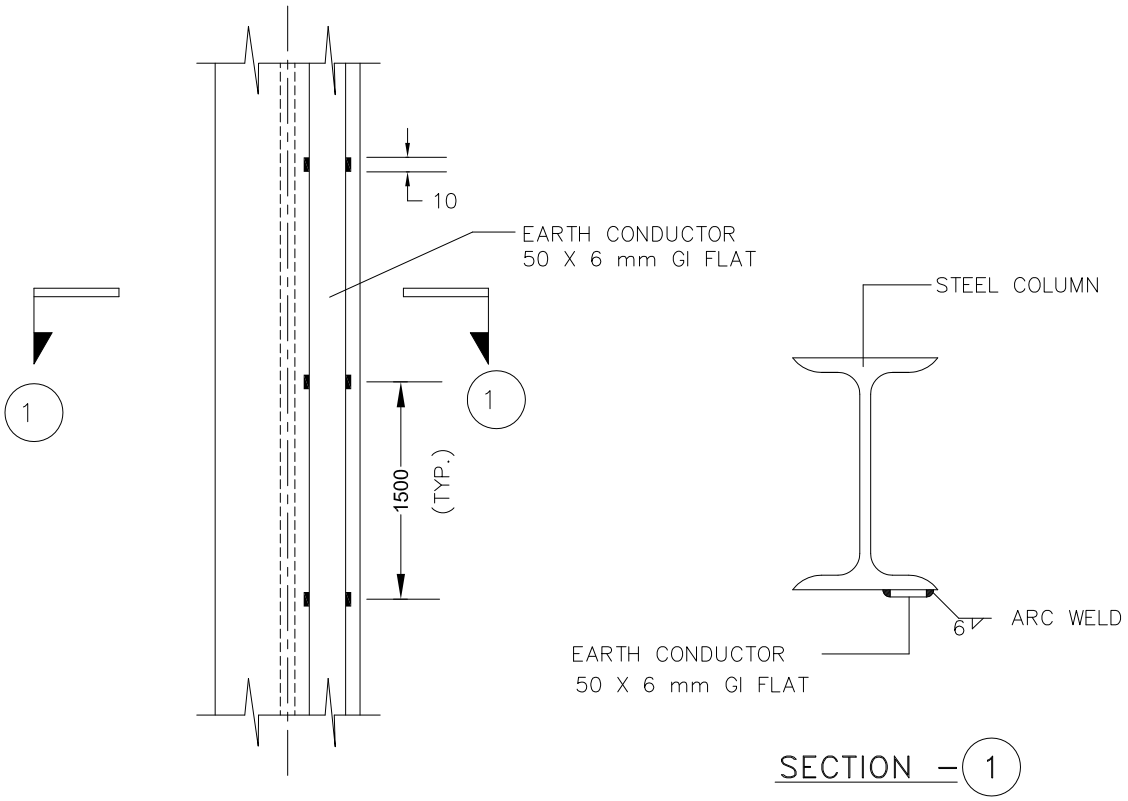
APPD.	A.A		
DATE	17.10.17		
SCALE	NTS		



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APPD.	A.A
DATE	17.10.17
SCALE	NTS

TITLE:–

EARTHING CONDUCTOR ALONG STEEL COLUMN

BSES Yamuna Power Limited

FILE NAME: REL–COENG–NEE–E21–P–00085 DATE:–08.09.10

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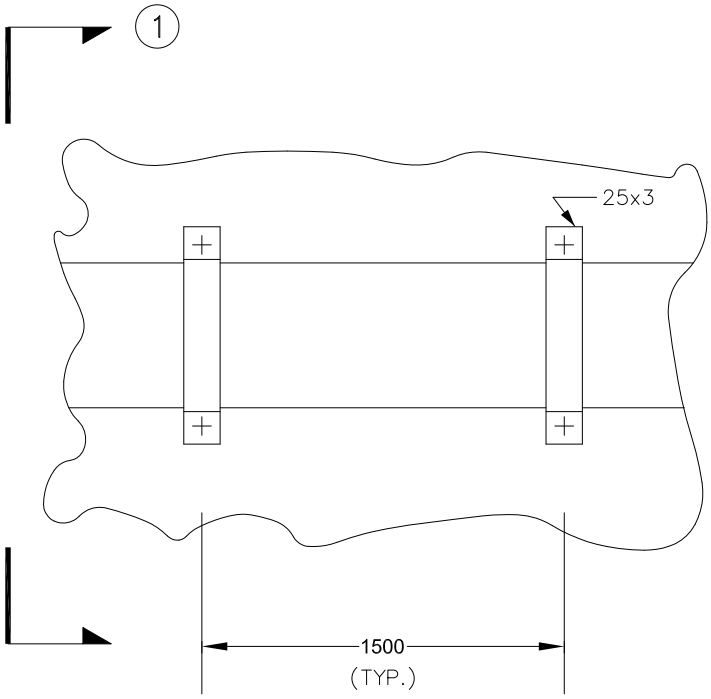

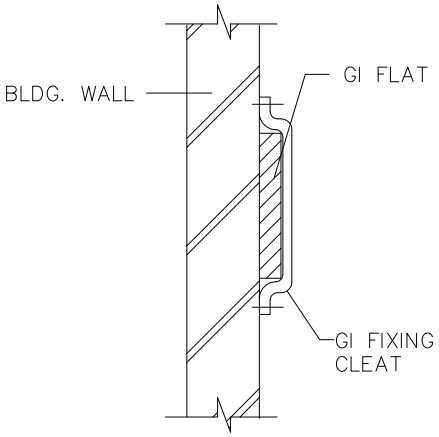

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APPD.	A.A
DATE	17.10.17
SCALE	NTS

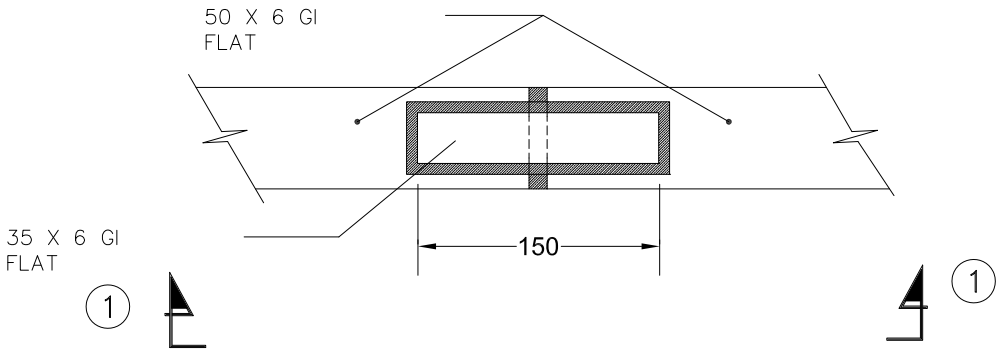
TITLE:–

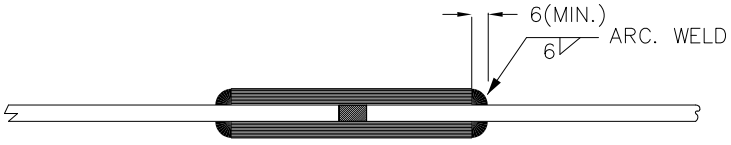
EARTHING CONDUCTOR ALONG BUILDING WALL

BSES Yamuna Power Limited

FILE NAME: REL–COENG–NEE–E21–P–00085 DATE:–08.09.10

A4 [210x297]





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DATE	17.10.17
SCALE	NTS

TITLE:–

BUTT JOINT BETWEEN GI FLATS

BSES Yamuna Power Limited

FILE NAME: REL–COENG–NEE–E21–P–00085 DATE:–08.09.10

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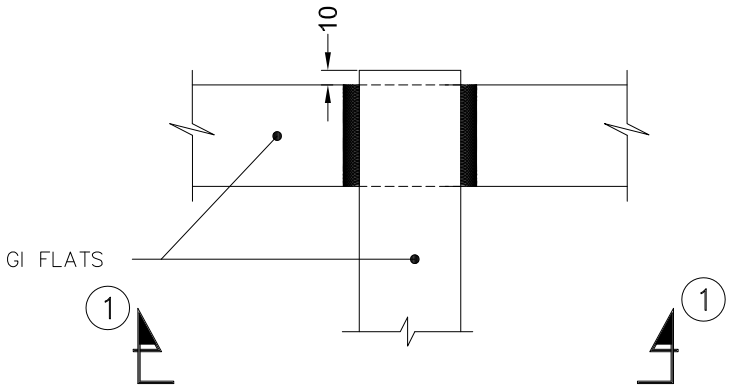

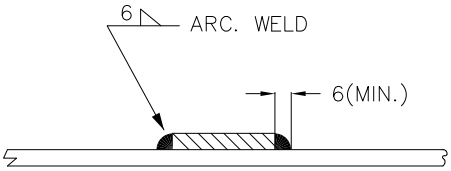

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SCALE	NTS

TITLE:–

CROSS JOINT BETWEEN GI FLATS

BSES Yamuna Power Limited

FILE NAME: REL–COENG–NEE–E21–P–00085 DATE:–08.09.10

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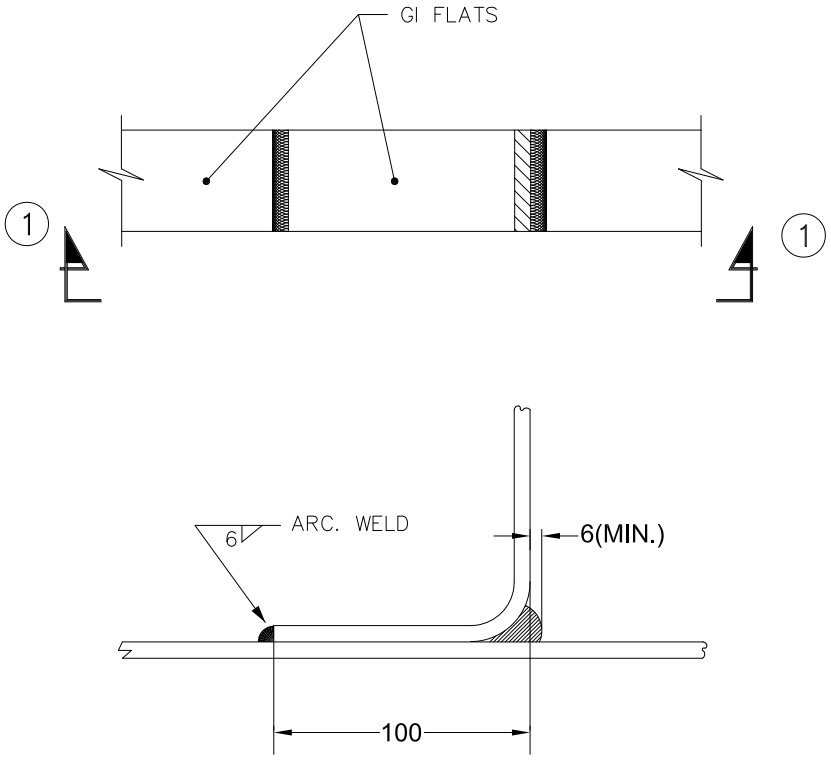

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DATE	17.10.17
SCALE	NTS

TITLE:–

ANGULAR JOINT BETWEEN GI FLATS

BSES Yamuna Power Limited

FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

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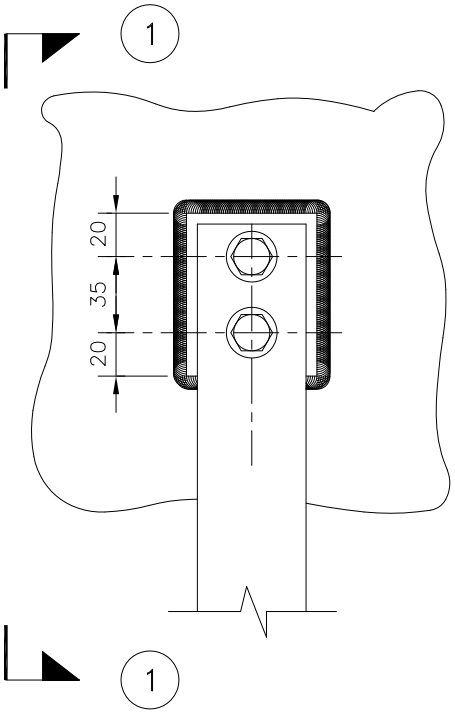

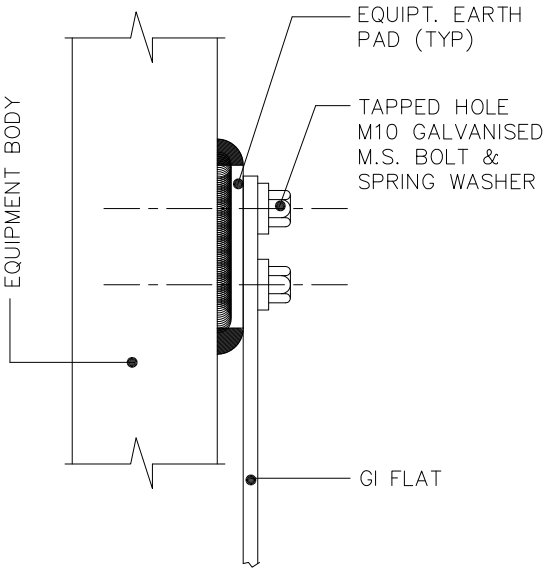

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DRAWN	A.H
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APPD.	A.A
DATE	17.10.17
SCALE	NTS

