BSES RAJDHANI POWER LIMITED

Tender Notification for

SURVEY, DESIGN, SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF 66/11 KV GIS GRID SUBSTATION ON SINGLE POINT RESPONSIBILITY BASIS FOR PROVIDING NEW CONNECTION OF 8MW IN F/O DGHS-1725 BEDS HOSPITAL, SEC-9 DWARKA

NIT NO CMC/BR/20-21/SV/RS/KG/885 DT 19.12.2020

Due Date for Submission: 08.01.2021 1530HRS

BSES RAJDHANI POWER LTD (BRPL)
Corporate Identification Number: **U74899DL2001PLC111527**
Telephone Number: +91 11 3009 9999
Fax Number: **+**91 11 2641 9833
Website: **www.bsesdelhi.com**

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SECTION – I: REQUEST FOR QUOTATION

1.00 **Event Information**

BRPL invites sealed tenders in 2 envelopes for following scope of work

Sl. No.	Description	Estimated Cost (Rs.)	Qty.	Delivery & Installation at
1	Survey, Design, Supply, Installation, Testing & Commissioning of 66/11 kV GIS Grid Substation on Single point responsibility basis for providing new connection of 8MW in f/o DGHS-1725 beds hospital, sec-9 Dwarka	12.5 Crores	As per BOQ Attached	Delhi, Sites

The bidder must qualify the requirements as specified in clause 2.0 stated below.

All envelopes shall be duly super scribed "Survey, Design, Supply, Installation, Testing & Commissioning of 66/11 kV GIS Grid Substation on Single point responsibility basis for providing new connection of 8MW in f/o DGHS-1725 beds hospital, sec-9 Dwarka NIT NO CMC/BR/20-21/SV/RS/KG/878"

1.01 The schedule of specifications with detail terms & conditions can be obtained from address given below against submission of non-refundable demand draft of **Rs.1180/-** drawn in favour of BSES Rajdhani Power Ltd, payable at Delhi. The tender documents & detail terms and conditions can also be downloaded from the website **"www.bsesdelhi.com --> Tenders --> BSES Rajdhani Power Ltd --> 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.

1.02 Bids will be received up to 08/01/2021 1530 HRS at the address given at 3.01 below. Part A of the Bid shall be opened on 08/01/2021 1600 HRS.

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.

1.03 BSES Rajdhani Power Ltd reserves the right to accept/reject any or all Tenders without assigning any reason thereof in the event of following

(i) **Earnest Money Deposit (EMD)** of value **Rs 12,50,000/-** is not deposited in shape of Demand Draft/Pay Order/Banker's Cheque /Bank Guarantee drawn in favour of BSES Rajdhani Power Ltd, payable at Delhi.
(ii) The offer does not contain prices indicating break-up towards all taxes & duties in prescribed format
(iii) Complete Technical details are not enclosed.
(iv) Tender is received after due date and time**.**
(iv) Technical offer contains any prices
(v) Prices are **not FIRM** and subject to Price Variation

2.0 **Qualification Criteria:-**

Technical

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

a. The bidder shall be currently in the field of manufacturing of Gas Insulated Switchgear (GIS) of 66 KV or above rating, OEM of GIS can only participate and joint venture/collaboration is not allowed.

b. The bidder shall have servicing , repairing, testing & refurbishment facility in INDIA with necessary spares and testing equipment for providing prompt after sales service for GIS. Details of the set-up available shall be brought out in the offer, failing which the offer will be rejected. The bidder shall submit undertaking along with the bid to confirming compliance to qualifying criteria for bidder.

c. The GIS offered should have been successfully type-tested as per relevant IEC and copies of the test reports latest for max 5 years shall be submitted along with the offer. Non submission of type test reports will lead to rejection of the offer.

d. The bidder must have designed, supplied, installed & commissioned at least 2 Nos 66 KV GIS grid substation or higher rating including civil works in last 5 years in India (Turnkey Basis). The list of such installations shall be furnished (List of Installations).

e. Bidder shall procure major equipments from the approved vendor list of BRPL who are meeting applicable qualification criteria for individual items. The vendor must be having valid type test reports carried out within five (5) years.

f. Bidder shall submit the performance certificates for 1 year satisfactory performance from 2 reputed companies for executed jobs.

g. The bidder should have technical & field services organization personnel at various stages of field erection & management services required for successful erection, testing & commissioning.

h. The bidder should have established field quality assurance system & safety organization designed to achieve high level of reliability at various stage of field services required for successful erection, testing, & commissioning.

i. The bidder should have qualified technical & dedicated QA personnel at various stages of manufacturing & testing.

Financial

a. Bidder must have average annual turnover of minimum Rs 50 crores during last Three(3) years.

b. The bidder must have adequate financial stability and status to meet financial obligation pursuant to scope of work.

c. The bidder shall submit a "NO LITIGATION" statement as per attached format.

d. The Bidder should possess valid HT contractor license issued by competent statutory agency to undertake work in Delhi/NCR.

e. The bidder must possess valid ISO 9001:2000 certification and valid BIS License or Equivalent International License.

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

g. The bidder must have valid PAN No., Service Tax Registration, sales tax registration, 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.

Note: All reference dates shall be taken as the date of technical bid opening.

Notwithstanding anything stated above, BRPL 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. BRPL also reserves the right to evaluate the bidder based on performance of past supplies/projects executed in BRPL. 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**. BRPL 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 to the following address

Head of Department
Contracts & Material Department
BSES Rajdhani Power Ltd
1st Floor, C Block
BSES Bhawan, Nehru Place
New Delhi 110019

PART A: TECHNICAL **BID** comprising of following (1 original + 1 copy)

- EMD in prescribed format
- Non-refundable demand draft for Rs 1180/- in case the forms are downloaded from website
- Documentary evidence in support of qualifying criteria
- Technical Details / Filled in GTP/Type test report etc
- Qualified Manpower available & Organization Chart
- Testing Facilities
- Copies of Orders, Execution /Performance Certificate & Other Documents to support the QC as per clause 2.0
- 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, PBG etc

PART B: FINANCIAL **BID** comprising of (1 original only)

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

3.02 **TIME SCHEDULE**

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

S. No.	Steps	Date
1	Date of sale of bid documents	18.11.2020
2	Pre-Bid meeting	04.01.2021 1430 HRS
3	Last date of Queries, if any	06.01.2021
4	Last date of receipt of bid documents	08.01.2021 1530HRS
5	Date & time of opening of tender – Part A	08.01.2021 1600HRS

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 after techno-commercial evaluation and only of the qualified bidders.

REVERSE AUCTION: Purchaser reserves the right to use **REVERSE AUCTION** through SAP-SRM as an optional tool as an integral part of the entire tendering process. All techno-commercially qualified bidders shall participate in this event

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.

In case RA is not concluded/conducted for any reasons, a "final no regret" financial bid in a sealed envelope will be called for from all qualified bidders

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

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 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.

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

4.04 Qty Variation: The purchaser reserves the rights to vary the quantity by (+/-) 30% of the tender quantity.

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. A bidder who violates the marketplace rules or engages in behavior that disrupts the fair execution of the marketplace shall be restricted from bidding for a length of time, depending upon the seriousness of the violation. Examples of violations include, but are not limited to:

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

6.00 Confidentiality

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

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

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

7.00 Contact Information

Technical or Commercial clarifications, 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 email/phone

	Technical	Commercial
Contact Person	Mr. Sheshadri Krishnapura(HOD-TSG)	Mr. Robin Sebastian (Head Procurement)
Address	BSES Rajdhani Power Ltd , 2nd Floor, B Block, BSES Bhawan, Nehru Place, New Delhi 110019	BSES Rajdhani Power Ltd , 1st Floor, D Block, BSES Bhawan, Nehru Place, New Delhi 110019
Email	**sheshadri .krishnapura@relianceada.com** abhinav.r.srivastava@relianceada.com	**robin.sebastian@relianceada.com** pankaj.goyal@relianceada.com

SECTION – II: INSTRUCTION TO BIDDERS

1.00 GENERAL

BSES Rajdhani Power Ltd, hereinafter referred to as "The Company " are desirous of awarding work for Survey, Design, Supply, Installation, Testing & Commissioning of 66/11 kV GIS Grid Substation on Single point responsibility basis for providing new connection of 8MW in f/o DGHS-1725 beds hospital, sec-9 Dwarka.

2.00 SCOPE OF WORK

The scope of the work is as per BOQ in the tender.

3.00 DISCLAIMER

This Document includes statements, which reflect various assumptions, which may or may not be correct .Each Bidder shall 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.

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

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.

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

4.00 COST OF BIDDING

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

5.00 BIDDING DOCUMENTS

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:

Request for Quotation (RFQ) - Section - I
Instructions to Bidders (ITB) - Section - II
Special Terms & Conditions of Contract (SCC) - Section –III

General Terms and Condition Supply (GCC-Supply) - Section –IV
Price Format Supply- Section V
General Terms and Condition Erection, Testing & Commissioning (GCC-ETC) - Section –VI
Price Format Erection, Testing & Commissioning - Section VII
Grand Summary of the Quoted Price – Section VIII
Vendor Code of Conduct - Section IX
Scope Demarcation and Route Map – Annexure II
Technical Specifications - Annexure III

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

6.00 AMENDMENT OF BIDDING DOCUMENTS

At any time prior to the deadline for submission of Bids, the Company 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.