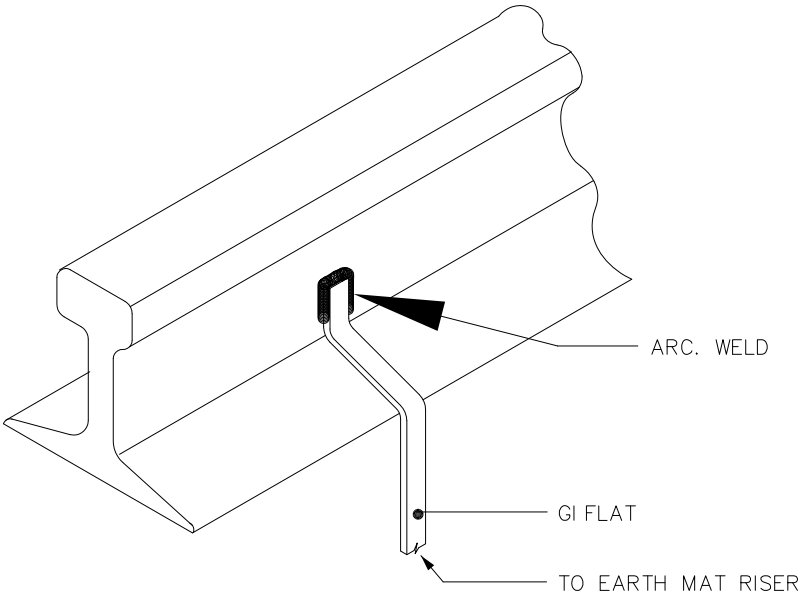
TITLE:–

EQUIPMENT EARTHING

BSES Yamuna Power Limited

FILE NAME: REL–COENG–NEE–E21–P–00085 DATE:–08.09.10

A4 [210x297]



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APPD.	A.A
DATE	17.10.17
SCALE	NTS

TITLE:-

RAIL EARTHING

BSES Yamuna Power Limited

FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

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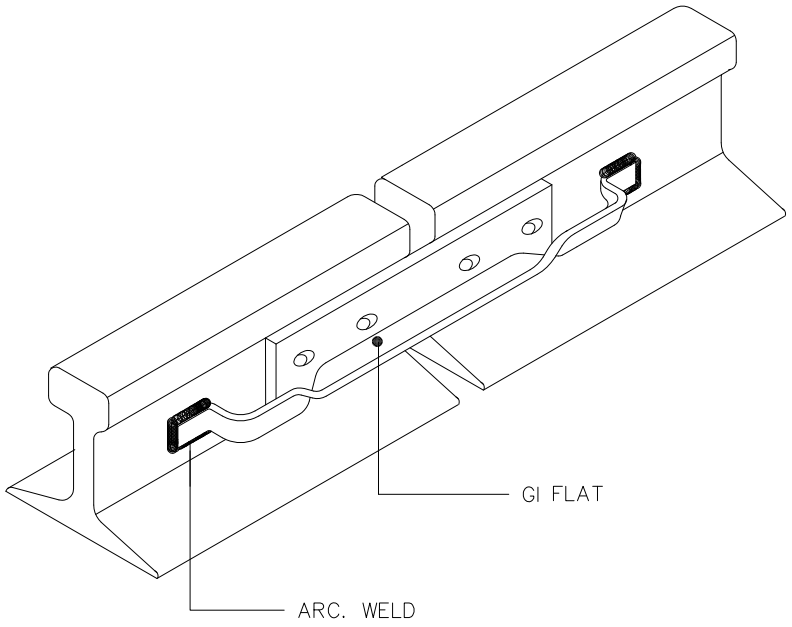

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APPD.	A.A
DATE	17.10.17
SCALE	NTS

TITLE:–

RAIL BONDING

BSES Yamuna Power Limited

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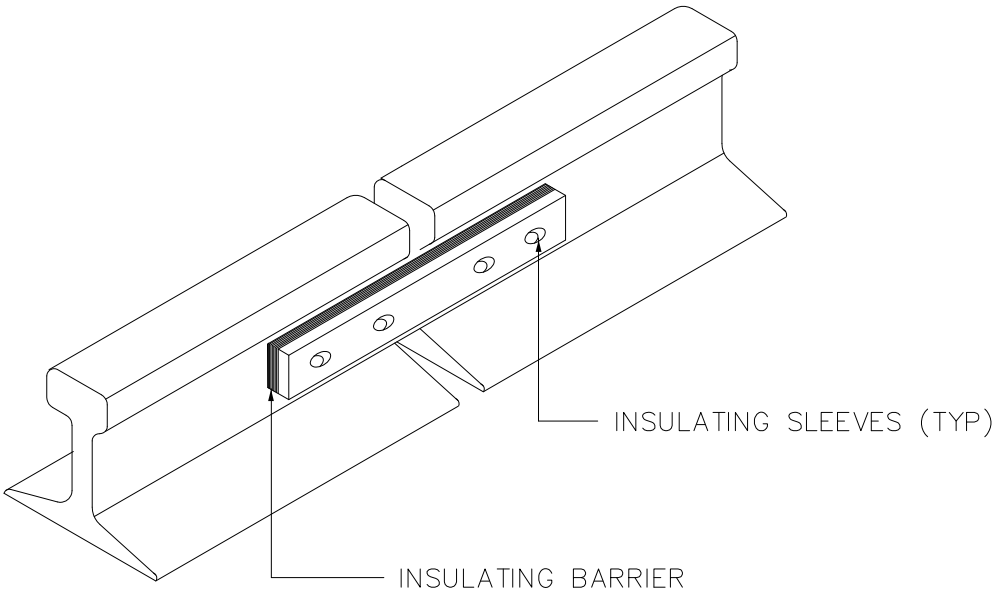
A4 [210x297]



Note: Such installation shall be provided at points where the rail track leaves the earth grid(typically at the plant boundary)

DRAWN	A.H
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DATE	17.10.17
SCALE	NTS

TITLE:–

RAIL SECTIONS LEAVING THE EARTH MAT

BSES Yamuna Power Limited

FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

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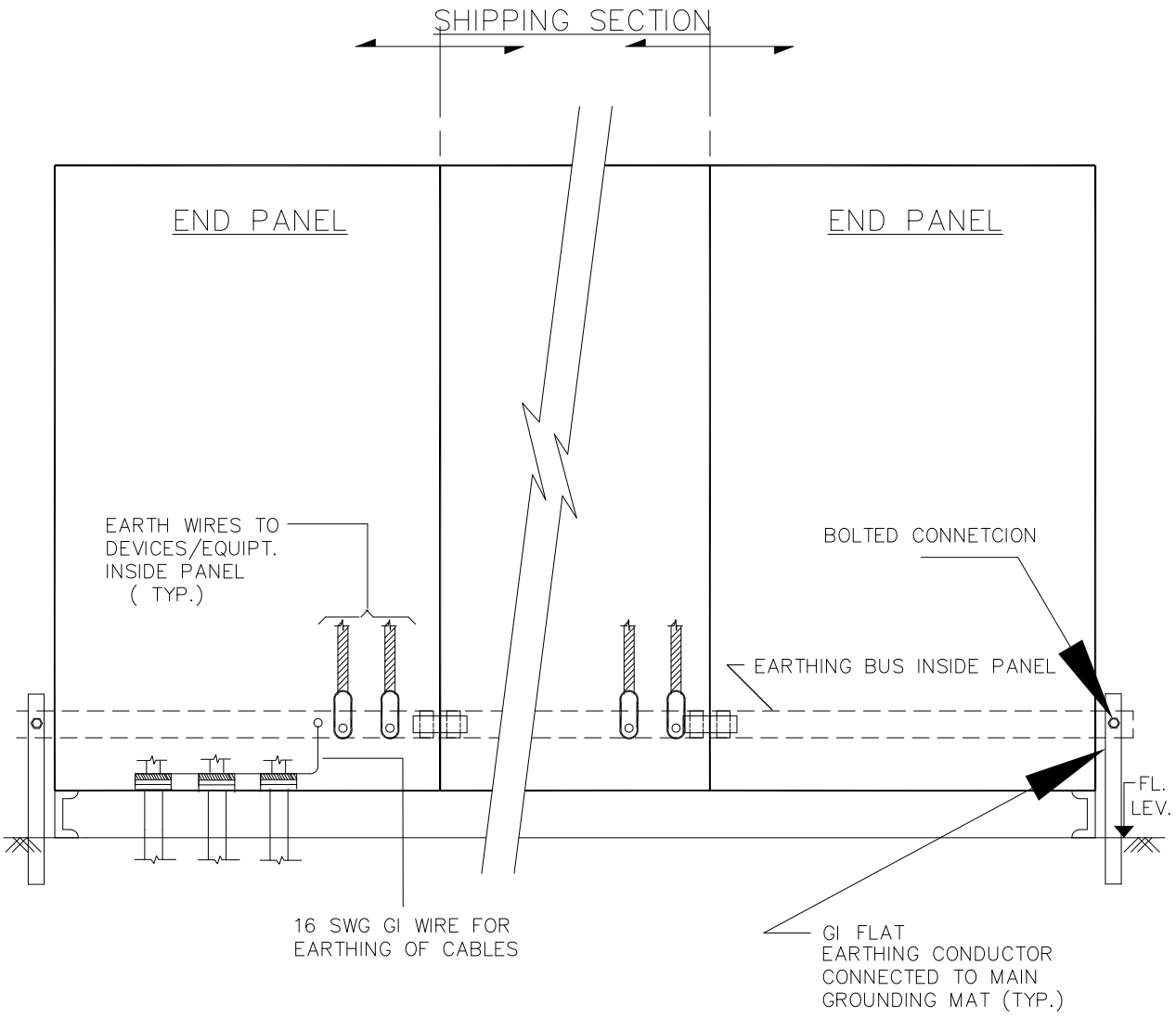

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APPD.	A.A
DATE	17.10.17
SCALE	NTS

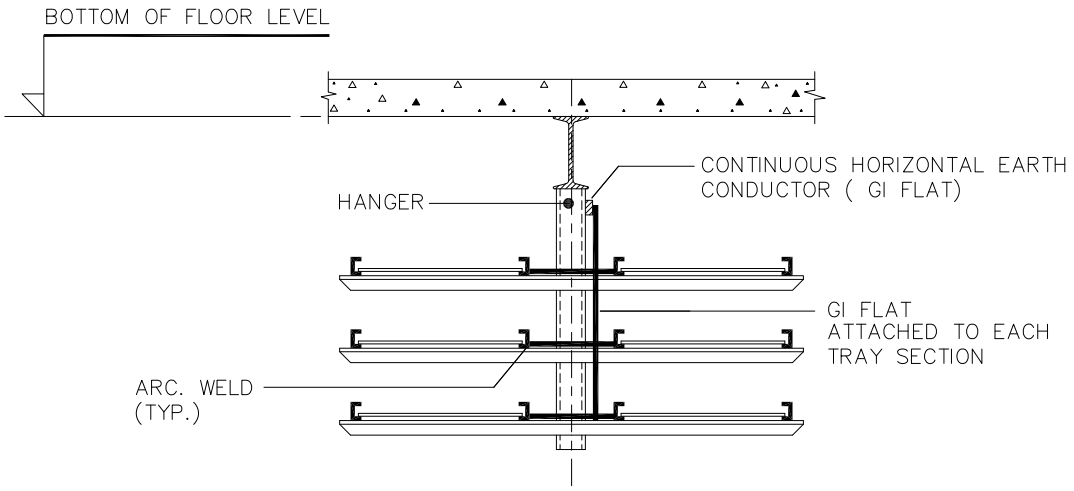
TITLE:-

EARTHING OF MCC, SWITCHGEAR

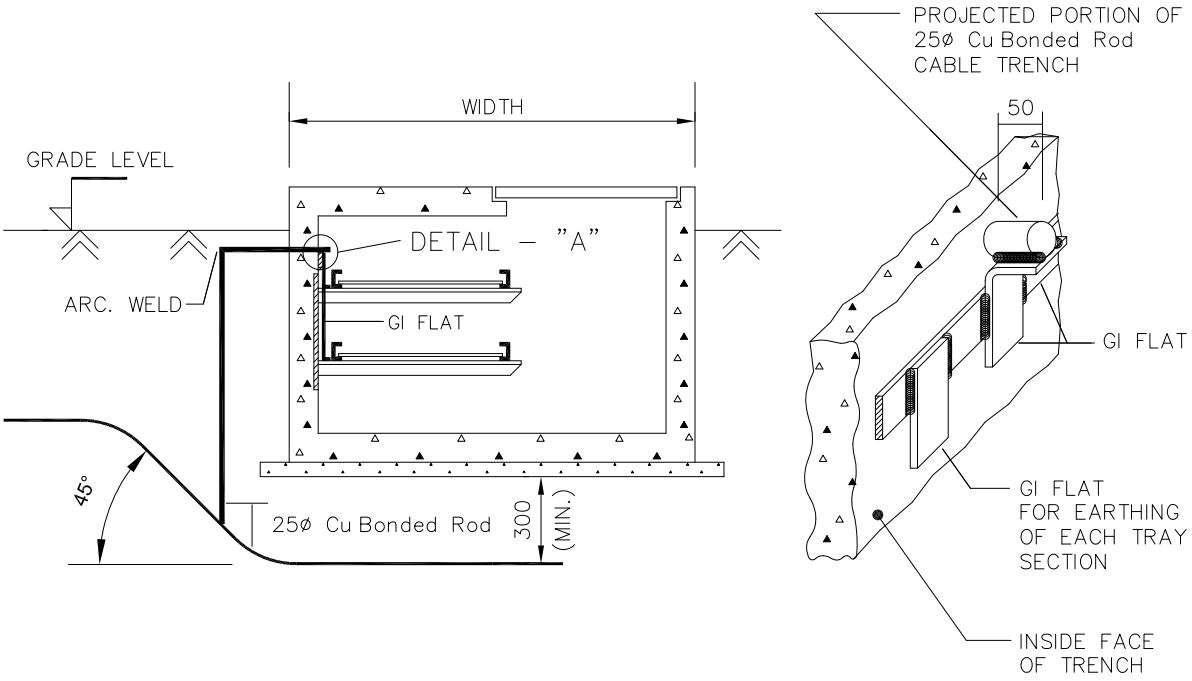
BSES Yamuna Power Limited

FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

A4 [210x297]



OVERHEAD CABLE TRAY EARTHING



DETAIL – A

DRAWN	A.H
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APPD.	A.A
DATE	17.10.17
SCALE	NTS

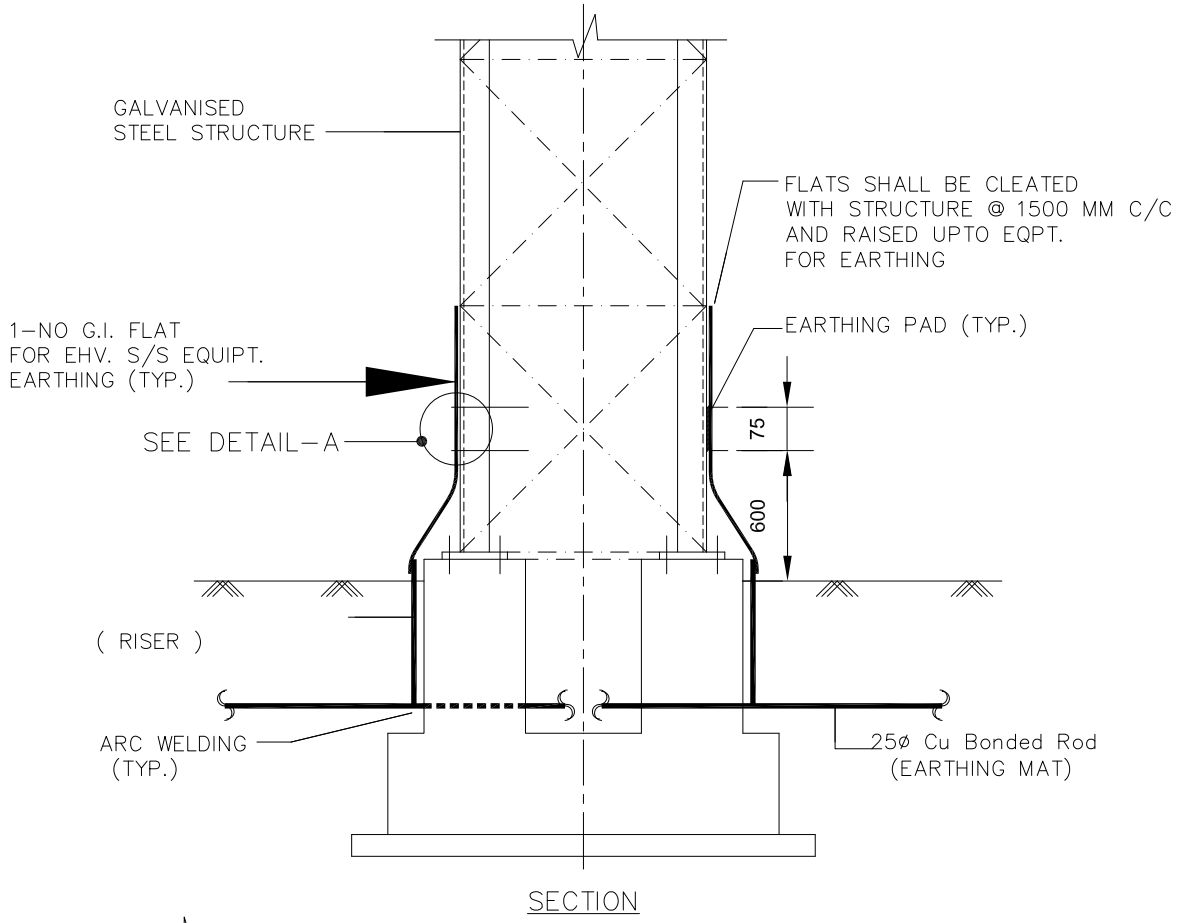
TITLE:–

CABLE TRANCH/TRAY EARTHING

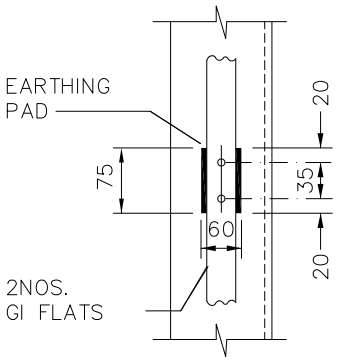
BSES Yamuna Power Limited

FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

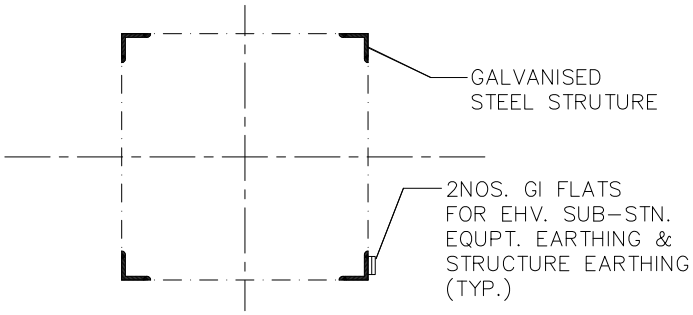
A4 [210x297]



SECTION



DETAIL – 'A'



PLAN

DRAWN	A.H
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APPD.	A.A
DATE	17.10.17
SCALE	NTS

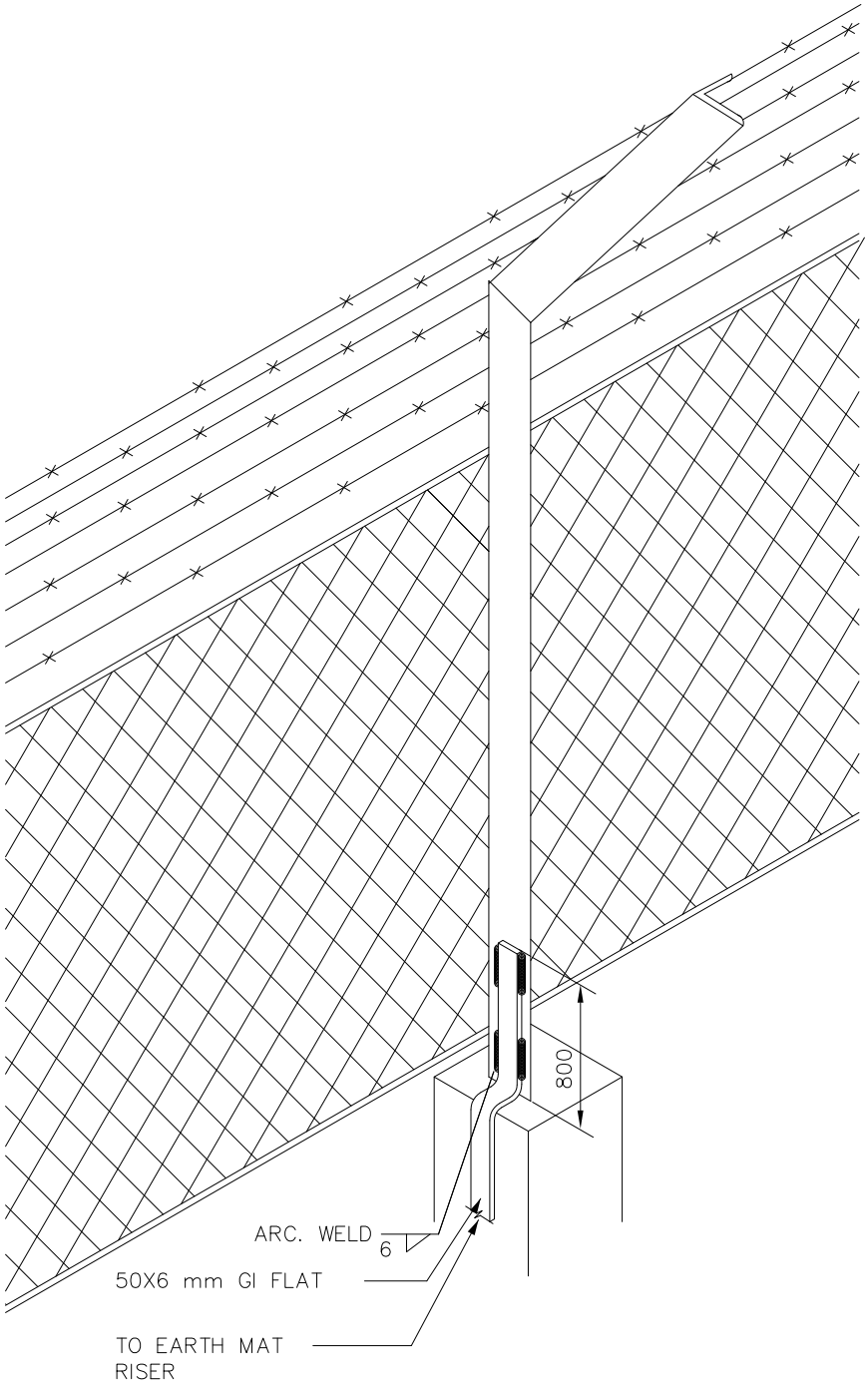
TITLE:–

EARTHING OF STRUCTURE MOUNTED ELECTRICAL EQUIPMENT

BSES Yamuna Power Limited

FILE NAME: REL–COENG–NEE–E21–P–00085 DATE:–08.09.10

A4 [210x297]



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APPD.	A.A
DATE	17.10.17
SCALE	NTS

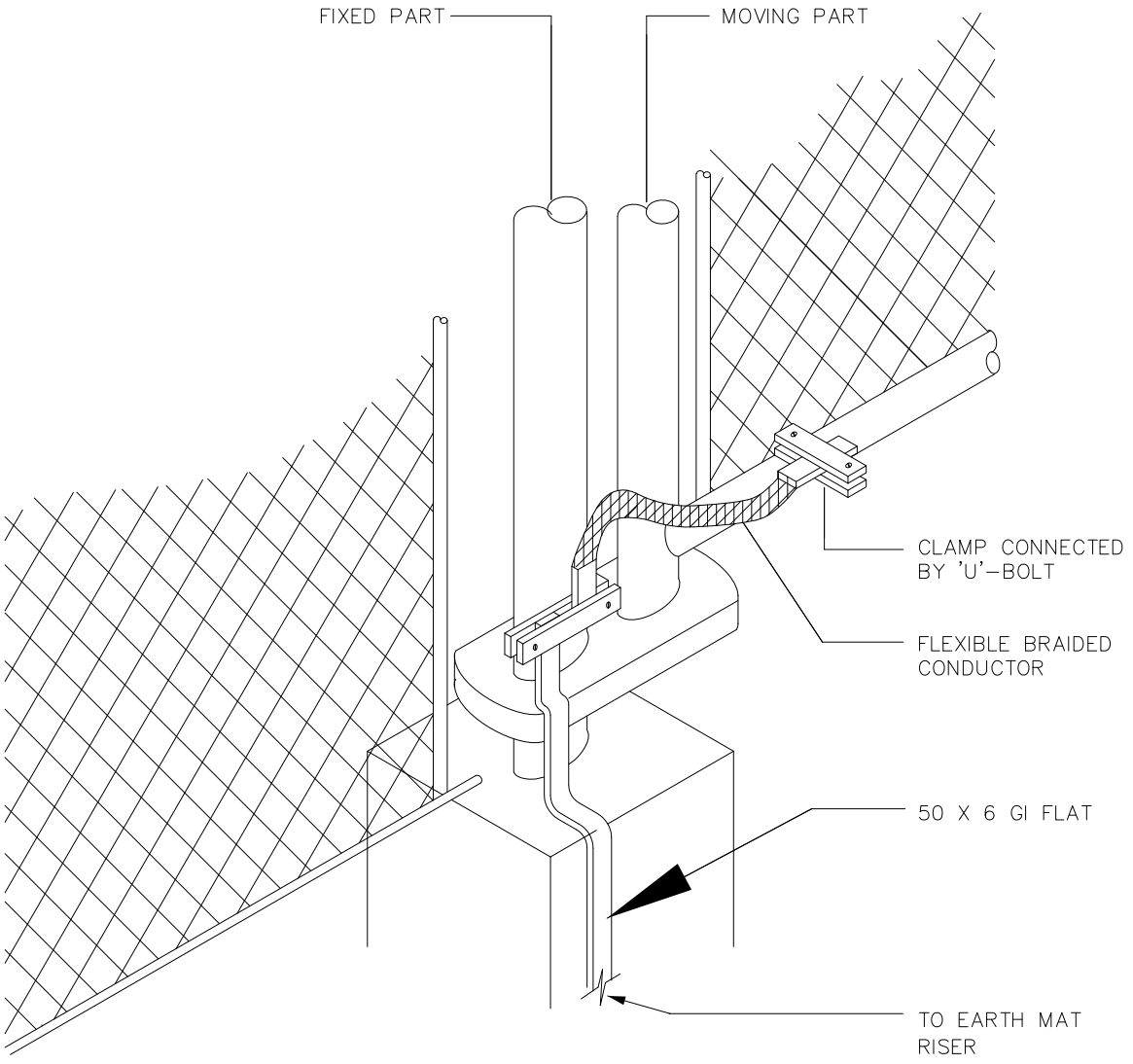
TITLE:–

FENCE EARTHING

BSES Yamuna Power Limited

FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

A4 [210x297]



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CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