The Amendment shall be part of the Bidding Documents, pursuant to Clause 5.00, and it will be notified in web site **www.bsesdelhi.com**, and will be binding on them.

In order to afford prospective Bidders reasonable time in which to take the Amendment into account in preparing their Bids, the Company 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.**

Purchaser shall reserve the rights to following

- extend due date of submission
- modify tender document in part/whole
- cancel the entire tender

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

7.00 LANGUAGE OF BID

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

8.00 DOCUMENTS COMPRISING THE BID

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

- Bid Form, Price & other Schedules (STRICTLY AS PER FORMAT) and Technical Data Sheets completed in accordance with Technical Specification
- All the Bids must be accompanied with the required EMD as mentioned in the Section-I against each tender.
- Tender documents duly stamped and signed on each page by authorized signatory

9.00 **BID FORM**

9.01 The Bidder shall submit one "Original" and one "Copy" of the Un-priced Bid Form, Price Schedules & Technical Data Sheets duly filled in as per attached specification/BOM etc enclosed.

9.02 **EMD**

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) Banker's Cheque / Demand Draft/Pay Order drawn in favour of BSES Rajdhani Power Ltd, payable at Delhi.

(b) Bank Guarantee valid for One hundred Twenty (120) days after due date of submission or amended due date of submission drawn in favour of BSES Rajdhani Power Ltd, BSES Bhawan, Nehru Place, New Delhi 110019

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/ Work Order, or

(ii) Furnish the required performance security BG.

10.00 **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, Erection, testing & commissioning 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. The Bidder is required, at his expense, to obtain all the information he may require to enable him to submit his tender including necessary visits to the site to ascertain the local conditions, procurement of necessary materials, labour, etc., requirements of the local/government/public authorities in such matters.

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.**

11.00 **BID CURRENCIES**

Prices shall be quoted in Indian Rupees Only**.**

12.00 **PERIOD OF VALIDITY OF BIDS**

12.01 Bids shall remain valid for 120 days from the due date of submission of the Bid & subsequent corrigendum/amendment/extension of due date of submission.

12.02 Notwithstanding Clause 12.01 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.

13.00 **ALTERNATIVE BIDS**

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

14.00 **FORMAT AND SIGNING OF BID**

14.01 The original Bid Form and accompanying documents, clearly marked "Original Bid" and "copy" 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 copy, 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.

15.00 **SEALING AND MARKING OF BIDS**

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

15.02 The Technical Documents and the EMD shall be enclosed in a sealed envelope and the said envelope shall be super scribed with —"Technical & EMD". The price bid shall be inside another sealed envelope with super scribed "Financial Bid ". Both these envelopes shall be sealed inside another big envelope. All the envelopes should bear the Name and Address of the Bidder and marking for the Original and Copy. The envelopes should be super scribed 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.

16.00 **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 thereafter be subject to the deadline as extended.

17.00 **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.

18.00 **LATE BIDS**

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

19.00 **MODIFICATIONS AND WITHDRAWAL OF BIDS**

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

20.00 **PROCESS TO BE CONFIDENTIAL**

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

21.00 **CLARIFICATION OF BIDS**

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

22.0 **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.

23.00 **EVALUATION AND COMPARISON OF BIDS**

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

23.01 The evaluation of the Bids shall be a stage-wise procedure. The following stages are identified for evaluation purposes: In the first stage, the Bids would be subjected to a responsiveness check. The Technical Proposals and the Conditional ties of the Bidders would be evaluated.

23.02 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:

- Delivery Schedule
- Conformance to Qualifying Criteria
- 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.

24.00 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.

25.00 THE PURCHASER ’S RIGHT TO ACCEPT ANY BID AND TO REJECT ANY OR A LL BIDS

The Purchaser reserves the right to accept or reject any Bid and to annul the Bidding process and reject all Bids at any time 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.

26.00 AWARD OF CONTRACT

26.01 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.

26.02 The Purchaser intends to issue separate Purchase/Work Orders viz
a) Purchase Order for Supply
b) Work Order for Installation, Testing & Commissioning

27.00 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.

28.00 **LETTER OF INTENT/ NOTIFICATION OF AWARD**

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

29.00 **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 the 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 up to completion period/handing over, whichever is earlier plus 3 months claim period. Upon submission of the performance security, the EMD shall be released. 2 (two) nos. separate CPBG's shall be submitted against Supply, ETC.

30.00 **CORRUPT OR FRADULENT PRACTICES**

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

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

"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

"Fraudulent practice" means a misrepresentation of facts in order to influence a award process or the execution of a contract to the detriment of the Company, 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 Company 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.

31.00 **COMPLETION PERIOD**

10 Months from the date of PO

2 months: Engineering - Drawing submission & approval and release of civil drawings to site for construction

5 months : Civil Construction at Site (by Consumer) and Electrical equipment Manufacturing

3 months: Erection, Testing and Commissioning of electrical equipment and related accessories and handing over

Section III

SPECIAL TERMS AND CONDITIONS OF CONTRACT

1.1. 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.

1.2. The scope of this tender includes supply , survey , design , engineering , manufacturer , shop testing ,inspection , packing , dispatch , loading , unloading and storage at site, storage and construction insurance , assembly , erection ,structural , complete pre-commissioning checks , testing and commissioning at site , obtaining statutory clearance & certification from state electrical inspector and handing over of Grid to owner on single point responsibility basis.

1.3. The scope includes supply of all barricading, free issued materials (including installation, transportation, loading & unloading), dewatering, watch and ward and transportation of scrap (generated at Site), balance free-issued material, dismantled material from site to BRPL store including loading & unloading and no additional charges shall be paid against these activities. Used barricading material will be taken back by bidder soon after job is handed over or as directed by BRPL Engineer-In-Charge (E-I-C). No additional cost for these items will be paid to the Bidder. Any leakage, pilferage and damage of the material shall be in vendor's scope.

1.4. Joints & Terminations installation shall only be done by OEM. No additional cost for this item will be paid to the Bidder. Contractor to provide all support to the Jointers for doing Joints & Terminations of Joint Kits.

1.5. Prices for all the activities shall be FIRM till the actual completion of the job. Statutory variation will be allowed for direct supplies only wherever breakup of Taxes & Duties are available in Price Bid. In case bidder has not submitted any price breakup, no variation on account of statuary variation shall be paid extra by BRPL.

1.6. There will be no price escalation given to bidder even if there is delay in the project due to ROW permission.

1.7. Permission from road owning agencies & statutory clearance for road cutting shall be taken by BRPL. However, the Bidder shall follow-up with local authorities and other connected persons that may required to carry out the job under this work order.

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

1.9. Wherever BRPL specifications are not available relevant IS/IEC to be followed. All Drawings mentioned in the Tender Specification and other required for the completeness of the tender shall be submitted. Drawing submission process shall not be deemed complete if all the requirements are not complied during the submission of the same.

1.10. The bidder should have own testing equipment's/they have to provide like IR Tester, Hi Pot Test Kit and Earth Tester and Sheath Integrity test kit with Calibration Certificates for testing the cables. Sheath integrity test will in scope bidder before charging of cable(for 66 kV Cable only)

1.11. The Bidder should have own Safety equipment like Neon Tester, Portable Earth, Earthing discharge rod etc. along with Calibration Certificates of all the equipment.

1.12. The Bidder should have all major tools and tackles required for installation, testing & commissioning works.

1.13. 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

1.14. Any other material not specifically mentioned above but required for successful commissioning and operation is in the scope of bidder. Prior approval shall be taken from central engineering department before execution. Commercial approval shall be taken from C&M Department before execution.

1.15. Successful bidder has to adhere to the statutory compliance.

1.16. Successful Bidder has to depute the safety officer and quality officer separately at site for whole duration and they have to submit the safety report and quality report to BRPL E-I-C on weekly basis.

1.17. Successful bidder has to send the weekly progress report to BRPL EIC.

1.18. 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.

1.19. Necessary Statutory Clearances from CEI of Delhi & any other authority for energizing shall be in the scope of this tender. However, any statutory fees shall be borne by BRPL on production of documentary evidence.

1.20. Taking over after commissioning of the complete system and final approval of Electrical Inspector & Compliance to punch points observed to the satisfaction of Projects as per statutory requirements, system shall be handed over to BRPL.

1.21. **Guarantee period/Defect Liability period:**

The Guarantee Period will be equipment/service/work specific and shall be as specified in the Technical Specifications for the equipment/material/service/work and where Technical specifications are not part of contract documents or guarantee period is not specified in the Technical specifications, the guarantee period shall be as per the Special Terms and Conditions of the Contract. In case of no mention of the guarantee period in Technical specifications, Defect liability period will be 24 Months from the Date of Commissioning or 30 months from the date of delivery of final lot of supplies made, whichever is later.

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

1.22. **Failure during Guarantee Period:**

If the equipment and material supplied/service or work rendered under the contract fails to perform its due, rated & intended quality performance, during the Guarantee period, the bidder is liable to undertake repair/rectify/replace the equipment and material supplied/service or work rendered under the contract within time frame as specified below at bidder's cost to make the equipment and material supplied/service or work rendered under the contract of performing its due, rated and intended quality performance. If bidder fails to repair/rectify/replace the equipment or material supplied/service or work rendered under the contract, failed in Guarantee Period, purchaser will be at liberty to get the same done at bidder's risks and costs and recover all such expenses plus the purchaser own charges (@ 15% of expenses incurred), from the bidder or from the "Performance Bank Guarantee" as the case may be.