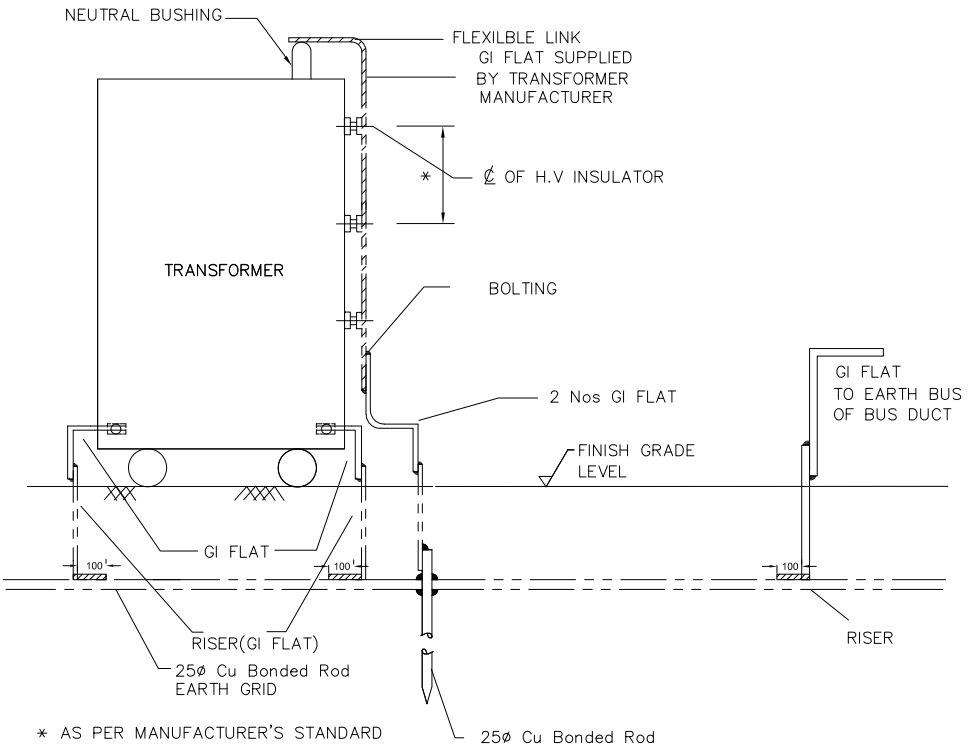
TITLE:-

FENCE GATE EARTHING

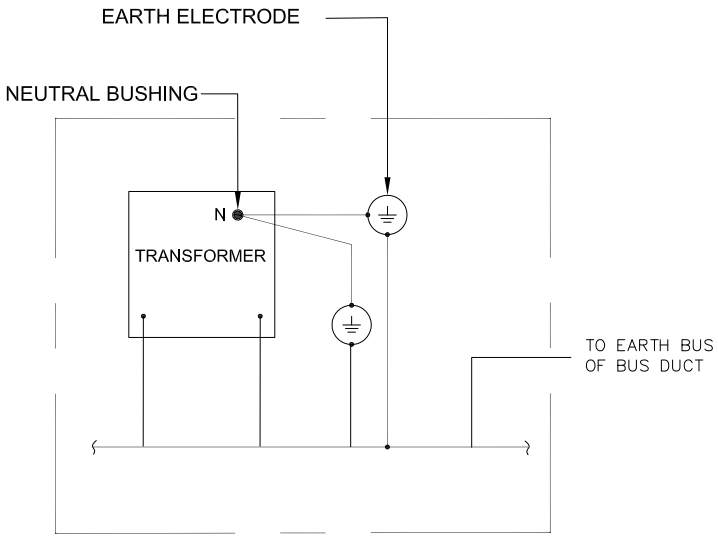
BSES Yamuna Power Limited

FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

A4 [210x297]



NOTE: APPLICABLE TO EHV WINDINGS AND LV (415V) WINDINGS OF TRANSFORMERS REQUIRING DIRECT EARTHING OF NEUTRALS.



LINE DIAGRAM

SOLID NEUTRAL EARTHING

DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

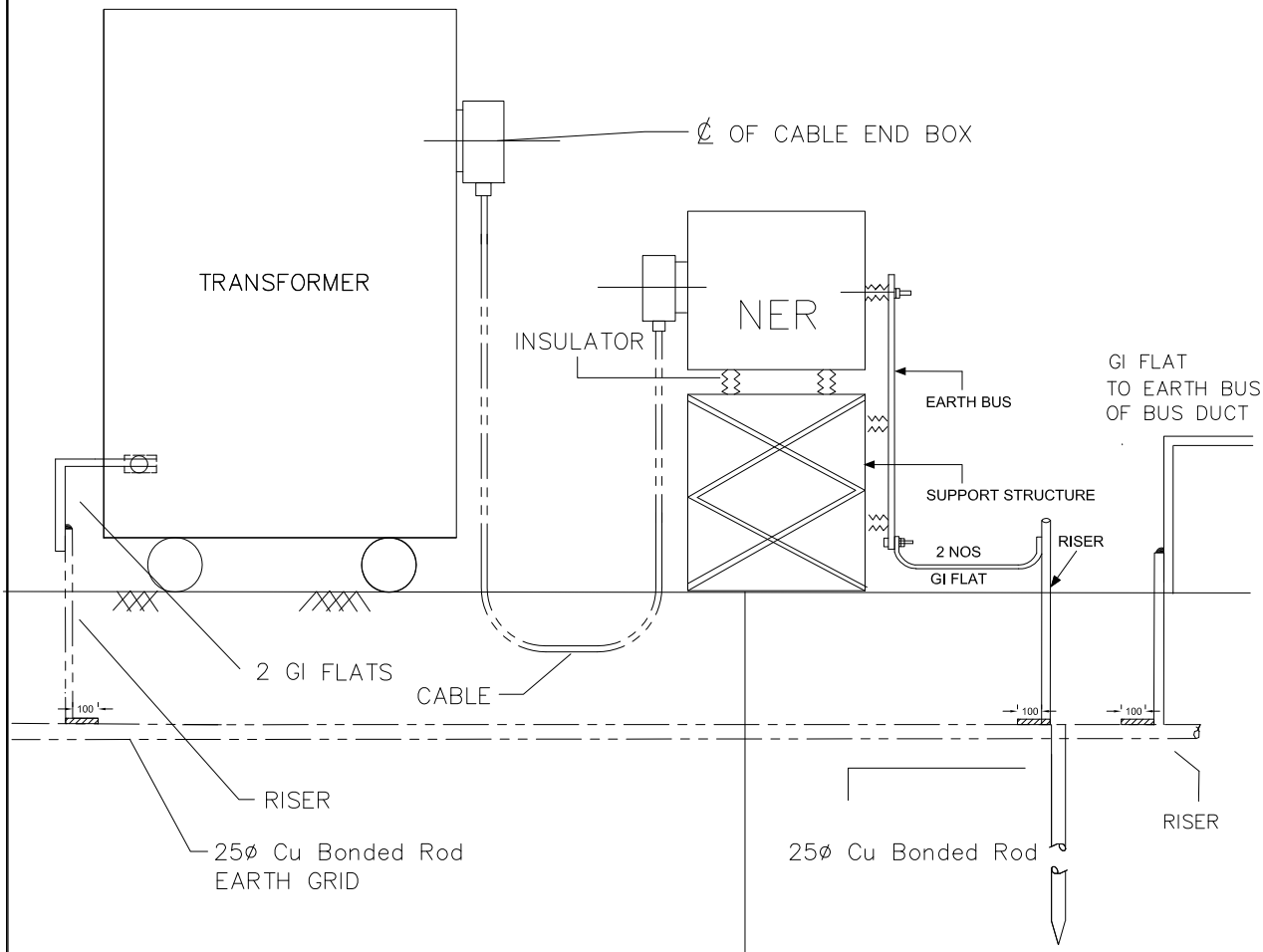
TITLE:-

TRANSFORMER NEUTRAL EARTHING (DIRECT)

BSES Yamuna Power Limited

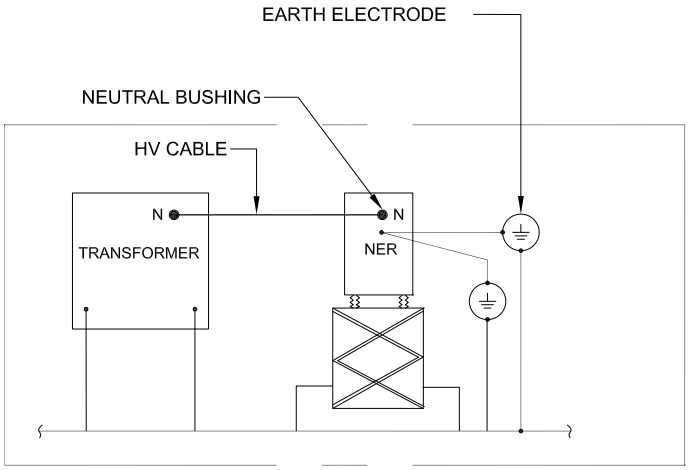
FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

A4 [210x297]



NOTES

1. APPLICABLE to MV(3.3KV,6.6KV,11KV WINDING)



LINE DIAGRAM

NEUTRAL EARTHING THROUGH NER

DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

TITLE:–

TRANSFORMER NEUTRAL EARTHING (THROUGH NGR)

BSES Yamuna Power Limited

FILE NAME: REL–COENG–NEE–E21–P–00085 DATE:–08.09.10

A4 [210x297]

TECHNICAL SPECIFICATION

FOR FIRE PROTECTION SYSTEM

OF MOTIA KHAN GRID S/S

1. Automatic fire detection system

The Existing grid already has the fully addressable automatic fire detection system and smoke aspiration system installed in the existing panel rooms. The new panel room to be installed with the fully addressable smoke detectors compactable to the existing panel and the smoke aspiration system.

Details of the panel and the detectors are as follows.

SNO	ITEM	SPECIFICATION	MAKE
1	Digital addressable fire alarm panel (PX-16E/32E)	2-32 zone digitally addressable zones with each zone support 20 addressable devices, Network able, PC based graphic software for easy monitoring, support ASES addressable MCP.	ASES
2	PA console	Keypad with feather touch switch for zone selection, gooseneck mike attached for announcement, main, Ac fail, fuse blown LED indication, inbuilt battery charger and battery upto 25AH.	ASES
3	Aspirating smoke detector system (ASD 531)	Alarm sensitivity range of 0.02%/m to 10%/m.	SECURITON
4	Photoelectric smoke detector	Tested and approved to EN54-7:2000, Bi-color LED detector status indicator	SYSTEM SENSOR
5	Rate of rise and fixed temperature thermal detector	Tested and approved to EN54-5:2000 class A1R	SYSTEM SENSOR
6	Digital addressable monitor module (PX-DA-MM)	Digital addressable communications, DIP switch for addressing of module,	ASES
7	Digital addressable manual call point		ASES
8	Conventional Sounder		ASES
9	Talk Back unit	Compatibility with any make conventional two way communication system, integrated alarm test key features.	ASES
10	Sinages		Reputed

2. First Aid Fire Extinguishers

The first aid fire extinguishers are already place in the conspicuous places in the existing installations. The vendor has to provide the following quantity of first aid fire extinguishers of make CeaseFire or Minimax only.

Quantity of F.E for 33kV grid:

4.5 kg CO2	----	2 nos
22.5 kg CO2	----	2 nos
6 kg ABC (MAP 90)	----	2 nos
75kg ABC (MAP 90)	----	1 nos

3. Fire Bucket with Stand

Fire bucket stand having provision to hang 4 fire buckets with dry sand filled and a suitable top cover to avoid the ingression of water during rain. The fire bucket must comply with the IS 2546.

The vendor has to provide two stand, 8 buckets with dry sand filled.

TECHNICAL SPECIFICATION

FOR

ILLUMINATION & LIGHTING SYSTEM

PREPARED BY	REVIEWED BY	APPROVED BY	REV	0
AH	GS	AA	DATE	9th Aug, 2018

INDEX

1. SCOPE....3
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1. SCOPE

The specification covers the design, engineering, manufacture, assembly and testing at manufacturer's work, supply and installation of Illumination system for substation including normal distribution pillars, normal lighting board, emergency distribution pillar, emergency lighting board, Junction boxes, Illumination lamps with required lux level.

2. STANDARDS AND CODES

Standard Code	Standard Description
IS 16101 : 2012	General Lighting -LEDs and LED modules – Terms and Definitions
IS16102(Part 1) 2012	Self-Ballasted LED Lamps for General Lighting Services, Part 1 Safety Requirements
IS16102(Part 2) 2012	Self-Ballasted LED Lamps for General Lighting Services, Part 2 Performance Requirements
IS16103(Part 1) 2012	Led Modules for General Lighting, Part 1Safety Requirements
IS16103(Part 2) 2012	Led Modules for General Lighting, Part 2 Performance Requirements
IS15885(Part2/Sec13)	Safety of Lamp Control Gear , Part 2 Particular Requirements , Section 13 dc. or ac. Supplied Electronic Control gear for Led Modules
IS16104 : 2012	d.c. or a.c. Supplied Electronic Control Gear for LED Modules - Performance Requirements
IS16105 : 2012	Method of Measurement of Lumen Maintenance of Solid State Light (LED) Sources
IS16106 : 2012	Method of Electrical and Photometric Measurements of Solid-State Lighting (LED) Products
IS 16107(Part 1)2012	Luminaires Performance ,Part 1 General Requirements
IS 16107(Part 2)2012	Luminaires Performance, Part 2 Particular Requirements ,Section 1 LED Luminaire
IS 16108 : 2012	Photo biological Safety of Lamps and Lamp Systems
IS 10322 : 2012	Luminaires: Part 5 Particular requirements, Section 3 Luminaires for road and street lighting
IS 5	Colours for Ready Mixed Paints and Enamels
IS 613	Copper Rods and Bars for electrical purposes
IS 694	PVC Insulated cables for working voltages up to and including 1100 V
IS 2551	Danger notice plates
IS 5082	Wrought Aluminium and Aluminium alloy bars, rods, tubes and sections for electrical purpose
IS 6665	Code of practice for industrial lighting
IS 13703	LV Fuses for voltage not exceeding 1000V ac or 1500V dc
IS 10118	Code of Practice for Selection, Installation and Maintenance of Switchgear and Controlgear
International Standard	

IEC 62612	Self-ballasted LED lamps for general lighting services for voltage above 50 V — Performance requirements
IEC : 60598-2-3	Particular requirements - Luminaries for road and street lighting
IEC 62471	Photo biological safety of lamps and lamp systems
IEC 62778	Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaries
IEC 61000-4-5	Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test
IEC 60439	Low Voltage Switchgear and Controlgear assemblies - Type tested and partially type tested assemblies
IEC 60529	Degrees of protection provided by enclosures (IP Code)
IEC 60947-1	Low Voltage Switchgear and Controlgear - General Rules
IEC 60947-2	Low Voltage Switchgear and Controlgear - Circuit breakers
IEC 61643	Low-voltage surge protective devices

3. ILLUMINATION SYSTEM

3.1.	Lux level requirement	3.1.1. The design of the illumination system shall ensure availability of the average illumination levels as specified below with the maximum possible uniformity in the entire substation. The illumination system shall consist of the normal lighting system and emergency lighting system. The minimum illumination levels shall be as specified below(Reference IS3646(Part II)). 3.1.1.1. Outdoor Substation : 20 lux 3.1.1.2. Roads within substation : 20 lux 3.1.1.3. Boundary wall of the substation : 10 lux 3.1.1.4. Control room : 300 lux 3.1.1.5. Switchgear Room : 200 lux 3.1.1.6. Battery room : 100 lux 3.1.1.7. Stair case : 100 lux 3.1.1.8. Transformers : 100 lux 3.1.2. The illumination level of specific spots such as operating mechanisms of Capacitor bank isolator, oil level and temperature gauges of transformer etc. shall be minimum 50 Lux. Contractor shall design the lighting system with the help of desired software. Owner shall verify the same post commissioning with lux meter to check the levels. In case desired lux levels are not met contractor has to install addition fitting in outdoor and indoor location as per requirement. 3.1.3. Complete design calculation sheets for arriving at the number of luminaires required for the normal and emergency requirements shall be furnished by the bidder. Design calculation sheets for the selection of cables, MCB, HRC fuses, bus bars, etc. are also required to be furnished for Owner's approval.

3.2.	Illumination circuit	3.2.1.	The illumination system load and welding load in the substation area shall be supplied from 415/230 volt ACDBs to be provided in the substation control room. Requisite numbers of 3-phase, 4-wire, cable circuits for illumination system and welding socket outlets shall be extended from the above board. The laying of cables from the Board to the illumination system/welding socket outlets and their installation are included in the Bidder's scope.
		3.2.2.	Each outgoing cable circuit for illumination loads from the 415 volt switchboard shall terminate in the respective outdoor pillar boxes located in the substation. Outgoing feeders from the illumination shall be taken to the various illumination points in the substation. Necessary fuses shall be provided near light fixtures in the substation.
		3.2.3.	The emergency illumination load shall be supplied from the main emergency illumination board located in the control room. Necessary cable circuits with appropriate fuses shall be provided by the Contractor for the supply system for emergency illumination load of the substation.
		3.2.4.	Emergency DC lighting system shall be provided in the substation wherever required. The emergency lighting shall be adequate for safe movement by the operating personnel in the substation in the event of failure of normal lighting system. Number of lights shall be decided at the time of detailed engineering. A total of minimum 12 no's individually controllable 60 watt lamps shall be provided in the substation.
3.3.	Wiring	3.3.1.	All lighting fixtures and 5A convenience outlets shall be wired with 1.1 KV grade PVC insulated extra flexible, multistranded, copper conductor cables of size not less than 2.5 sq.mm.
		3.3.2.	For 15A heavy-duty outlets copper conductor cables of size not less than 6 sq. mm shall be used.
		3.3.3.	The wiring shall consist of phase, neutral and ground. For grounding the lighting fixtures/convenience outlets etc., GI wire of size not less than 14 SWG shall be used. The phase and neutral conductor shall be suitably colour coded.
		3.3.4.	Supply shall be looped between the lighting fixtures of the same circuit by using junction boxes. For this purpose one (1) 100 mm x 100 mm square junction box shall be provided for each lighting fixture. For recessed lighting fixtures, supply shall be extended from the junction boxes to the fixtures by means of flexible conduits. While for stem-mounted/wall-mounted lighting fixtures the junction box shall be mounted below one of the mounting stems.
		3.3.5.	For lighting branch circuits the nos. of lighting switches shall be decided keeping in mind the ease of control, as well as to limit the current to 2.5A per circuit.
		3.3.6.	For convenience outlets, the bidder shall design the wiring scheme so as to limit 6 nos. of 5A outlets per branch

		circuit and two nos. of 15A outlets per branch circuit. 3.3.7. All wiring materials such as terminals, crimping lugs, ferrules etc. shall also be provided by the Contractor. 3.3.8. No section of the conduit shall be filled with more than 70% of its area. Any consumable material that is required for pulling the wires through conduit shall also be provided by the Contractor. 3.3.9. Lighting fixtures coming in one area shall be evenly distributed between three phases so that tripping of one phase or two phases does not cause total loss of illumination in that area.
3.4.	Required documents to be submitted	Complete manufacturer's literature/catalogues, performance curves, illumination distribution curves, G.A. drawings, specification sheets, etc. as relevant in respect of all materials/equipment to be supplied shall be submitted by the Contractor.
3.5.	Illumination system check after installation	After completion of installation of the illumination system in the substation, the actual illumination level at different locations shall be measured by the Contractor in the presence of Owner's authorised representative. If the average value of the measured illumination levels is found to fall short of the specified levels, the Contractor shall have to provide additional lighting fixtures so as to achieve the specified levels of illumination at no additional cost to the Owner. While measuring the illumination levels due allowance shall be made on account of maintenance factor. The specified lux levels shall be suitably increased to cover maintenance factor of 0.6 for outdoor areas.

4. DISTRIBUTION PILLARS FOR NORMAL ILLUMINATION SYSTEM

4.1.	Construction	4.1.1. Distribution pillars of adequate dimensions shall be constructed from sheet steel having a thickness not less than 2 mm. 4.1.2. The pillars shall be totally enclosed weather-proof, dustproof, vermin-proof, having hinged doors with locking arrangement and shall be capable of being mounted in the substation. 4.1.3. The pillars suitable for cable entry at the bottom shall be designed for easy access of connections to terminals and inspection of equipment mounted therein. 4.1.4. The degree of protection of the board shall be IP55. 4.1.5. The enclosure shall be painted externally with Shade No., 692 of IS:5 and internally with brilliant white of semi-glossy finish of IS:5.
4.2.	Configuration	4.2.1. Each pillar shall accommodate the following: 4.2.2. One incoming, 4-pole (3 phase and neutral) isolating switch with MCB of appropriate current rating. 4.2.3. 3-phase and neutral bus bars of appropriate current rating. 4.2.4. Single-pole earth leakage circuit breakers of suitable current ratings on all outgoing circuits.

		4.2.5. Neutral links for all outgoing circuits. 4.2.6. Cable lugs, compression type cable glands, name plates, circuit numbers, earthing lugs, etc. to make the pillar complete in all respects. 4.2.7. 20% spare outlets shall be provided for outgoing feeders. 4.2.8. Three (3) indicating lamps with fuses to indicate that supply is 'ON'.

5. LIGHTING DISTRIBUTION BOARDS

5.1.	Construction	5.1.1. Metal-clad enclosure with minimum 2 mm CRCA sheets for load-bearing members and 1.6 mm for non load-bearing members suitably reinforced with structural. 5.1.2. 3-phase, 4-wire bus bar system with high conductivity aluminium busbars mounting on FRP insulators having anti-tractive property with minimum 25 mm phase-to-phase and minimum 19 mm phase-to-earth clearances. The busbars shall be uniform throughout the length of the LDB and busbar joints shall be silver plated and covered with shrouds. 5.1.3. All cables shall enter from the bottom. 5.1.4. The degree of protection for the LDB shall be IP-54. 5.1.5. The enclosure shall be painted externally with Shade No., 692 of IS:5 and internally with brilliant white of semi-glossy finish of IS:5.
5.2.	Configuration	Each LDB shall accommodate the following: 5.2.1. One incoming, 4-pole (3 phase and neutral) isolating switch with MCB of appropriate current rating. 5.2.2. 3-phase and neutral bus bars of appropriate current rating. 5.2.3. 4 Pole outgoing MCBs of appropriate rating 5.2.4. Cable lugs, compression type cable glands, name plates, circuit numbers, earthing lugs, etc. to make the pillar complete in all respects. 5.2.5. 20% spare outlets shall be provided for outgoing feeders. 5.2.6. Three (3) Nos. indication lamps (Red, Yellow, Blue) shall be provided to indicate that the incoming supply is available. Similarly, 3 Nos. indication lamps shall be provided to indicate that the busbar is energised.
5.3.	Busbar	5.3.1. The busbars shall be suitable for short-time current rating of 40KA for 1 Sec. 5.3.2. The busbar temperature rise shall not exceed 35 Deg C over an ambient of 50 Deg C. 5.3.3. The LDBs shall be provided with a continuous busbar of 25 x 6 sq.mm (electrolytic copper) with suitable hardware for connection to the main grounding grid

6. MAIN EMERGENCY LIGHTING BOARD

6.1.	Construction	6.1.1. Metal-clad enclosure with minimum 2 mm CRCA sheets for load-bearing members and 1.6 mm for non load-bearing members suitably reinforced with structural. 6.1.2. All cables shall enter from the bottom. 6.1.3. The degree of protection for the LDB shall be IP-54. 6.1.4. The enclosure shall be painted externally with Shade No., 692 to IS:5 and internally with brilliant white of semi-glossy finish to IS:5.
6.2.	Configuration	6.2.1. Each Board shall accommodate the followings: 6.2.2. Automatic changeover contactor. 6.2.3. Voltage sensing relays. 6.2.4. Time delay relay. 6.2.5. Bus Bars. 6.2.6. Two pole MCBs of adequate ratings for incoming and outgoing feeders. 6.2.7. Test switch, push button type. 6.2.8. Indicating lamps, ac - Green, dc - Red. 6.2.9. Terminals for remote indication 6.2.10. Cable lugs, compression type cable glands, name-plates, circuit numbers, earthing lugs and remote indication wiring upto substation 415V a.c. control board, to make the board complete in all respects.
6.3.	Changeover facility	The main emergency lighting board shall have an automatic changeover switch to energise the dc lighting system in the event of AC power failure. It shall have voltage-sensing relays to perform the changeover automatically when AC voltage of any one phase falls below 60 percent of 240 volts and continues at that low level for more than 10 seconds. These shall changeover from DC to AC again when 70 percent of 240 volt is restored and this continues for 10 seconds.
6.4.	Emergency Lighting Pillar	Local Emergency Lighting Pillar shall be identical in details to Lighting Distribution Pillar specified in clause 4 except that it shall have two pole isolating switch fuse unit on the incoming side and only two busbars and shall be without neutral links.

7. LUMINAIRES

7.1.	Luminaires type	Luminaires for use in normal and emergency illumination systems in the substation shall be suitable for LED lamps. All the luminaires shall be supplied complete with all accessories and lamps. The LED lamps ratings shall be adequate to achieve the required Lux level and calculation for number of luminaires shall be in the bidder's scope. Minimum rating shall be a follows - 7.1.1. Outdoor – 90W minimum 7.1.2. Indoor – 36W minimum

7.2.	Flood lights	The flood light luminaires in the substation shall be fixed at suitable height on the substation structures/ building, so as to provide the specified average illumination in the substation area without causing any glare to the operational/ maintenance staff working in the substation. While fixing the luminaires it shall be ensured that the stipulated electrical clearances are not violated. The Contractor shall supply and install suitable type of non-mettalic street light poles or octagonal galvanished poles required for installing the fittings for illuminating the roads, fence boundary wall etc.
7.3.	Reliability	Substation lighting circuits shall be divided into two or three sections and provided with time switches of suitable ratings.
7.4.	Design features for Outdoor Luminaires	
7.5.	Fixture	7.5.1. The luminaries housing shall be either extruded or pressure die casted aluminium of minimum 1.6 mm thickness. Body must be Corrosion Resistant Powder Coated and UV resistant. 7.5.2. The entire housing shall be dust and waterproof having Ingress protection of housing as IP65 or above as per IEC 60529. 7.5.3. Luminaire should be covered with suitable Glass or diffuser with high Transitivity. All luminaires shall be supplied with either clear toughened glass or clear polycarbonate cover for better IP retention and higher life.
7.6.	LED	7.6.1. The luminous efficacy of LED luminaire shall be atleast 85 lumen/watt. 7.6.2. LED module efficacy shall not be less than 90 percent of the rated LED module Efficacy. 7.6.3. Color Rendering Index (CRI) shall be at least 70 7.6.4. Color Temperature shall be 5500-6500K 7.6.5. Uniformity Emin/Eavg> 0.4, Emin/Emax>0.33
7.7.	LED Driver	LED driver shall have following features: 7.7.1. LED driver shall be applicable for Power supply 240V AC±10%, at 50Hz+3% / -5%. 7.7.2. Output voltage of the driver shall be designed to meet the Power Requirements of the system. 7.7.3. Power factor of complete fitting shall be more than 0.90 at full load. 7.7.4. Total Harmonic Distortion (THD) shall be < 10 %
7.8.	General Requirements	7.8.1. The connecting wires used inside the Luminaire, shall be low smoke halogen free, fire retardant e-beam cable and fuse protection shall be provided in input side. 7.8.2. The lumen maintenance of all the LED fixtures shall not be less than 70% after 50,000 hours. 7.8.3. Built in protection features for Short circuit, Surges (at least upto 5kV), and overvoltage shall be provided.

		7.8.4. High /Low voltage cut-off shall be provided. 7.8.5. The whole luminaire shall be eco-friendly green technology based i.e. mercury free. 7.8.6. No UV and IR radiations shall be produced. 7.8.7. Access of driver for maintenance shall be provided at the top/side of the luminaire fixture. 7.8.8. All fasteners must be of stainless steel.

8. JUNCTION BOXES/WALL BOXES

8.1.	Size	100 mm x 100 mm junction boxes and wall boxes of standard size shall be provided.
8.2.	Construction	Wall boxes and junction boxes shall be made of FRP with a thickness of 2.0mm. Necessary conduit termination fittings such as bushings, locknuts etc. also be provided.

9. AUTOMATIC LIGHTING CONTROLLER

9.1.	Size	Contractor shall provide microprocessor based automatic lighting controller for controlling switching arrangement of indoor and outdoor lighting. The controller shall have provision of setting 52 week ON / OFF time as per astronomical clock or as per user requirement. All abnormal events shall be recorded in the controller. Secure / Genus or equivalent are approved makes.

10. SOCKETS & SWITCHES

10.1.	Indoor	All sockets and switches shall be modular and universal type suitable for 5/15A
10.2.	Outdoor	Two nos transformer oil filtration sockets shall be provided, one at each transformer bay. These sockets shall be three phase industrial type and rated for 100A.