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

a) Service Engineer Availability to Attend, Identify & Restore Defects (Minor) of materials/Equipment's under Guarantee Period within 48 Working Hours (Exclusion of Material Support Cases)

b) Spare Material Delivery for rectification of defect (Major) Under Guarantee Period within Two Weeks. Bidder must keep Requisite Inventory of Critical Spares & Other Equipments Covered in Guarantee Period to Restore Equipment within Two Weeks.

c) In Case Of Complete Replacement of material, within a Period of 4 Weeks.

Note: BRPL is in the business of Power distribution and is committed to providing reliable and continuous power supply to its customers. In case of any fault in the system, BRPL's top most priority is to rectify the fault and restore the system as soon as possible and maintain the supply.

If during the defect liability period any fault occurs in the system due to faulty materials, design or workmanship, BRPL shall intimate the vendor of such occurrence for taking immediate corrective action.

However, if the situation, in BRPL's sole discretion warrants an emergency restoration, it reserves the right to take immediate action for identifying the fault and restoring the system with available resources & materials or with help from any other third party agency under intimation to the Vendor. All costs of replacement, substitution, shipping, labour and other related expenses including taxes and levies incurred in connection with the restoration of fault plus 15% of expenses incurred as administrative overheads shall be for the account of Vendor. BRPL will charge the vendor for the costs incurred for fault restoration or may set off such costs against any amounts payable by BRPL to the Vendor or deduct from the PBG submitted by the Vendor. Vendor shall pay BRPL the amount within 30 days.

Root cause analysis of the fault shall be done jointly by BRPL's CES & O&M teams and Vendor. In case the fault is due to any reason other than faulty materials, design or workmanship, Vendor shall be exempted from any further action or Cost.

1.23. All the bay equipment (i.e- LA, CT, PT, Disc Insulator, String, Suspension Insulator, Bushing etc.) shall be Polymeric type in the place of porcelain with creepage 31mm/kV. Rest of the parameter to be followed as per tech spec.

1.24. PROJECT INFORMATION & COMPLETION

The contractor shall be fully responsible to complete the project in time. It is desired that the project should be completed as per the schedule from the date of LOI or purchase order whichever is earlier. The detailed 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 with this tender/as asked by the Purchaser.

1.25. 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

c) Project Organization Chart for Representatives, Project Office & site office teams along with the functions.
d) Bar Chart & Network Diagram (with critical path) for various activities to achieve scheduled completion.

SECTION IV
GENERAL TERMS AND CONDITIONS - SUPPLY

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 Rajdhani 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 BRPL 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 supplying, acceptance shall mean issue of necessary equipment / material takeover receipt after installation & commissioning and final acceptance.

3.0 Contract Documents & Priority

Contract Documents: The terms and conditions of the contract shall consist solely of these RFQ conditions and the offer sheet. 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 Purchaser, 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. Any amendments to Contract
2. Commercial Terms & Conditions of the Contract
3. Clarifications/addendum/corrigendum to Tender
4. Terms & Conditions of the Tender

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. In case of standard items, BRPL shall forward the standard QAP which is to be followed by vendor during manufacturing.

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 can proceed with the work past a hold point only after clearance by purchaser or a witness waiver letter from BRPL.

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

5.04 On completion of manufacturing the items can only be dispatched after receipt of dispatch instructions issued by the Purchaser.

5.05 All in-house testing and inspection shall be done without any extra cost. The in-house inspection shall be carried out in presence of BRPL/BRPL 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 BRPL, 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

Bidder has to quote their prices on Landed Cost Basis and quote separate price for each item.

FIRM prices for supply to BRPL Delhi/New Delhi stores inclusive of packing, forwarding, loading at manufacturer's premises, payment of all taxes, GST, Freight, any other local charges etc.

The above supply prices shall also include unloading at BRPL Delhi/New Delhi stores/site.

Transit insurance will be arranged by bidder.

8.0 Terms of payment and billing – SUPPLY

a) 10% advance against submission of BG of equivalent amount valid upto completion period/handing over , whichever is earlier plus 3 months claim period. In case of delay, the BG shall be extended suitably.

b) 75% pro-rata of supply value shall be payable against R/A bills for supply of equipment and materials within 30 days against receipt of material at site and submission of following documents duly certified by BRPL Project-in-charge:

i. Consignee copy of LR
ii. Detailed invoice showing commodity description, qty, unit & total price,
iii. Original certificate issued by BRPL 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.

c) 10% pro-rata after installation/erection of equipment duly certified by BRPL Project-in-charge

d) 5% pro-rata after completion of successful acceptance testing, commissioning and Handing Over of the entire Installation and duly certified by BRPL Project-in-charge and submission of PBG of 10% of contract value valid up to Defect Liability period i.e. 24 months from the date of Handing over of entire Installation Plus 3 months towards Claim period.

9.0 Price Validity

9.01 All bids submitted shall remain valid, firm and subject to unconditional acceptance by BRPL Delhi for 120 days from the due date of submission & subsequent corrigendum/amendment/extension of 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 Rajdhani Power Ltd" as applicable. The performance Bank guarantee shall be in the format as specified by BRPL.

10.02 Contract performance bank guarantee of total 10% of the contract price shall be submitted within 15 days of award of contract with the validity till completion of the contract period.

10.03 Contractor shall submit the performance bank guarantee equivalent to the 10% of the contract value at the time of claiming the last payment as per clause no. 8.0(C) (Terms of payment and billing – SUPPLY), with the validity of the bank guarantee till Defect Liability Period plus 3 months towards Claim period.

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 BRPL 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 BRPL at its sole discretion determines that supplier has failed to comply with any term or condition set forth in the contract.

12.0 Release

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

13.0 Guarantee of Performance

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

14.0 Guarantee Period/Defects Liability Period

The Guarantee Period will be equipment/service/work specific and shall be as specified in the Technical Specifications for the equipment/material/service/work and where Technical specifications are not part of contract documents or guarantee period is not specified in the Technical specifications, the guarantee period shall be as per the Special Terms and Conditions of the Contract. In case of no mention of the guarantee period in Technical specifications, Defect liability period will be 24 Months from the Date of Commissioning or 30 months from the date of delivery of final lot of supplies made, whichever is later.

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.

Cost of repairs on failure in Guarantee Period:

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

15.0 Latent Defect:

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

16.0 Support beyond the Guarantee Period

The Bidder shall ensure availability of spares and necessary support for a period of at least 10 years post completion of guarantee period of equipment /technology supplied against this contract. BRPL shall be duly intimated by the Vendor of End of Life Support for the product /technology supplied at least 12 months in advance.

17.0 Return, Replacement or Substitution

BRPL shall give Supplier notice of any defective Commodity promptly after becoming aware thereof. BRPL may at its discretion elect to return defective Commodities to Supplier for replacement, free of charge to BRPL, or may reject such Commodities and purchase the same or similar Commodities from any third party. In the latter case BRPL shall furnish proof to Supplier of the cost of such substitute purchase. In either case, all costs of any replacement, substitution, shipping, labour and other related expenses incurred in connection with the return

and replacement or for the substitute purchase of a Commodity hereunder should be for the account of Supplier. BRPL may set off such costs against any amounts payable by BRPL to Supplier. Supplier shall reimburse BRPL for the amount, if any, by which the price of a substitute Commodity exceeds the price for such Commodity as quoted in the Bid.

18.0 Effective Date of Commencement of Contract:

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

19.0 Time – The Essence of Contract

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.

20.0 The Laws and Jurisdiction of Contract:

The laws applicable to this Contract shall be the Laws in force in India. To the best of their ability, the parties hereto shall endeavor to resolve amicably between themselves all disputes arising in connection with this work order. If the same remain unresolved within thirty (30) days of the matter being raised by either party, either party may refer the dispute for adjudication by arbitration. The arbitration shall be undertaken by the sole arbitrator jointly appointed by the parties. In case the parties fail to arrive at consensus to appoint the sole arbitrator, either party may approach the Court for appointing an arbitrator under Section 11 of the Arbitration and Conciliation Act, 1996 and the award of the said sole arbitrator, shall be final and binding upon the parties. The arbitration proceeding shall be conducted in accordance with this provisions of the Indian Arbitration & Conciliation Act, 1996 (as amended up to date) and the venue of such arbitration shall be the city of New Delhi only. The Arbitration shall be conducted in English language only. The courts at Delhi shall have the exclusive jurisdiction over the subject matter of Arbitration/dispute. The cost of the Arbitration shall be equally shared by the parties as per directions of the Sole Arbitrator.

21.0 Events of Default

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

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

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

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

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

22.0 Consequences of Default

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

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

(i) present for ` to the relevant bank the Performance Bond;

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

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

23.0 Liquidated Damages

23.01 If supply of items / equipment is delayed beyond the supply schedule as stipulated in LOI/PO, then the Supplier shall be liable to pay the Purchaser for delay a sum of 0.5% (half percent) of the total price for every week of delay or part thereof for undelivered units.

23.02 The total amount for delay under the contract will be subject to a maximum of ten percent (10%) of the total contract value.

23.03 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.

24.0 Statutory variation in Taxes and Duties

The total order value shall remain **FIRM** within stipulated delivery period and shall not be adjusted on account of any price increase/variations in commodities & raw materials. However Statutory Taxes, duties and Levies imposed by Competent Authorities by way of fresh notification(s) within the stipulated delivery period shall be borne by BRPL on submission of necessary documents claiming such variation. The variation will be applicable only on such value wherever price breakup of same is submitted by vendor/available in PO/WO

25.0 Force Majeure

25.01 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.

25.02 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.

25.03 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.

25.04 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.

25.05 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.

25.06 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.

25.07 The Purchaser may terminate the contract after giving 7(seven) 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

25.08 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.

25.09 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.

25.10 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 an event of Force Majeure."

26.0 Transfer and Sub-Letting

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.

27.0 Recoveries

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.

28.0 Waiver

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

29.0 Indemnification

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.

30.0 Documentation:

The Bidder's shall procure all equipment from BRPL 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. The Bidder's shall ensure for the strict compliance to the specifications and Field Quality Procedures issued by BRPL Engineer in-charge.

31.0 Commissioning Spares

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

SECTION V

PRICE FORMAT – SUPPLY

Supply BOQ 66 Indira Gandhi Hospital 66kV GIS								
Sl no	**Description**	**Qty**	**UOM**	**Basic (Rs)**	**Freight (Rs)**	**GST (Rs)**	**Unit Landed (Rs)**	**Total Landed Cost (Rs)**
1	66kV GIS Panels including LCC (As per Tender SLD)							
1a	66kV GIS Panel Line panel(As per Tender SLD)	4	Set					
1b	66kV GIS Panel Bus coupler(As per Tender SLD)	1	Set					
1c	66kV GIS Bus PT(As per Tender SLD)	2	Set					
2	66kV Control Relay Panel							
2a	66kV Control Relay Panel Line Feeder	4	Set					
2b	66kV Control Relay Panel Bus coupler Feeder	1	Set					
3	220V Li-Ion Battery bank	1	Set					
4	DCDB with battery charger	1	Nos					
5	ACDB	1	Nos					
6	SCADA RTU	1	Set					
7	Indoor LED lighting system including emergency lighting	1	Lot					
8	Air conditioning for complete substation building except Toilet and Pantry	1	Lot					

9	Exhaust and Ventilation for Toilet and Pantry	1	Lot					
10	Fire detection and alarm system for building	1	Lot					
11	Control cables							
A	6CX4Sqmm	3000	Mtr					
B	6CX2.5Sqmm	3000	Mtr					
C	10CX2.5Sqmm	3000	Mtr					
12	LT power cable							
A	2CX10Sqmm	600	Mtr					
B	4CX10Sqmm	800	Mtr					
C	2CX2.5Sqmm	250	Mtr					
D	4CX25Sqmm	300	Mtr					
E	4Cx50 sqmm	300	Mtr					
13	66kV GIS Termination kits							
A	66KV 1CX1000Sqmm	12	Nos					
14	Cable trays & Cable mounting Structure (including accessories) as per requirement	1	Lot					
15	Tools ,tackles and spares as per spec	1	Lot					
16	Cabling between equipments and RTU as per requirement	1	Lot					
17	Control Cable Terminations and Glands as per requirement	1	Lot					
18	Fire Extinguisher as per spec	1	Lot					
18	Line current differential relay for remote location including all OFC accessories as per spec	4	Nos					
19	Video Surveillance system as per spec	1	Set					
20	EOT Crane	1	Set					
21	Cable entry sealing as per requirement	1	lot					
22	IT Requirements as per spec/BOQ	1	Lot					
23	Grounding and earthing of entire substation including earthing (as per specs)	1	Lot					

BOQ shall be read in conjunction with the Tender Document & General Design Criteria

Appendix- I

COMMERCIAL TERMS AND CONDITIONS - SUPPLY

Sl No	Item Description	AS PER BRPL	BIDDER'S CONFIRMATION
1	Validity	120 days from the due date of submission or amended due date of submission	
2	Price basis	a) **Firm**, FOR Delhi store basis. Prices shall be inclusive of all taxes & duties, freight up to Delhi stores. b)Unloading at stores - in vendor's scope c) Transit insurance in Bidder scope	
3	Payment terms	a. 10% advance against submission of BG of equivalent amount valid upto completion period/handing over, whichever is earlier plus 3 months claim period. In case of delay, the BG shall be extended suitably. b. 75 % against R/A bills within 30 days against receipt of material at site. c. 10% pro-rata after installation/erection of equipment d. 5% pro-rata after completion of successful acceptance testing, commissioning and Handing Over of the entire Installation and duly certified by BRPL Project-in-charge and submission of BG of 10% of contract value valid up to Defect Liability period i.e. 24 months from the date of Handing over of entire Installation Plus 3 months towards Claim period	
4	Completion time	10 months from date of LOI/Order	
5	Defect Liability period	24 months from the date of Handing over of entire Installation.	
6	Liquidated damages	0.5% of total price for every week delay subject to maximum of 10% of total contract value	
7	Contract Performance Bank Guarantee	10% (Ten percent) of the Contract Price valid up to completion period/handing over.	
8	Performance Bank Guarantee	10% (Ten percent) of the Contract Price valid up to Defect Liability Period plus 3 months towards claim period.	

BSES RAJDHANI POWER LIMITED

APPENDIX II

BID FORM

To

Head of Department
Contracts & Material Deptt.
BSES Rajdhani Power Ltd
New Delhi 110019

Sir,

1 We understand that BRPL is desirous of execution of ……(Name of work)

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 above 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 120 days from the due date of bid submission & subsequent corrigendum/amendment/extension of due date of submission. 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).....

Appendix III

ACCEPTANCE FORM FOR PARTICIPATION IN REVERSE AUCTION EVENT

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

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

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

1. In case of bidding through Internet medium, bidders are advised to ensure availability of all associated infrastructure as required to participate in the reverse auction event. Inability to bid due to telephone glitch, internet response issues, software & hardware hangs/failures, power failures or any other reason shall not be the responsibility of BRPL.
2. In case bidder fails to participate in the reverse auction event due to any reason whatsoever, it shall be presumed that the bidder has no further discounts to offer and the initial bid submitted by them as a part of tender shall be considered as bidder's Final No Regret offer. Any off-line price bids received from a bidder in lieu of non-participation in the reverse auction event shall be rejected by BRPL.
3. The bidder is advised to understand the auto bid process t safeguard themselves against any possibility of non-participation in the reverse auction event.
4. The bidder shall be prepared with competitive price quotes during the day of reverse auction event.
5. The prices quoted by bidder in reverse auction event shall be on FOR Landed cost BRPL Store/site basis inclusive of all relevant taxes, duties, levies, transportation charges etc.
6. The prices submitted by the bidder during reverse auction event shall be binding on the Bidder.

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

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

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

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

11. BRPL shall provide the user id and password to the authorized representative of the bidder. Authorization letter in lieu of the same shall be submitted along with the signed and stamped acceptance form.

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 reverse auction event for arriving at contract amount

APPENDIX IV

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 Rajdhani Power Ltd., with it's Corporate Office at BSES Bhawan Nehru Place, New Delhi -110019 ,(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____.

THE 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 Hundred Twenty (120) 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

APPENDIX - V

LITIGATION HISTORY

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

APPENDIX - VI

CURRENT CONTRACT COMMITMENTS/ WORK IN PROGRESS

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

APPENDIX - VII

FINANCIAL DATA

(Duly Certified by Chartered Accountant)

	FY 18-19	FY 17-18	FY 16-17
Total assets			
Current assets			
Total Liability			
Current Liability			
Profit before taxes			
Profit after taxes			
Sales Turnover			

APPENDIX VIII

CHECK LIST

Sl 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 RAJDHANI 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

SECTION VI

GENERAL TERMS & CONDITIONS - ERECTION, TESTING & COMMISSIONING

1. DEFINITIONS and INTERPRETATION

The following terms shall have the following meanings:

1.1 "Company": means BSES Rajdhani Power Ltd, a company incorporated under the Companies Act 1956 and having its office at BSES Bhawan, Nehru Place, New Delhi 110 019, 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 BRPL 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.

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 includes survey , design , engineering , manufacture , shop testing ,inspection , packing , dispatch , loading, unloading and storage at site, storage and construction insurance , assembly , erection ,structural , complete pre-commissioning checks , testing and commissioning at site , obtaining statutory clearance & certification from state electrical inspector, Municipal Corporation department, Fire Officer, Horticulture department and handing over to owner after successful testing & Commissioning of 66/11 kV GIS Substation at sec-9 Dwarka, New Delhi, BRPL on single point responsibility basis. Schedule of work shall be as per BOQ attached herewith.

After completion of E/T/C work of the scheme, contractor has to obtain the Electrical Inspectorate's Clearance from the Electrical Inspector of Delhi Govt. However, the the Electrical Inspector Clearance fees shall be borne by the BRPL.

BRPL E-I-C shall arrange any permission like road cutting clearance etc from the Delhi Civic authorities. However, the Bidder shall follow-up with local authorities and other connected persons that may required to carry out the job under this work order.

All the labour, cranes, tool and tackles, and technical supervision etc. are including in your scope of work. Adequate number of engineers, supervisors and laborers 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 (within 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 be 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 Bidder's 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 at his own shall arrange Water and Electricity Power at his cost.