11. NAMEPLATE & MARKING

11.1.	Name plate details of LED housing	Followings shall be clearly engraved / embossed on the die cast housing of LED: Rated voltage or voltage range (marked 'V' or 'Volt'); 11.1.1. Rated current (marked A' or 'Ampere'); 11.1.2. Rated wattage (marked 'W' or 'Watts'); 11.1.3. Rated frequency (marked in 'Hz') 11.1.4. Rated lumen 11.1.5. Indian/International Standards to which it is manufactured 11.1.6. Month and year manufacture 11.1.7. Customer Name - BSES Yamuna Power Ltd 11.1.8. Fitting serial number 11.1.9. PO no and date 11.1.10. Guarantee period
11.2.	Panel nameplate and marking details	
11.2.1.	Panel nameplate	Panel shall have a nameplate clearly indicating the following: 11.2.1.1. Panel Serial No.- 11.2.1.2. Customer Name - BSES Yamuna Power Ltd 11.2.1.3. PO No. & date - 11.2.1.4. Panel Name - 11.2.1.5. Current rating - 11.2.1.6. Guarantee period -
11.2.2.	Feeder nameplate	Large and bold name plate carrying the feeder identification shall be provided on the top of each module.
11.2.3.	Danger plate	Panel shall have a danger plate of anodized Aluminium clearly indicating the danger logo and voltage details.
11.2.4.	Material	Anodized Aluminium 16SWG. Nameplates shall be satin silver in colour with black letters engraved on them. Stickers are not allowed.
11.2.5.	Fixing	All nameplates shall be riveted to the panels at all four corners. Bolting/screwing is not acceptable.

12. APPROVED MAKE OF COMPONENTS

12.1.	Relays	ABB/Jyoti/Omran
12.2.	HRC Fuse Links	GE/ Siemens/ L&T
12.3.	AC Contractors/ DC contactor	L&T/Siemens/Telemechanique/GE/ABB

12.4.	Terminals	Connectwell/Elmex/Wago/Phoenix
12.5.	Push buttons / Actuator	L&T/Siemens/Vaishno/Schneider
12.6.	MCB	Legrand/Hager/Schneider/ABB
12.7.	LED	NICHIA/ OSRAM/ CREE/ PHILIPS//EDISON
12.8.	Luminaire fittings	GE/Philips/Crompton/Bajaj
12.9.	Indicating lamps	Vaishno/Binay/Teknic/Siemens/Mimic/C&S

13. INSPECTION & TESTING

13.1.	Type test	All Equipment should be of type tested quality only, type test certificate to be submitted along with offer. If the manufacturer's lab is accredited by govt. / authorized body then it shall be acceptable for type testing.
13.2.	Acceptance & Routine tests	As per relevant Indian standard

14. DEVIATION

14.1.	Deviation	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. No deviation will be acceptable post order.

TECHNICAL SPECIFICATION

FOR

EXHAUST

AND

VENTILATION SYSTEM

PREPARED BY	REVIEWED BY	APPROVED BY	REV	00
			DATE	10 Aug, 2018
AH	GS	AA	PAGE	1 OF 4

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3. GENERAL REQUIREMENT 3
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1. INTENT OF SPECIFICATION

This specification is intended to cover the design, manufacture, assembly, testing at manufacturer's works, supply & delivery, properly packed for transport at site of Air Conditioning system and Ventilation system for substation control room building complete with all materials and accessories for efficient and trouble free operation.

In the event of any discrepancy with the listed documents, the stipulation of this specification shall govern.

2. SCOPE OF SUPPLY

The following equipment shall be furnished with all accessories: -

2.1. Exhaust and supply air fans for ventilation
2.2. 5 star rated split air-conditioner for control room only
2.3. All necessary components for operation of the above equipment.
2.4. All wiring & accessories to complete the installation.
2.5. All relevant drawings, data & instruction manuals.

3. GENERAL REQUIREMENT

3.1. All equipment and material shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards except where modified and/or supplemented by this specification.

3.2. Equipment and materials conforming to any other standard, which ensures equal or greater quality, may be accepted. In such case copies of the English version of the standard adopted shall be submitted along with the bid.

4. DESIGN CRITERIA

4.1. Exhaust system

Industrial type Axial Exhaust fan of propeller type / axial type shall be provided for rooms with suitable drive motor, DOL starter, rain protection cowl with screen, grouting bolts etc. Fan for battery room shall be bifurcated type spark proof construction. The quantity shall be based on calculation. Minimum requirement is given in the subsequent sections.

4.2. Exhaust fan shall be supplied in:

a. Switchgear room – 3 no's heavy duty with sweep of 600mm
b. Battery Room – 2 no's with sweep of 600mm
c. Toilet – 1 no (200mm domestic exhaust fan)

4.3. Industrial type wall mounted fan shall be provided as follows -

a. Battery room – 1 No, air circulator 600mm
b. Control room – 3 No's, domestic 450mm sweep
c. Switchgear Room – 4 No's, air circulator 600mm

4.4. Air Conditioning

5 star Split air conditioners shall be provided in control room building of to maintain the temperature at 25 degrees Celsius. N-1 redundancy shall be provided for air-conditioning system. Make of air conditioners shall be Daikin / Hitachi/ O-General make.

4.5. All equipment, accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion.

5. DEVIATION

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. No deviation will be acceptable post order.

TECHNICAL SPECIFICATION

FOR

CIVIL WORK

AT MOTIA KHAN

GRID S/S

Prepared by	Reviewed by	Approved by	Rev	1
			Date	23-Apr-19
Akhilesh Kumar	Gaurav Sharma	Ashwani Aggarwal	Page	1 of 15

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1 INTENT

The specification covers the following:

a. Design, engineering, and construction of civil works at 33/11KV Motia Khan Grid-Delhi. All civil works shall also satisfy the general technical requirements specified in other Sections of this Specification and as detailed below.

b. They shall be designed to the required service condition / loads as specified elsewhere in this Specification or implied as per National and International Standards.

c. All civil works shall be carried out as per applicable Indian Laws, Standards and Codes. All materials shall be of best quality conforming to this specification, relevant Indian Standards and Codes.

d. The Contractor shall furnish all design, drawings, labour, tools, equipment, materials, temporary works, constructional plant and machinery, fuel supply, transportation and all other incidental items not shown or specified but as may be required for complete performance of the Works in accordance with approved drawings, specifications and direction of Owner.

e. The work shall be carried out according to the design/drawings to be developed by the bidder and approved by the Owner. The electrical layout for the substation is provided along with the specification. Bidder shall develop design/repair work keeping in view the functional requirement of the substation facilities and providing enough space and access for operation, use and maintenance based on the input provided by the Owner. Certain minimum requirements are indicated in this specification for guidance purposes only.

f. The Owner shall hand over the substation land on as is basis; the bidder shall visit the substation site to ascertain the quantum of work, present condition of the land before submitting the offer. No request for commercial changes will be entertained post award of work due to any claim related to site condition / plot condition. The layout and levels of all structure etc shall be made by the bidder at his own cost from the general grids of the plot and benchmarks set by the bidder and approved by the Owner in presence of engineer in charge.

g. The bidder shall give all help in instruments, materials and personnel to the Owner for checking the detailed layout and shall be solely responsible for the correctness of the layout and levels. The contractor shall make his own arrangements for water and electricity.

2 CODES & STANDARDS

The following Indian Codes and Standards shall generally be used for design of civil and structural works. In all cases, the latest revisions with amendments, if any, shall be followed.

a. SP: 6 ISI handbooks for structural engineers.

b. IS: 2062 Specification for Structural Steel (Standard quality).

c. IS: 456 Code of practice for plain and reinforced concrete.

d. IS: 800 Code of practice for general construction in steel.

e. IS: 806 Code of practice for use of steel tubes in general building construction

f. IS: 808 Rolled steel beam, channel & angle sections

g. IS: 813 Scheme of symbols for welding.

h. IS: 816 Code of practice for use of metal arc welding for general construction in mild steel.

i. IS: 1080 Code of practice for design and construction of shallow foundations in soils (other than raft, ring and shell).

j. IS: 875 Code of practice for design loads (other than earthquake) for buildings and structures.

k. IS: 1893 Criteria for earthquake resistant design of structure

l. IS: 1904 Code of practice for foundations in soil:-General requirements

m. IS: 1905 Code of practice for structural safety of buildings

n. IS: 2074 Ready mixed paint, air drying, red oxide chrome, priming

o. IS: 2212 Code of practice for brick work

p. IS: 2911 Code of practice for design & construction of pile foundation

q. IS: 2950 Code of Practice for design and construction of raft foundations

r. IS: 2974 Code of Practice for design and construction of machine foundations

s. IS: 4326 Code of Practice for earthquake resistant design and construction of Buildings

t. IS: 8009 Code of Practice for calculation of settlement of foundations: (parts 1& 2)

u. IS: 1829 Code practice for protection of iron and steel (Part I to III) structures for atmosphere corrosion

v. IS: 13920 Code practice for ductile detailing of reinforced concrete structure subjected to seismic force

3 SCOPE OF WORK

All the above work is only a guideline, bidder shall include any other work which is anticipated based on site condition or required for safe operation of the substation. Bidder has to assess the existing civil structure and prepare civil design/drawings accordingly.

Bidder shall submit Design (as applicable for specific works) and drawings for all the works prior to start of construction. Drawing and design needs to be approved by BYPL.

4 GUIDELINES FOR DESIGN

4.1 Design Loads for Equipment

Design criteria shall comprise the codes and standards used. Applicable climatic data including wind loads, earthquake factors maximum and minimum temperatures applicable to the building locations, assumptions of dead and live loads, including equipment loads, impact factors, Safety factors and other relevant information.

a. Loads of equipment shall be considered as per manufacturer's certified drawings.

b. The foundation shall be designed considering the net allowable bearing pressure of 200KN/m^2 at the depth of 2.0m from ground level.

c. Foundations shall be analyzed for all possible load combinations as per the relevant IS codes.

d. Minimum reinforcement shall be governed by IS: 2974 and IS: 456.

4.2 Design Criteria

a. The minimum grade of concrete shall be M-25 & Grade of Steel FY-415

b. Limit state method of design shall be adopted unless specified otherwise in the specification.

c. For detailing of reinforcement IS: 2502 and SP: 16 shall be followed. Cold twisted deformed bars conforming to IS: 1786 shall be used as reinforcement. However, in specific areas mild steel (Grade I) conforming to IS:432 can also be used. Two layers of reinforcement (on inner and outer face) shall be provided for wall & slab sections having thickness of 150 mm and above. Clear cover to reinforcement towards the earth face shall be minimum 40 mm.

d. The procedure used for the design of the foundations shall be the most critical loading combination of the steel structure and or equipment and/or superstructure and other conditions, which produces the maximum stresses in the foundation or the foundation component and as per the relevant IS Codes of foundation design.

Detailed design calculations shall be submitted by the bidder showing complete details of work proposed to be used.

e. Design shall consider any sub-soil water pressure that may be encountered following relevant standard strictly.

f. Necessary protection to the foundation work. If required shall be provided to take care of any special requirements for aggressive alkaline soil. Black cotton soil or any other type of soil, which is detrimental / harmful to the concrete foundations.

g. Foundation system adopted by Bidder shall ensure that relative settlement and other criteria shall be as per provision in IS: 1904 and other Indian Standards.

5 CONSTRUCTION/EXECUTION WORK

The Contractor shall develop the site area to meet the requirement of the intended purpose. The site preparation shall conform to the requirements of relevant sections of this specification or as per stipulations of standard specifications. The Contractor shall give all help in instruments, materials and personnel to the Owner for checking the detailed layout and shall be solely responsible for the correctness of the layout and levels.

5.1 Cement, Concrete & Steel Grades

5.1.1 Cement

a. Unless otherwise specified or called for by Engineer, the fresh ordinary Portland cement conforming to IS-8112 of 1976 (latest revision) i.e. 43 grade shall be used for the works.

b. Make of cement shall be Ambhuja/J.K Laxmi/Ultratech or approved by the owner.

c. The record of cement shall be maintained in M.A.S register by the contractor and verified by engineer of the BYPL.

d. Cement shall be stored in a perfectly water-tight and well ventilated site store capable of accommodating cement to ensure continuity of the work and having a raised and perfect dry floor. Each parcel or consignment of cement shall be stacked separately therein to permit easy access for inspection and a record shall be kept so that each parcel or consignment may be identified. Cement which has become stale or otherwise unsuitable and any bags or the like containing hardened lumps or cakes of cement, consequent to storage at Contractor's site stores will be rejected and shall be removed from the site and disposed of as directed by the Engineer. The cost of such rejected quantities shall be borne by the Contractor.

5.1.2 Concrete

a. Design Mix of M-25 grades of concrete as per provisions of IS: 456 and other applicable codes shall generally be used for civil work.

5.1.3 Steel

a. The reinforcing bars shall be Fe-415 generally conform to various requirements of IS: 1786 (for High Strength deformed steel bars and wires for concrete reinforcement).

b. Only TATA/SAIL/JINDAL make shall be used.

5.1.4 Aggregates

a. Aggregates shall consist of natural sand, crushed stone and gravel and shall be chemically inert, strong, hard, clean, durable against weathering of limited porosity, free from deleterious materials and shall conform to the applicable standards. If so desired by the Engineer, they shall be washed and screened.

b. Sampling and testing shall be as per the applicable standards and shall be carried out under the supervision of Engineer. The cost of all test, sampling, etc. shall be borne by the Contractor.

c. All coarse and fine aggregates shall be stacked separately and shall avoid contamination with foreign materials. Segregates aggregates shall be rejected.

d. The necessary arrangements for field test shall be done at site. The material testing register and weighing material register shall be maintained for field and lab mandatory test by the contractor's authorized site engineer, having degree in Civil Engineering or minimum three year experience with diploma in civil engg. The copy of all the certificates shall be submitted to BSES officials.

5.1.5 Water

a. Water used for both mixing and curing shall be as per applicable standards.

b. Potable waters are generally satisfactory. Where water can be shown to contain an excess acid, alkali, sugar or salt, Engineer may refuse to permit its use.

5.1.6 Bricks

a. Ensure that the bricks are free from cracks, war page and of uniform colour.

b. Manufacturer's test report & Material Test reports for all the materials shall be submitted for approval prior to the utilization for work.

c. Contractor shall make his own arrangements for the storage of adequate quantity of material.