Special Instruction:-

a. All Erection tools and tackles and testing equipment shall be available with contractor in event of order.

b. Penalty clause shall be incorporated in case any of workmen of contractor is found violating safety protocol as per BRPL WO.

Any additional work beyond the scope enumerated in the work order above shall be carried out as per the instructions of Engineer-In Charge. The company shall not entertain any claim or increase in the Work Order value due to execution of such additional work if the same is not approved by Engineer in Charge.

5. 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.

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

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

The cost of training of BRPL Official shall be included in the prices quoted by vendor.

6. TAXES AND DUTIES:

Prices are inclusive of all taxes and duties including 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** within stipulated delivery period and shall not be adjusted on account of any price increase/variations in labour. However Statutory Taxes, duties and Levies imposed by Competent Authorities by way of fresh notification(s) within the stipulated delivery period shall be borne by BRPL on submission of necessary documents claiming such variation. The variation will be applicable only on such value wherever price breakup of same is submitted by vendor/available in PO/WO.

7. TERMS OF PAYMENT (Erection, Testing & Commissioning)

Payment shall be made as under:

(i) 10% mobilization advance against submission of Advance Bank Guarantee of equivalent amount valid up to completion period/ handing over, whichever is earlier plus 3 months claim period. In case of delay, the BG shall be extended suitably.

ii) 75% pro-rata of total installation value shall be payable against R/A bills payable within 45 days after installation / erection of material at site duly certified by Engineer in charge.

iii) 10% pro-rata of total installation value shall be payable against R/A bills payable within 30 days after testing & commissioning of material at site.

iv) 5% of contract value payable after completion of successful acceptance testing, commissioning and handing over of complete systems duly certified by Engineer in charge, submission of Electrical Inspector Clearance Certificate & submission of Performance Bank Guarantee of 10% of contract value valid up to defect liability period i.e. 24 months from the date of Handing over of entire Installation Plus 3 months towards Claim period.

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. Guarantee of Performance

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

9. Guarantee period/Defect Liability period:

The Guarantee Period will be equipment/service/work specific and shall be as specified in the Technical Specifications for the equipment/material/service/work and where Technical specifications are not part of contract documents or guarantee period is not specified in the Technical specifications, the guarantee period shall be as per the Special Terms and Conditions of the Contract. In case of no mention of the guarantee period in Technical specifications, Defect liability period will be 24 Months from the Date of Commissioning or 30 months from the date of delivery of final lot of supplies made, whichever is later.

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.

10. Performance Guarantee

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

10.02 Contract performance bank guarantee of total 10% of the contract price shall be submitted within 15 days of award of contract with the validity till completion of the contract period.

10.03 Contractor shall submit the performance bank guarantee equivalent to the 10% of the contract value at the time of claiming the last payment as per clause no. 7.0 (iii) (TERMS OF PAYMENT (Erection, Testing & Commissioning)), with the validity of the bank guarantee till Defect Liability Period i.e. 24 months from the date of Handing over of entire Installation plus 3 months.

11. 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, Testing & Commissioning work should be completed within 10 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.

12. 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.

13. 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.

14. 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.

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. Contractor must submit a periodical material reconciliation statement in the approval format with every Running

Bill raise by him or end of every month whichever is earlier. 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.

15. PENALTY AND LIQUIDATED DAMAGES

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

14.2 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 0.5 % of the order value for each week or part there of delay until the actual date of completion up to a maximum deduction of 10% of total order value. Once the maximum is reached to Company may consider termination of contract without any liabilities to Company.

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

16. 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 coordinator 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 coordinator 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 causalities, 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.

17. STATUTORY OBLIGATIONS:

The Contractor shall take all steps as may be necessary to comply with the various applicable laws/rules including the provisions of contract labour (Regulation & Abolition Act) 1970 as amended, minimum wages Act, 1984, Workman Compensation Act, ESI Act, PF Act, Bonus Act and all other applicable laws 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 issued by Govt.of Delhi.
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) PAN No.
f) Work Contract Tax Registration Number/ GSTN Registration.
g) Labour License under Contract Labour Act (R & A) Act 1970

(The Contractor shall provide BRPL Engineer-in-charge a copy of Labour License responsible for execution of the job before start of the work.)

The Contractor must follow:

a) Third party Insurance Policy before start of work.
b) To follow Minimum Wages Act prevailing in the state.
c) Salary / Wages to be distributed in presence of representative of Company's representative not later than 7th of each month.
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}

18. 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.

19. STAFF AND WORKMAN

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.

The records shall be in the prescribed formats only.

(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 Engineer in charge to assist him to discharge the overall responsibility of the execution of the project.

20. INSURANCE

a) THIRD PARTY INSURANCE

Before commencing the execution of the work the contractor shall take third party insurance policy at his own cost to insure against any damage or loss or injury which may occur to any property/public property or to any person or any employee or representative of any outside Agency / the company engaged or not engaged for the work of the company, by or arising out of the execution of the work or temporary work or in carrying out of this Agreement. For third party insurance policies, the contractor shall be responsible for settlement of claims with the underwriters without any liability on the purchaser / owner and will arrange replacements / rectification expeditiously without awaiting settlement by insurance claim at contractors own cost.

b) ACCIDENTAL INSURANCE POLICY FOR LIFE COVER:

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 BRPL. The premium amount for such life cover policy shall be borne by the contractor. The contractor shall furnish copy of policy when demanded by BRPL.

c) INSURANCE FOR MAN, MATERIAL & MACHINERY DEPLOYED AT SITE

Contractor shall be responsible for the insurance for his own man, material and machinery deployed at site for the package awarded. Contractor shall furnish the copy of this insurance policy to the purchaser, prior start of work.

21. SECURITY

Adequate number of trained Security Guards shall be deployed both at the storage yard and stores as well as places of work to prevent theft and pilferage of material and accessories and various other materials. All security rules and safety rules enforced at site by company shall be strictly observed.

22. 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 contractors 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.

23. 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.

24. 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.

25. 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.

26. 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.

27. RISK & COST:

If the Contractor of fails to execute the work as per specification / as per the direction of Engineer's In-change 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.

28. 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 is 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.

29. FORCE MAJEURE:

29.1 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

29.2 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:

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, and

b) Explosions or fires

c) Declaration of the Site as war zone.

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

29.3 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.

29.4 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 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.

29.5 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.

29.6 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.

30. <u>SECRECY CLAUSE</u>:

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 Contractor 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 contractor shall indemnify the Company against any loss, cost or damage or claim by any party in respect of such breach.

31. TERMINATION

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

31. QUALITY

Contractor shall ensure that strict quality is maintained and execution of works under the 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.

32. ACCEPTANCE

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

SECTION VII

PRICE FORMAT – ERECTION, TESTING & COMMISSIONING

Services BOQ 66 Indira Gandhi Hospital 66kV GIS							
S.No.	**Item Description**	**Quantity**	**UOM**	**Basic (Rs)**	**GST (Rs)**	**Unit Landed (Rs)**	**Total Landed Cost (Rs)**
1	ETC of 66kV GIS Panels including LCC (As per Tender SLD)						
1a	ETC of 66kV GIS Panel Line panel(As per Tender SLD)	4	Set				
1b	ETC of 66kV GIS Panel Bus coupler(As per Tender SLD)	1	Set				
1c	ETC of 66kV GIS Bus PT(As per Tender SLD)	2	Set				
2	ETC of 66kV Control Relay Panel						
2a	ETC of 66kV Control Relay Panel Line Feeder	4	Set				
2b	ETC of 66kV Control Relay Panel Bus coupler Feeder	1	Set				
3	ETC of 220V Li-Ion Battery bank	1	Set				
4	ETC of DCDB with battery charger	1	Nos				
5	ETC of ACDB	1	Nos				
6	ETC of SCADA RTU	1	Set				
7	ETC of Indoor LED lighting system including emergency lighting	1	Lot				
8	Installation of Air conditioning for complete substation building except Toilet and Pantry	1	Lot				
9	Installation of Exhaust and Ventillation for Toilet and Pantry	1	Lot				
10	ETC of Fire detection and alarm system for building	1	Lot				
11	Laying of Control cables						
A	6CX4Sqmm	3000	Mtr				
B	6CX2.5Sqmm	3000	Mtr				
C	10CX2.5Sqmm	3000	Mtr				
12	Laying of LT power cable						
A	2CX10Sqmm	600	Mtr				
B	4CX10Sqmm	800	Mtr				
C	2CX2.5Sqmm	250	Mtr				
D	4CX25Sqmm	300	Mtr				
E	4Cx50 sqmm	300	Mtr				
F	LT 4Cx300 sq.mm. cable (Free issue) required for commissioning	100	Mtr				

13	ITC of of 66kV GIS Termination kits						
A	ITC of 66KV GIS Termination for 1CX1000Sqmm Cables	12	Nos				
14	Installation of Cable trays & Cable mounting Structure (including accessories) as per requirement	1	Lot				
15	Laying and termination of Cabling between equipments and RTU as per requirement	1	Lot				
16	Installation of Control and LT Cable Terminations and Glands as per requirement	1	Lot				
17	Installation of Fire Extinguisher as per spec	1	Lot				
18	ETC of Line current differential relay for remote location including all OFC accessories as per spec	4	Nos				
19	ETC of Video Surveilence system as per spec	1	Set				
20	ETC of EOT Crane	1	Set				
21	Installation of Cable entry sealing as per requirement	1	lot				
22	Painting with Fire retardent material on all power cables upto a length of 4 meter on each cables						
23	ITC of IT Requirements as per spec/BOQ	1	Lot				
24	ITC of Grounding and earthing of entire substation including earthing (As per specs)	1	Lot				
Civil BOQ 66 Indira Gandhi Hospital 66kV GIS							
25	Supervision Charges for constrcution of GIS and other building structure for BRPL part	1	Lot				
26	Design and layout drawings for all equipment BRPL substation	1	Lot				
27	Design and layout drawings for all equipment foundation details and trenches/celler	1	Lot				

Appendix-IX

COMMERCIAL TERMS AND CONDITIONS – E/T/C

Sl No	Item Description	AS PER BRPL	BIDDER'S CONFIRMATION
1	Validity	120 days from the due date of submission or amended due date of submission	
2	Price basis	**Firm**. Prices shall be inclusive of all taxes & duties.	
3	Payment terms	a) 10% mobilization advance against submission of Advance Bank Guarantee of equivalent amount valid upto completion period/ handing over, whichever is earlier plus 3 months claim period. In case of delay, the BG shall be extended suitably. b) 75% pro-rata of total installation value shall be payable against R/A bills payable within 45 days after installation/erection of material at site duly certified by Engineer in charge. c) 10% pro-rata of total installation value shall be payable against R/A bills payable within 30 days after testing & commissioning of material at site duly certified by Engineer in charge. d) 5% of contract value payable after completion of successful acceptance testing, commissioning and handing over of complete systems duly certified by Engineer in charge, submission of Electrical Inspector Clearance Certificate & submission of Bank Guarantee of 10% of contract value valid up to defect liability period i.e. 24 months from the date of Handing over of entire Installation Plus 3 months towards Claim period.	
4	Completion time	10 months from date of LOI/Order	
5	Defect Liability period	24 months from the date of Handing over of entire Installation.	
6	Liquidated damages	0.5 % of the order value for each week or part there of delay until the actual date of completion up to a maximum deduction of 10% of total order value	
7	Contract Performance Bank Guarantee	10% (Ten percent) of the Contract Price valid up to completion period/handing over.	
8	Performance Bank Guarantee	10% (Ten percent) of the Contract Price valid up to Defect Liability Period i.e. 24 months from the date of Handing over of entire Installation plus 3 months towards claim period.	

APPENDIX-X
FORMAT FOR PERFORMANCE BANK GUARANTEE

(TO BE ISSUED ON RS 1OO/- STAMP PAPER)

Bank Guarantee No.

Place:

Date:

To
BSES Rajdhani Power Limited

Whereas BSES RAJDHANI POWER LTD (hereinafter referred to as the "Purchaser", which expression shall unless repugnant to the context or meaning thereof include its successors, administrators and assigns) has awarded to M/s. with its Registered/ Head Office at

(Hereinafter referred to as the "Supplier" which expression shall unless repugnant to the context or meaning thereof, include its successors administrators, executors and assigns), a contract no. Dated (the Contract);

And whereas the value of the Contract is Rs. (The Contract Value).

And whereas it is a condition of the Contract that the Supplier shall provide a Performance Bank Guarantee for the due and faithful performance of the entire Contract for a sum equivalent to - % of the Contract Value to the Purchaser on or before

And whereas the Bank under instructions from the Supplier has agreed to guarantee dIe due performance of the Contract.
Now it is agreed as follows:

1. we (Name of the Bank) having its Head Office at
(hereinafter referred to as the Bank, which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns) 5hall indemnify and keep indemnified the Purchaser for, and guarantee and undertake to pay to the Purchaser immediately on written demand, a sum equivalent to % of the Contract Value
as aforesaid at any time upto (day/month/year) without any demur, reservation,
contest, recourse or protest and/or without any reference to the Supplier, against all losses, damages, costs and expenses that may be caused to or suffered by the Purchaser by reason of any default on the pall of the Supplier in performing and observing any and all the terms and conditions of the Contract or breach on the part if the Supplier of terms or conditions of the Contract.

2. The demand shall consist only of an original letter issued by Purchaser stating that the Supplier has failed to fulfill its obligations under the Contract. Such demand made by the Purchaser on the Bank shall be conclusive and binding notwithstanding any difference or dispute between the Purchaser and the Supplier or any difference or dispute pending before any Court, Tribunal, Arbitrator or any other authority.

3. The Bank undertakes not to revoke this guarantee during its currency without previous written consent of the Purchaser and further agrees that the guarantee herein contained shall continue to be enforceable during the period that

would be taken for satisfactory performance and fulfillment in all respects of the Contract or in the event of any dispute between the Purchaser and Supplier until the dispute is settled (provided that d1e claim! demand under this guarantee is lodged /referred during the currency of this guarantee) or till the Purchaser discharges this guarantee whichever is earlier.

4. The Purchaser shall have the fullest liberty without affecting in any way the liability of the Bank under this guarantee from time to time to extend the time for performance of the Contract by tbe Supplier. The Purchaser shall have the fullest liberty, without affecting the liability of the Bank under this guarantee, to postpone from time to time the exercise of any powers vested in them or of any right which they might have against the Supplier, and to exercise the same at any time in any manner, and either to enforce or to forbear to enforce any covenants, contained or implied, in the Contract. or any other course or remedy or security available to the Purchaser. The Bank shall not be released of its obligations under these presents by any exercise by the Purchaser of its liberty with reference: to the matters aforesaid or any of them or by reason of any other act or forbearance or other acts of omission or commission on the part of the Purchaser or any other indulgence shown by the Purchaser of by any other matter or thing whatsoever which under law would, but for this provision, have the effect of relieving the Bank.

5. The Bank agrees that the Purchaser and its option shall be entitled to enforce this guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Supplier and notwithstanding any security or other guarantee that the Purchaser may hive in relation to the Supplier's liabilities.

6. Notwithstanding anything contained hereinabove the liability of the Bank under this guarantee is restricted to a sum equivalent to % of the Contract Value ie. Rs.(Rupees) and it shall remain in force upto and including .Unless a demand to enforce a claim under this guarantee is made against the Bank within 3 months from the the above date of expiry i.e. up to all the rights of the Purchaser under the said guarantee shall be forfeited and the Bank shall be released and discharged from all liabilities thereafter.

7. This Performance Bank Guarantee shall be governed by the laws of India.

Dated this Witness

day of 20……. at

1. For Bank

2. Signature
Name Power of Attorney No:

Banker's Seal

SECTION VIII

GRAND SUMMARY OF THE QUOTED PRICE

Sr. Nos.	SCHEME DESCRIPTION	Total price for supply F.O.R site inclusive all duties taxes	Total for Erection, Testing & Commissioning inclusive all Taxes(INR)	Grand Total(INR)
1	Survey, Design, Supply, Installation, Testing & Commissioning of 66/11 kV GIS Grid Substation on Single point responsibility basis for providing new connection of 8MW in f/o DGHS-1725 beds hospital, sec-9 Dwarka			
TOTAL Package Cost				
In words :				

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

Date: Bidder Name:

Place: Bidders Address:

Name & Signature …….

Designation: ……

Common Seal:…….

SECTION IX

VENDOR CODE OF CONDUCT

Bidder shall agree to comply with Vendor code of Conduct as mentioned in BRPL Website. 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 Labour - Child labour 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 Labour - 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 heath, 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 the 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/tagout), 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 with appropriate emergency 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 be 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, targets and 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 modelled 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.

ANNEXURE –I

The Contractor must submit the following to Engineer-In-Charge before commencement of work:

a) An Electrical license. (If applicable)
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) PAN No.
f) Work Contract Tax/GSTN Registration Number.
g) Labor License under Contract Labor Act (R & A) Act 1970(All Engineer-in-charge responsible for execution of the job should obtain a copy of Labor License as per guidelines of HR department 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) Salary/ Wages to be distributed in presence of Company's representative not later than 7th of each month.

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) Labor license before start of work. (If applicable)

INSURANCE POLICY

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 premium amount for such policy shall be in contractor scope. The policy document shall be submitted before commencement of the work by the contractor.

ANNEXURE-II

TECHNICAL SPECIFICATIONS

BSES Rajdhani Power Limited
BSES Bhawan, Nehru Place, New Delhi- 19

TECHNICAL SPECIFICATION

FOR

ERECTION, TESTING & COMMISIONING OF 66KV INDIRA GANDHI HOSPITAL GIS GRID SUBSTATION AT NEW DELHI ON TURNKEY BASIS

(SPEC NO. BRPL-EHV-TS- IGH)

Prepared by	**Javed Ahmed**		**Rev: 1**
Reviewed by	**Abhinav Srivastava**		**Date: 04.12.2020**
Approved by	**K.Sheshadri**		

Technical Specification for 66KV INDIRA GANDHI HOSPITAL GIS Grid Substation in New Delhi

INDEX

Technical Specification for 66KV INDIRA GANDHI HOSPITAL GIS Grid Substation in New Delhi

SCHEDULE & ANNEXURE

BSES Bhawan, Nehru Place, New Delhi- 19

TECHNICAL SPECIFICATION

FOR

GENERAL DESIGN CRITERIA

Prepared by	**Javed Ahmed**		**Rev: 0**
Reviewed by	**Abhinav Srivastava**		**Date: 24th Nov, 2020**
Approved by	**K.Sheshadri**		

1.0 INTENT OF SPECIFICATION

This specification is intended to cover complete design, engineering, manufacturing, assembling, testing at manufacturer's works, supply and Transportation F.O.R. site of all equipment and accessories, steel structures, all structural work complete erection, testing, commissioning & putting into successful commercial operation of 66 KV GIS substation including supply of all Labour, supervision, tools and plants and supplies as required.