5.2 Levelling, Excavation, Backfill & Compaction

a. The Capacitor bank area shall be properly levelled before construction. If fill material is required, the fill material shall be suitable as per the requirement & level. The fill shall be such a material and the site so designed as to prevent the erosion by wind

and water of material from its final compacted position or the in-situ position of undisturbed soil. Backfill material around foundations or other works shall be suitable for the purpose for which it is used and compacted to the density described under Compaction. If rocky strata available at site then bidder have to do all the necessary arrangements for rock cutting & its disposal.

b. The thickness of fill material under the foundations shall be such that the maximum pressure from the footing, transferred through the fill material and distributed onto the original undisturbed soil will not exceed the allowable soil bearing pressure of the original undisturbed soil. For expansive soils the fill materials and other protections etc. to be used under the foundation is to be got approved by the Owner. All the area excavated in due course of construction must be filled by vendor. The area of future bay must be filled by vendor up to the proper level of yard.

c. Whenever water table is met during the excavation, it shall be dewatered and water table shall be maintained below the bottom of the excavation level during excavation, concreting and backfilling.

d. Material unsuitable for founding of foundations shall be removed and replaced by suitable fill material and to be approved by the Owner. Excavated material not suitable or not required for backfill shall be disposed off in areas as directed by Owner. Excavation and backfill for foundations shall be in accordance with the relevant IS code.

e. The density to which fill materials shall be compacted shall be as per, relevant IS and as per direction of Owner. All compacted sand filling shall be confined as far as practicable. Backfilled earth shall be compacted to minimum 95% of the Standard Proctor's density at OMC. The sub grade for the roads and embankment filling shall be compacted to minimum 95% of the Standard Proctor's density at OMC. Cohesion less material sub grade shall be compacted to 70% relative density (minimum).

5.3 General Requirement Site Surfacing/Stone Filling

The material required for site surfacing/stone filling shall be free from all types of organic materials and shall be of standard quality, and as approved by the Owner. The material to be used for stone filling/site surfacing shall be uncrushed/crushed/broken stone of 20 mm nominal size (ungraded single size) conforming to Table 2 of IS:383 - 1970. Hardness, Flakiness shall be as required for wearing courses are given below:

a. Sieve Analysis limits (Gradation)
(IS: 383 - Table - 2)

Sieve Size	% passing by weight
40mm	100
20mm	85 – 100
10mm	0 – 20
	0 – 5

'One Test' shall be conducted for every 500 Cu.m.

b. Hardness

Abrasion value (IS: 2386 Part-IV) - not more than 40%
Impact value (IS: 2386 Part-IV) - not *more* than 30% and frequency shall be one test per 500 cum with a minimum of one test per source

c. Flakiness Index

One test shall be conducted per *500* cum of aggregate as per IS:2386 Part-I and maximum value is 25%

5.4 Admixtures & Additives

a. Only approved admixtures shall be used in the concrete for the Works. When more than one admixture is to be used, each admixture shall be batched in its own batch and added to the mixing water separately before discharging into the mixer. Admixtures shall be delivered in suitably labeled containers to enable identification.

b. Admixtures in concrete shall conform to IS: 9103. The waterproofing cement additives shall conform to IS: 2645. Owner shall approve concrete Admixtures/ Additives.

c. The contractor may propose and the Owner may improve the use *of* a water-reducing set-retarding admixture in some *of* the concrete. The use of such an admixture will not be approved to overcome problems associated with inadequate concrete plant capacity or improperly planned placing operations and shall only be approved as an aid to overcoming unusual circumstances and placing conditions.

d. The water-reducing set-retarding admixture shall be an approved brand of Ligno-sulphonate type admixture.

5.5 Construction of Capacitor Bank Foundations

a. All Reinforcement to Steel Bars shall confirm to IS 1786:1985 of Grade Fe-415.

b. M-25 Grade of Concrete shall be used.

c. 100mm Thick Lean Concrete shall be laid under all foundations.

d. Loose pockets shall be completely removed & filled with PCC(1:4:8)

5.6 Anti weed Treatment, Stone Spreading & PCC

a. The Contractor shall furnish all labour, equipment and materials required for complete performance of the work in accordance with the drawings specification and direction of the Owner.

b. The contractor shall prepare the specified area before stone spreading . PCC must be carried out in capacitor bank area in two layers. First layer of 75 mm thickness

nominal of grade 1:4:8 concreting and second layer of 75 mm thickness of grade 1:2:4 cement concrete.

c. Along with PCC Stone spreading of 100cm thickness shall be done in the Capacitor Bank area under present scope of work.

d. Before taking up stone filling, anti weed treatment shall be applied in the specified area wherever gravel filling is to be done, and the area shall be thoroughly de-weeded including removal of roots. The recommendation of local agriculture or horticulture department shall be sought wherever feasible while choosing the type of chemical to be used. Nevertheless the effectiveness of the chemical shall be demonstrated by the contractor in a test area in capacitor bank and monitored over a period of two to three weeks by the Engineer-in-Charge. The final approval shall be given. by Engineer-in-Charge and final approval given based in the results.

e. The anti weed chemical shall be procured from reputed manufacturers. The dosage and application of chemical shall be strictly followed as per manufacturer's recommendation. The contractor shall be required to maintain the area free of weeds for a period of 1 year from the date of application of 1st dose of anti weed chemicals.

5.7 Trench

a. All the material wherever required for trenches shall be supplied by bidder.

b. Power Cable trench and Control cable trench shall be separate

c. The precast removable RCC covers (with lifting arrangement) as per the layout drawing shall be provided. The precast covers shall be constructed using RCC of M35 grade. Trench cover must be of pre-cast concrete of grade not less than M-35 of appropriate load bearing capacity.

d. Cable trench RCC covers shall be designed for self weight of top slab + UDL of 2000 Kg/m2 + concentrated load of 200 kg at centre of span on each panel.

e. Paved portion of cable trenches shall be repaired to withstand class AA Loading of IRC/relevant IS Code

f. The top of trenches shall be kept at least 100 mm above the finished ground level. The top of cable trench shall be such that the surface rain water do not enter the trench.

g. All metal parts inside the trench shall be connected to the earthing system at regular intervals.

h. Wherever required, all the construction joints of cable trenches i.e. between base slab to base slab and the junction of vertical wall to base slab as well as from vertical wall to wall and all the expansion, joints shall be provided with approved quality PVC water stops of approx. 230 x 5 mm size for those sections where the ground water

table is expected to rise above the junction of base slab and vertical wall of cable trenches.

i. The repaired Cable trenches shall be blocked at the ends if required with brick masonry in cement sand mortar 1:6 and plaster with 15mm thick 1:6 cement and mortar.

j. Angles 50x50x6 mm (minimum) with lugs shall be provided for edge protection all round edges of repaired RCC cable/pipe trenches supporting covers.

k. Sealing of repaired cable trench must be made in such a manner that no rain water can accumulate in it.

l. If trench passes through road/load bearing path then Box Culvert of Appropriate load bearing shall be used.

m. All the floor openings in building shall be covered with 6mm thick Checkered plates

n. Trench in existing control room may be used for control cable/LT Power Cable laying but repairing and modification of the same shall be in vendor's scope. If new trench is required in control room then the same shall also be in vendor's scope.

5.8 Substation Building

a. Ground floor of the building shall be made for cable cellar.

b. First floor of the building shall be made for 11kV and 33kV Switchgear.

c. Height of cable cellar room shall be 3 meter.

d. Height of and Switchgear room shall be 3.5 meter.

e. There shall be two entries and two exits of cable cellar and switchgear room.

f. Motorized shutter shall be provided for entry and exit of switchgears.

g. Doors and windows shall be provided in Building. Doors and windows shall be fire rated with fire rating of 2 hour.

h. Two staircase shall be provided in substation building with granite finish and SS Railing of 304 grade.

i. Kota stone shall be provided in cable cellar and switchgear room for flooring purpose.

j. Finishing of walls shall be with three coats of Plastic Paint i.e. two coats during installation and one coat at the time of handover.

k. Plaster work, putty and painting all around the building and common area with plastic paint

l. Epoxy flooring after installation of kota stone shall be provided in Switchgear room.

m. Level of cable cellar room shall be above 900 mm from FGL.

n. Provision for Cable Entry and Exit in Switchgear room and Cable Cellar Room.

o. Provision of Lighting, Exhaust Fan, Ceiling Fan, Power Points For Cable Cellar and Switchgear Room shall be provided.

p. Water proofing in three layers shall be done in roof slab and ground floor. Proofing shall be done by using Dr Fixit chemical

6 INTERFACING

The proper coordination & execution of all interfacing civil works activities shall plan in advance and execute in such a manner that interfacing activities do not become bottlenecks and dismantling, breakage etc. is reduced to minimum.

7 MISCELLANEOUS GENERAL REQUIREMENT

a. Bricks having minimum 75kg/cm^2 compressive strength can only be used for masonry work. Contractor shall ascertain himself at site regarding the availability of bricks of minimum 75 kg/cm^2 compressive strength before submitting his offer.
b. Anti termite chemical treatment shall be given to foundations of Enclosure, filling below the Enclosure floor etc. as per IS: 6313 and other relevant Indian Standards.

c. The details given in tender drawings shall be considered along with details available in this section of the specification while deciding various components of the Site.

d. Items/components of site not explicitly covered in the specification but required for completion of the project shall be deemed to be included in the scope.

e. Suitable pigment shall be added to render the surface aesthetically pleasing as per directions of Engineer-in-charge

f. The curing period shall commence immediately after the concrete is finally screened and continued a period of 21 days all civil works. The top and side surfaces of concrete shall be kept moist and be protected from the direct rays of the sun during the period. The Contractor shall submit to the Engineer's proposals for ensuring continuous protection of the concrete during the curing period.

8 INSPECTION & TESTING

Necessary arrangements for field tests shall be done at site. Bidder has to do the following tests from NABL accredited labs:

a. Raw material test : For Cement, sand , aggregates, water, brick, Steel

b. Cube Test for compressive strength of concrete

9 DRAWINGS & DATA SUBMISSION

The following information shall be submitted for review and approval to the Owner

a. Structural design calculations and drawing (including construction/fabrication) for all reinforced concrete and structural steel structures.

b. Fully, dimensioned concept plan including cross sections, longitudinal sections, elevations and perspective view of Structure or Foundation. These drawings shall be drawn at a scale not smaller than 1: 50 and shall identify the major components.

c. Fully dimensioned drawings showing details and sections drawn to scales of sufficient size to clearly show sizes and configuration of the Foundation & Super Structural components and the relationship between them.

d. Product information of Foundation materials

e. Bidders have to submit all the test reports mentioned in this specification.

f. Complete set of documents shall be provided in hard and soft forms.

Approval of the above information shall be obtained before ordering materials or starting fabrication or construction as applicable.

10 QUALITY CONTROL

a. Construction Quality shall be properly controlled by the bidder. Bidder shall work as per the Field Quality Plan provided by the owner. All the Tests specified in the Field Quality Plan shall be done by bidder.

b. Weekly construction status will be updated by the bidder to Owner to assure the work progress & the construction quality.

c. A Civil Engineer shall be deployed by the bidder for construction quality control. Civil Engineer has to review ongoing construction work, check materials and workmanship.

11 STATUTORY RULES

a. Contractor shall comply with all the applicable statutory rules pertaining to factories act (as applicable far the State). Fire Safety Rules of Tariff Advisory Committee. Water Act for pollution control and coordinate with forest department for necessary approval prior to tree cutting.
b. Plastering on structural members (in fire prone areas) etc. shall be made according to the recommendations of Tariff Advisory Committee.
c. Statutory clearance and norms of State Pollution Control Board shall be followed as per Water Act for effluent quality from plant.

12 DEVIATIONS

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. No deviation will be acceptable post order.

TECHNICAL SPECIFICATION

FOR

SCADA NETWORK & INTEGRATION

INDEX

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1.0 SCOPE

A. This specification is intended to cover the supply, erection, testing and commissioning of SCADA Network and Integration associated hardware/software (like protocol converters), cables, accessories and other material required for interfacing of all electrical equipments with existing ABB RTU 560A for efficient and trouble free operation.

A.1. ABB RTU panel is multi processor CMU05/CMR02 based having required nos. of co processor and main processor and having redundant power supply. Main processor is having ethernet ports and serial ports. Ethernet port of main processor is connected to LAN Switch (to be provided by BSES) for communication with Master Control Centre on IEC 104.

A.2. The co processors are having ethernet ports which are responsible to communicate to all numerical relays and Digital RTCC on IEC 61850 protocol.

A.3. The co processors are having serial ports which are responsible to communicate to all multifunction meters (MFMs) and battery charger on Modbus protocol through RS485 network.

A.4. The main processors and co processors are having the licenses of IEC61850, MODBUS RTU MASTER & PLC, Archive, HMI, IEC 103 and IEC 104

B. The devices ie Numerical relays, digital RTCC,MFMs, battery charger etc. on serial and LAN should have redundant media and redundant co processor connectivity.

C. This specification shall be used in conjunction with all specifications, data sheets, single line diagrams, and other drawings attached to the specification / purchase requisition.