The 66kV Gas insulated Double Bus substation shall have following bays with all associated equipment and civil works: - Four (04 No's) Feeder - One (01 No) Bus Coupler bay -Two (02) sets Bus PT.

The substation shall have control room building with 66kV Control and Relay Panel, 66kV GIS, Battery & Battery Charger, ACDB and DCDB etc. The suggestive Layout Plan and Single Line diagram of the substation is enclosed.

Civil Supervision during construction shall be in Bidder's scope. The Bidder shall coordinate with BRPL Civil team for civil drawings as regards to the requirements of electrical equipment and conformance to BSES's specification.

The Bidder will ensure adherence to approved drawings during construction. Any minor civil work if required shall be in Bidder's scope.

This specification shall be read in conjunction with other sections of bidding document. In the event of any discrepancy with the listed document, the most stringent one shall govern. In the tender document, the term 'Bidder' and 'Contractor' has been used interchangeably.

It is advisable that bidder should visit the site to confirm its present status prior to submission of their bid

2.0 SCOPE OF SUPPLY

This scope of work shall include design, engineering, manufacture, shop floor testing, inspection, packing, dispatch, loading, unloading and storage at site, transit/storage and, assembly, erection, complete pre-commissioning checks, testing & commissioning at site, obtaining statutory clearance & certification from State Electrical Inspector, Municipal Corporation department, Fire officer, etc. and handing over to the Owner after satisfactory commissioning of complete 66 kV substation of BSES Rajdhani Power Ltd. at Indira Gandhi Hospital, New Delhi.

Civil Supervision during construction shall be in Bidder's scope. The Bidder shall coordinate with BRPL Civil team for civil drawings concerning the requirements of electrical equipment and conformance to BSES's specification.

The Bidder will ensure adherence to approved drawings during construction. Any minor civil work if required shall be in Bidder's scope

The scope includes all material, equipment and works required for the construction of the Substation complete with all items considered essential for safe and trouble-free continuous commercial operation of the system in a manner acceptable to the Owner and complying with latest revision of National and International Standards Codes & Practices, Indian Electricity Rules and Indian Electricity Act.

The scope of supply broadly includes the following:

2.1 Major Equipments:

- 66kV GIS Panels (as per SLD) – 7 Set.
- Control & Relay Panels – 7 Sets
- DCDB – One (1 No.)
- Li-Ion Battery of 220VDC- 1 Set
- Battery Charger- 1 Set
- ACDB – One (1 No.)
- SCADA RTU
- Gas filling device with filter and leakage detector for above GIS Panel (DILO Make) – 1 set
- Single Girder EOT Crane (As per Specs)

2.2 Item as System

- Grounding and earthing of individual for BRPL equipments. Connection of the same with main Earthmat laid by IGH (As per calculation, Minimum 12 nos shall be considered).
- Indoor illumination including emergency lighting (DC lighting incase of black out) including its wiring and conduiting.
- Air Conditioning, Exhaust and Ventilation for complete substation building including its wiring and conduiting.
- Fire detection and alarm system for complete substation (Including Cable Celler) including its SCADA integration.
- Video Surveillance system including its SCADA integration.
- Material GPS Tracking System.
- Fiber optic Cable including patch cord, LIU splicing inside substation for line differential protection at Remote and Receiving substation.
- Cable mounting structures including fixing arrangements in ground/ wall with cable trays (Control and Power Cable Trench shall be separate)
- Fire retardant paint for all cable entering to panels till the cable opening
- 6 Months O&M from the date of handing over of Substation (refer Annexure-O for Details).
  GIS foundation arrangements with all required accessories

2.3 Items as Lot

- LT Power & Control cables (fire retardant type) supply and termination and Glands.
- Building Cable entry Sealing
- Cable trays and laying and commissioning of Power and control Cables for BRPL Equipments.

- Supply and ETC of GIS Termination Kits
- Supply and installation of Fire extinguisher
- Maintenance tools & tackles including testing & measuring instruments
- Cabling between equipments and RTU
- Supply Erection testing and commissioning of Line differential protection Relay at remote end
- Rubber Mat for all Indoor equipments.

2.4 Civil Works

- **Civil Supervision as per approved drawings (Inputs required from Civil team)**
- **Minor civil work as per the site requirement shall also be in the scope of bidder.**

2.5. Design Work

Design documentation in sufficient copies including design memo, calculations, general arrangement, plans, elevations and sectional drawings, , short circuit calculations, electro-dynamic force calculations, single line diagrams, schematic interconnection drawings, wiring diagrams, cable schedules, bill of materials, lighting system design calculations, , illumination system design, calculation, conductor sizing, calculation insulation coordination, protection coordination etc.

- Operation & Maintenance Manuals and As-built drawings. (Six sets hard copy & two sets soft copy)
- Documentation required by State Electrical Inspector or by other statutory body for statutory approval/certification of the Substation installation. (as required)
- Temporary sheds for storage of equipment, tools & tackles.

The above equipment and services are specifically listed for the guidance of the Bidder. Apart from the above, Single Line Diagram and Layout Plan (suggestive) may also be referred for further details of equipment. However, it is to be understood that the Contractor's scope is not limited to the items specifically listed above but covers all items required for the completion of a safe and fully functional Substation.

2.6 Tools and Spares

Tools & Commissioning Spares: Contractor should be equipped with all tools, tackles and commissioning spares for successful commissioning of substation.

Recommended Spares: Contractor shall be providing the Owner a list of recommended spares along with quantity and market/budgetary prices. This shall be a recommendation only and shall not be a part of quotation for price bid

3.0 COMPLETION SCHEDULE

The contractor shall be fully responsible to complete the project in time. It is desired that the total project should complete in *300 days* from the date of LOA. The broad completion schedule is attached here under for reference. The detailed completion schedule shall be prepared by contractor in MS-Project or Primavera software and shall be submitted at the time of detail engineering for approval. The detailed schedule shall be finalized with the help of schedule given by Owner.

Activity schedule shall be as tabulated below. The reference date shall be the date of LOA.

Sl. No.	Description of Work	Time Line from Zero Date(in days)	Responsibility
1	Zero Date (Letter of Award)	0	BRPL
2	Mobilization of manpower	15	Contractor
3	Inception Report	15	Contractor
4	PERT chart approval / L2 schedule majorly including : • Manpower & Machinery to be deployed • Procurement of major equipment • Dispatch schedule of the major item • Intermediate milestone schedule	15	Contractor
5	Submission of Drawings/Documents/ calculations for Engineering Approval	30	Contractor
6	Engineering Approval	60	BRPL
7	Procurement/Supplies	210	Contractor
8	Equipment Erection	240	Contractor
9	Testing & Commissioning of entire substation	270	Contractor
10	Handing Over	300	Contractor

4.0 ELECTRICITY & WATER FOR CONSTRUCTION

Electricity Supply and Water for construction purpose shall be arranged by Contractor.

5.0 SUPPLY AND WORKS BY BIDDER

The termination kits/jumpers, Glands, Cable Seal and interconnections for all the Cables/Conductors shall be in the scope of Contractor. Extension of 48 core Fiber optic embedded in Infeed Power Cable and interconnections for all the remote and receiving end Cables/Conductors (with all the accessories of 48 core FO including LIU, joint box, patch cord and extension of fiber optic from Power Cable to LIU), shall be in the scope of Contractor. Laying of LT & control cables and shall also be in the scope of Contractor only. Also Earthing and grounding, illumination, shall be in Contractors scope.

.**WORKS BY OWNER:** The following works shall be carried out by Owners:

1. Soil Investigation and Soil resistivity test

6.0 COORDINATION WITH STATUTORY BODIES & OUTSIDE AGENCIES

The Contractor shall be fully responsible for getting all statutory clearances, including but not limited to Electrical Inspector clearance, Fire officer or any other statutory bodies for implementation of the work.

The contractor shall be fully responsible for carrying out all co-ordination and liaison work as may be required with Electrical Inspector, Fire officer or any other statutory bodies for implementation of the work.

The application on behalf of BRPL for submission to the Electrical Inspector and other statutory bodies along with copies of drawings complete in all respects shall be done by the contractor & approval / certificates shall be obtained by the contractor well ahead of time so that the actual commissioning of equipment is not delayed for want of inspection and approval by the inspector & statutory bodies. The contractor shall arrange the actual inspection work by Electrical Inspector.

However official fees paid to electrical inspector / statutory bodies shall be borne by the Owner.

7.0 COORDINATION WITH OTHER CONTRACTOR & OWNER'S SYSTEM

The contractor shall be fully responsible for carrying out all the co-ordination work required with their sub-contractors, if any, as well as with Owners system for execution and completion of work.