2.0 SCADA NETWORK

2.1	INFRASTRUCTURE	i. All numerical relays & Digital RTCC shall be connected to RTU in parallel redundancy protocol (PRP). ii. The communication shall be made in 1+1 mode, including the links between numerical relays & Digital RTCC to switch and up to RTU, such that failure of one set of communication shall not affect the normal operation of system. However it shall be alarmed in RTU. iii. Data exchange is to be realized on dual star Bus topology using IEC 61850 protocol with a redundant managed switched Ethernet communication infrastructure. iv. MFMs shall be connected to RTU through RS485 network so loop shall be prepared in daisy chain fashion v. Battery charger and APFC shall be connected

		to RTU in separate loops. vi. Devices connected to single loop shall not be more than 10.
2.2	SCOPE OF WORK	i. Laying and termination of LC/ ST multimode duplex fibre optic patch cords in PVC conduit connecting the numerical relay to switch ii. Laying and termination of LAN cables from SWITCHGEAR end switch to RTU end switch shall be done in PVC conduit of minimum 2 inches. iii. Laying and termination of RS 485 cables from MFMs, APFC and battery charger to RTU- shall be in PVC conduit of minimum 2 inches.
2.3	SCOPE OF SUPPLY	i. All the hardware required to extend the relay signals to the RTU shall be supplied along with the switchboards. ii. Aux supply of these hardware devices shall be same as grid control voltage having wide range (-20% to +20%). iii. All communication hardware or protocol converters required for compatibility with SCADA shall be in bidder's scope.
2.3.1	Ethernet switches at SWITCHGEAR end	i. Shall be layer 3 ,managed type & PRP compatible ii. Shall have KEMA certification for IEC 61850 compliance iii. The switches shall be industrial grade with dual power supply arrangement iv. Shall be suitably mounted in an auxiliary compartment in switchgear panel. v. Ethernet Switch shall have required nos. of ports (having RJ45 Ports / FO Ports).20% spare ports shall be provided. vi. Com speed of all ports shall be at least 10 Mbps/100 Mbps vii. LED indicators on each RJ45 ports shall be blinking with data transfer. viii. It should support remote user setting configuration. ix. Warranty for the switch must be 5 years x. It should own separate maintenance/console port. xi. Latency shall be not more than 10ms.
2.3.2	Interface between Numerical Relay and	i. LC/ ST multimode duplex fibre optic patch cords connecting the numerical relay to switch

	Ethernet switch at SWITCHGEAR end	shall be supplied by the bidder. Spare patch cords shall also be provided by the bidder.
2.3.3	Interface between Ethernet switch at RTU end and Ethernet switch at SWITCHGEAR end	Bidder shall provide LAN Cable of CAT 6 STP Grey Color
2.3.4	Interface between 1. MFM and RTU 2. APFC and RTU 3. Battery charger and RTU	RS485 Belden class shielded cable shall be provided by bidder. One spare loop for each loop of RS485 cable from MFM to RTU, APFC to RTU and Battery Charger to RTU shall be provided by bidder.
2.3.5	Communication hardware	All hardware like LAN Switch, FO glass/plastic, cables, protocol converters required for interfacing IEDs like protection relays, multifunction meters, Digital RTCC, APFC,battery charger controllers etc. To RTU should be included in scope of supply.

3.0 SCADA INTEGRATION

3.1	INFRASTRUCTURE	Numerical relays should be only IEC 61850 & PRP compatible having dual fibre optic ports. Through these ports relays shall be connected to switches.
3.2	SCOPE OF WORK	i. Configuration of Protection relays, Digital RTCC and multifunction meters for SCADA signals as per Annexure : Signals Related with Digital RTCC, Annexure : Signals Related with SWITCHGEAR and Annexure : Signals Related with MFM and communication for the same in existing RTU 560A Co Processor CMU05/CMR02. ii. For communication configuration and troubleshooting of Relays, Digital RTCC and MFM, required software, ICD file (IED configuration description file), SCD file (substation configuration description file), configuration tool for relay integration on IEC 61850 and other IEC61850 files compatible with existing RTU560A,communication cables and documents to be handed over to team SCADA BYPL. iii. Providing SCADA signal mapping table for signals listed in Annexure : Signals Related with Digital RTCC, Annexure : Signals Related with SWITCHGEAR and Annexure : Signals

		Related with MFM and communication configuration details for RTU configuration. iv. Simulation of all configured SCADA signals (Listed in Annexure : Signals Related with Digital RTCC, Annexure : Signals Related with SWITCHGEAR and Annexure : Signals Related with MFM) over LAN on IEC 61850 and over RS 485 on modbus on separate terminal with same configuration settings. v. Testing & commissioning of Numerical relays, Multifunction meters and testing of Digital RTCC and commissioning of all related signals in RTU. vi. Testing of Indications, Command, Interlocks as per scheme, Relay soft interlock testing from Relay HMI as well as simulation of SCADA command through configured output of Relay. vii. Downloading of Disturbance records facility and uploading/downloading of configuration file facility shall be provided from remote also through ethernet switches at pre decided IPs. viii. Demonstration of operational compatibility with SCADA.
3.3	SCOPE OF SUPPLY	
3.3.1	Configuration Software and Tools	All software and configuration tools required for configuration of SCADA Network should be included in scope of supply. ICD file (IED configuration description file), SCD file (substation configuration description file), configuration tool for relay integration on IEC 61850 and any other IEC61850 file and configuration tool required for relay integration compatible with existing RTU560A, communication cables and documents shall be supplied by bidder

4.0 SPARES

4.1		i. Bidder shall submit list of recommended spares for BSES BYPL SCADA approval. ii. Recommended minimum 20% spares of supplied SCADA accessories for SCADA interface to be supplied by bidder. Price for spares shall be included in switchgear package. All spares shall be tested in our premises

5.0 DOCUMENTATION

5.1	Documents for approval	i. The bidder shall ensure that all necessary drawings, write-up, information, etc required to fully describe the equipment and network architecture are to be submitted for approval. ii. The manual shall clearly indicate in English the installation and connection method. Check up, maintenance and calibration method shall also be provided in the manuals.

6.0 DRAWING APPROVAL

6.1	Before starting manufacture of any equipment and network, the bidder shall have to take approval of the relevant drawings, data sheet from SCADA BYPL team in writing
6.2	Any manufacture done prior to the approval of drawings / data shall be rectified in accordance with the approved drawings / data by the Bidder at his own cost and the equipment shall be supplied within the stipulated period
6.3	The make and type of communication devices shall be subject to approval by the SCADA BYPL team. Bought-out items are also subject to approval

7.0 COMPLETENESS OF SUPPLY

7.1	It is not the intent to specify completely herein all details of the equipment and network. Nevertheless, the equipment and network shall be complete and operative in all aspects and shall conform to highest standard of engineering, design and workmanship and be capable of performing in continuous commercial operation up to the guarantees in a manner acceptable to the SCADA BYPL team, who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgment is not in full accordance therewith
7.2	Any material or accessory which may not have been specifically mentioned but which is necessary or usual for satisfactory and trouble-free operation and maintenance of the equipment shall be furnished without any extra charge.
7.3	The bidder shall supply all brand new equipment and accessories as specified herein with such modification and alteration as agreed upon in writing after mutual discussion

8.0 TRAINING

8.1	Training at site	Training to SCADA BYPL team's engineers at site (two day training included on basic price).

9.0 DEVIATIONS

9.1	Deviation	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. No deviation will be acceptable post order.

Annexure: Signals Related with Digital RTCC

Sr. No.	Signal Detail	Type of Signal on IEC61850
	Digital Input Signals-	
1	Bucholz Alarm	Single Point Information
2	Bucholz Trip	Single Point Information
3	MOG Alarm	Single Point Information
4	OSR Trip	Single Point Information
5	OTI Alarm	Single Point Information
6	OTI Trip	Single Point Information
7	WTI Alarm	Single Point Information
8	WTI Trip	Single Point Information
9	PRV Trip	Single Point Information
10	SPRV Trip	Single Point Information
11	Digital RTCC Auto/Manual	Single Point Information
12	Digital RTCC Communication Fail	Single Point Information
13	Digital RTCC L/R Switch	Single Point Information
14	Digital RTCC Watchdog Operated	Single Point Information
15	Oil surge Trip	Single Point Information
16	FAN failed	Single Point Information
17	Winding Temp. High alarm	Single Point Information
18	OLTC PRV Trip	Single Point Information
19	OLTC Low Oil Level	Single Point Information
20	Tap Changer Stuck Up	Single Point Information
21	OLTC motor Supply Fail	Single Point Information
22	OLTC supply fail	Single Point Information
23	Tap Max Reach	Single Point Information
24	Tap Min Reach	Single Point Information
25	Under Voltage	Single Point Information
26	Over Voltage	Single Point Information
	Digital Output Signals-	
1	Digital RTCC Relay Auto/Manual	Single Command Output
2	Tap Changer Raise	Single Command Output
3	Tap Changer Lower	Single Command Output
	Measurement Signals-	
1	Oil Temperature	Measured Float
2	Tap Position	Measured Float
3	Tap Count	Measured Float
4	Winding Temperature	Measured Float
5	Voltage BR (of 11kV)	Measured Float
6	Voltage RY (of 11kV)	Measured Float
7	Voltage YB(of 11kV)	Measured Float

(This is the indicative IO list, however the signal list may vary during the engineering time)

Annexure: Signals Related with SWITCHGEAR

Sr. No.	Signal Detail	Type of Signal on IEC61850
1	**Signals of Differential Relay**	
	Digital Input Signals	
1	Differential Trip Bph	Single Point Information
2	Differential Trip Rph	Single Point Information
3	Differential Trip Yph	Single Point Information
4	Differential Highset Trip	Single Point Information
5	Differential Trip	Single Point Information
6	Inrush detected	Single Point Information
7	REF Trip	Single Point Information
8	Trafo. Differential lockout operated	Single Point Information
9	Trafo. Differential watchdog operated	Single Point Information
10	Trafo. Differential communication fail	Single Point Information
11	Trafo Trouble Trip	Single Point Information
	Measurement Signals	
1	Current Bph	Measured Float
2	Current Rph	Measured Float
3	Current Yph	Measured Float
4	Fault Current Bph	Measured Float
5	Fault Current Rph	Measured Float
6	Fault Current Yph	Measured Float
7	Fault Current Nph	Measured Float
8	Fault locator in some relays	Measured Float
9	Sigma kA square	Measured Float
2	**Signals of Distance Relay**	
	Digital Input Signals	
1	Distance Relay Lockout Operated	Single Point Information
2	Distance Trip	Single Point Information
3	Distance Zone-1 operated	Single Point Information
4	Distance Zone-2 operated	Single Point Information
5	Distance Zone-3 operated	Single Point Information
6	Line Distance Relay Communication Fail	Single Point Information
7	Line Distance Relay watchdog operated	Single Point Information
3	**Signals of Line Differential Relay**	
	Digital Input Signals	

1	Conductor Broken	Single Point Information
2	Differential Trip	Single Point Information
3	Rph Differential Trip	Single Point Information
4	Yph Differential Trip	Single Point Information
5	Bph Differential Trip	Single Point Information
6	Distance Trip	Single Point Information
7	Distance Zone-1 operated	Single Point Information
8	Distance Zone-2 operated	Single Point Information
9	Distance Zone-3 operated	Single Point Information
10	Earth Fault high set trip	Single Point Information
11	Earth Fault IDMT trip	Single Point Information
12	General Trip	Single Point Information
13	Inter-trip	Single Point Information
14	Line differential block	Single Point Information
15	Line differential Channel-1 fail	Single Point Information
16	Line differential Channel-2 fail	Single Point Information
17	Line differential operated	Single Point Information
18	Line differential relay watchdog operated	Single Point Information
19	Phase fault high set trip	Single Point Information
20	Phase fault IDMT trip	Single Point Information
21	PT Fuse Fail	Single Point Information
	Measurement Signals	
1	Active Power	Measured Float
2	Current Bph	Measured Float
3	Current Rph	Measured Float
4	Current Yph	Measured Float
5	Fault Current Bph	Measured Float
6	Fault Current Rph	Measured Float
7	Fault Current Yph	Measured Float
8	Fault Current Nph	Measured Float
9	Fault Locator in some relays	Measured Float
10	Frequency	Measured Float
11	Power Factor	Measured Float
12	Reactive Power	Measured Float
13	Sigma kA square	Measured Float
14	Voltage BR	Measured Float
15	Voltage RY	Measured Float
16	Voltage YB	Measured Float
4	**Signals of Overcurrent Earthfault Relay**	
	Digital Input Signals	
1	50BF/LBB Operated	Single Point Information
2	86 Supervision	Single Point Information
3	Relay Communication fail	Single Point Information

4	Relay watchdog operated	Single Point Information
5	Isolator A status	Double Point Information
6	Isolator B status	Double Point Information
7	Cable door open	Single Point Information
8	CB in Remote	Single Point Information
9	CB Status	Double Point Information
10	Earth Fault General Trip	Single Point Information
11	Earth Fault High set Trip	Single Point Information
12	Earth Fault IDMT Trip	Single Point Information
13	Earth Switch AE status	Double Point Information
14	Earth Switch BE status	Double Point Information
15	Earth Switch LE status	Double Point Information
16	Line Isolator status	Double Point Information
17	Breaker L/R switch in Remote	Single Point Information
18	Negative Phase Sequence	Single Point Information
19	Phase Fault General Trip	Single Point Information
20	Phase Fault Highset Trip	Single Point Information
21	Phase Fault IDMT Trip	Single Point Information
22	Phase Fault Overload Trip	Single Point Information
23	PT Fuse Failure	Single Point Information
24	Relay Reset	Single Point Information
25	SF6 Gas Pressure Low	Single Point Information
26	SF6 Lockout Operated	Single Point Information
27	Spring Charged	Single Point Information
28	TCS Alarm-1	Single Point Information
29	TCS Alarm-2	Single Point Information
	Digital Output Signals	
1	CB Command	Double Command Output
2	Relay Reset	Single Command Output
	Spare Output	
	Measurement Signals	
1	Active Power	Measured Float
2	Current Bph	Measured Float
3	Current Rph	Measured Float
4	Current Yph	Measured Float
5	Fault Current Bph	Measured Float
6	Fault Current Rph	Measured Float
7	Fault Current Yph	Measured Float
8	Fault Current Nph	Measured Float
9	Fault Locator in some relays	Measured Float
10	Frequency	Measured Float
11	Power Factor	Measured Float
12	Reactive Power	Measured Float
13	Sigma kA square	Measured Float

14	Voltage BR	Measured Float
15	Voltage RY	Measured Float
16	Voltage YB	Measured Float

(This is the indicative IO list, however the signal list may vary during the engineering time)

Annexure: Signals Related with MFM

Sr. No.	Signal Detail	Type of Signal on Modbus
	Measurement Signals	
1	Active Power	Measured Float
2	Current Bph	Measured Float
3	Current Rph	Measured Float
4	Current Yph	Measured Float
5	Frequency	Measured Float
6	Power Factor	Measured Float
7	Reactive Power	Measured Float
8	Voltage BR	Measured Float
9	Voltage RY	Measured Float
10	Voltage YB	Measured Float
11	Neutral Current	Measured Float
12	THD	Measured Float

(This is the indicative IO list, however the signal list may vary during the engineering time)