8.0 TERMINAL POINTS OF CONTRACTOR'S SCOPE

8.1 Up to Line take off point and including provision for Cable termination at the incomer and outgoing bays.

8.2 Lighting/Illumination/Lightning	:	Within Indoor Substation Area
8.3 Earthing electrodes	:	Within Substation area and building.

9.0 SALIENT FEATURES, BASIC DESIGN CRITERIA AND MINIMUM TECHNICAL REQUIREMENTS OF 66 KV SUBSTATION/SUBSTATION EQUIPMENTS

9.1 Introduction

BRPL is setting up 66KV GIS Grid substation at Indira Gandhi Hospital at Dwarka New Delhi. The Substation shall be constructed on turnkey EPC execution. EPC contractor is responsible for detailed design also. In this paragraph only salient features, basic design criteria and Owner's minimum technical requirements are enumerated for the guidance of the Bidder. However, this should be referred in conjunction with SLD enclosed. The salient features of substation have been tabulated as under:

Particulars	Description
Voltage Level	66 kV
Infeed Plan	66 kV Double Circuit
Infeed arrangement	66 kV U/G Cables
Present status of Land	Built up space to be provided by IGH for BRPL ESS

9.2 **Substation Capacity**

The substation capacity shall be as per the table in Clause no. 9.1 above.

9.3 **Battery Charger and Battery Bank**

The Control supply shall be 220V DC. The Li-Ion Battery bank shall be installed in separate room with proper ventilation system as per safety requirement .The battery charger shall be thyristor controlled installed inside control room building and shall be SCADA compatible.

9.4 **Gas Insulated Switchgear**

The GIS switch gear shall be of modular design offering high degree of flexibility. Each module shall be complete with SF6 gas circuit breaker, Isolators, fast Earthing switches, Voltage transformers, cable end enclosures, Surge Arrester., local control cubicle, Line Side Isolator shall be integral part of GIS. One set Gas filling device along with filter, Gas leakage detector shall be integral part of GIS.

9.5 Protection coordination through **ETAP Software.**

9.6 **Power and Control cable -**

All power and control cables within substation premise will be laid in single piece. No cable joint shall be accepted within substation premise.

9.7 **Other Parameters for 66 KV Substation**

Following parameters /service conditions shall prevail for entire system design under the scope of this turnkey project:

General Service Condition

S. No	Particulars	Data
1	Design Ambient temperature	50 °C
2	Seismic Condition	Zone IV as per IS 1893
3	Wind Pressure	195 kg/M² upto elevation of 30 M as per IS 875
4	Maximum Relative Humidity	100%
5	Maximum Altitude above Sea level	1000M
6	Rainfall	750mm (concentrated in 4 months)
7	Pollution level	Heavy/Dry

System Parameters

S. No.	Parameters	HV Side	LV Side
1	Nominal Voltage (kV)	66	11

2	Rated Voltage (kV)	72.5	12
3	Rated Frequency (Hz)	50 +/- 3%	50 +/- 3%
4	System Neutral Earthing	Solidly Grounded	Solidly Grounded
5	Short Circuit rating (for 3 sec)	3600 MVA / 31.5 kA	500 MVA / 26.3 kA
6	Basic Insulation Level		
6.1	Impulse frequency withstand voltage (kVp)	325	75
6.2	Power frequency withstand voltage (kV rms)	140	28

Parameters for Switchyard Equipments (66kV)

S. No	Particulars	66kV	11kV
1	Minimum Creepage	31mm/KV	31mm/KV
2	Minimum Clearances		
2.1	Phase to Phase	630 mm	280
2.2	Phase to Earth	630 mm	140
3	Safety Clearances		
3.1	Sectional Clearances	3000 mm	
3.2	Height of lowest live point on the insulator from the ground	4300 mm	
4	Bus Configuration	Double Bus	Single Bus
5	Conductor	Silver Platted/tinned electrolytic copper / ACSR Zebra(For Jumpering)	Silver Platted/tinned electrolytic copper

Site Service Conditions (considering main external road at 0.00 level)

S. No.	Particulars	Level
1	Substation Road level	+750 mm
2	Final top level of gravel in outdoor yard	+750 mm
3	Final top level of Equipment & gantry foundation	+1050 mm
4	Control Room Building Plinth Level	+1500 mm

10.0 CODES & STANDARDS

The contractor shall follow latest Indian Standards or international standard. Refer respective equipment specification for applicable standards.

11.0 ENGINEERING DELIVERABLES

The Bidder shall submit following minimum Engineering Deliverables from award of the Contract. Any other drawing / calculation which is not listed below and may be required for execution of the job shall also be submitted by the bidder.

S. No.	Drawing Title
A.	Inception report including work schedule and PERT chart within two weeks from LOA(Letter of Award)
B.	**Electrical Drawing**
1	Main Single Line Diagram indicating bus/breaker rating, cable/overhead conductor size, fault levels of different voltage grade, Transformer details, metering and protection with CT / PT cores / ratio / burden / accuracy class.
2	Complete BOQ of the substation with technical details.
3	Single Line Diagram of 415 V AC Distribution board
4	Single Line Diagram of 220V DC Distribution board
5	Layout Plan
6	Maximum & Minimum fault level calculation for the substations
7	Insulation coordination
8	Switchgear/Control building layout – Plan
9	Cable trench layout Plan & Section – outdoor
10	Cable tray layout Plan & Section – Indoor
11	BOQ of Cable trays and accessories
12	Sizing calculation of LV Cables
13	Power cable schedules
14	Control cable schedules
15	BOQ of Cables
16	Codification of cable trays and cable tray/cable tag marking concept
17	Drawing of ground mat along with BOQ
18	Drawing of Indoor equipment grounding details
19	Input /Output list of SCADA system
20	Indoor Illumination system design Calculation
21	Drawing of Indoor Illumination with erection details
22	Complete BOQ indoor and outdoor illumination system
23	CT/PT sizing/detail calculation of burden, knee point voltage
24	All major equipment sizing calculation
25	Cabling, earthing & lightning concept
26	Fire fighting-indoor equipments
27	Relay setting with calculations
28	GIS details and its calculations
29	As built documentation of the drawing / documents
30	DC Sizing Calculation
31	Exhaust and Ventilation
32	All the other required design Documents
33	Total coincident LT load requirement for LT source arrangement to ESS

12.0 SUBMISSION OF DRAWINGS & OTHER DOCUMENTS

BOQ, Calculations and other documents etc. shall be on A4 size paper. All the drawings shall be drawn to the scale as far as possible on A3 size or larger size paper and should be legible. The submission shall be

- Two (03) Sets of approved and released for construction drawings/BOQ/Calculation for Owners reference.
- Six (06) Sets of final As Built drawings, design, BOQ, Calculation. O&M manual, for all equipments supplied.

- Soft copies of all drawings/Documents/calculation in Auto CAD and Microsoft office file format as applicable.

Drawings shall be treated as submitted, only if provided with BOQ (If applicable). Transmittal sheet shall be mandatory to attach with all the drawing and documents. Format for transmittal shall be provided to successful bidder for drawing approvals etc.

13.0 TEST CERTIFICATES

All equipments shall be tested as per their corresponding specification in Tender document.
All tests (Type test, Routine test, Acceptance test) shall be carried out at bidders cost. However prices against special test for equipments have to be quoted separately. Special test shall be Owners decision.
Type and Special test has to be carried out at CPRI/ERDA or as mentioned in specification. Routine,and Acceptance tests may be carried out at manufacturer's lab.
Bidder shall submit type test certificate of all the equipment with validity of five years (on the date of bid opening carried out at CPRI/ERDA.

14.0 QUALITY PLAN

14.1 Manufacturing Quality Plan

Manufacturing Quality plan with respect to all major equipment and work has to be submitted by the successful bidder for following as a minimum:

I. An outline of the proposed work and execution plan for approval.
II. The structure of the supplier's organization for the contract
III. The duties and responsibilities assigned to staff ensuring quality of work for the contract
IV. Hold and notification points
V. Submission of engineering documents required as per specification
VI. The inspection of materials and components Inspection during fabrication /construction
VII. Final inspection & tests

Successful bidder shall include submittal of bills invoice, Bill of lading, and factory test certificate for grade, physical tests, dimension, and specific watt loss per kg of core material to the purchaser for verification in quality plan suitably.

14.2 Field Quality Plan

14.2.1 Quality Assurance Plan for various stages of execution work shall be submitted by Contractor for approval of Owner. The plan should include the Organization structure so the Safety personnel to ensure the Manpower and Material safety during the entire duration of execution.

14.2.2 Environment, Health and Safety (EHS) shall be covered in the plan submitted by Contractor.

14.2.3 A checklist to ensure the quality of equipment installation shall be submitted by Contractor for approval

15.0 INSPECTION

One inspector from EPC contractor must be available for inspection along with BRPL executives. In case of Fake call Bidder shall be liable for all the cost incurred.

16.0 TRAINING OF BRPL OFFICIALS

Training on all the equipments shall be in Bidders scope for Minimum 5 Man-days at Factory or Site.

17.0 MONITORING OF MATERIAL DISPATCH STATUS

Once the material is dispatched after Final clearance Transport Vehicle shall have GPS Tracking Device (Preferably Map My India Asset Tracking Device) and status of dispatch of material shall be sent to all the stake holders via SMS thru GPS Device. This shall be applicable to all the major equipments like GIS Panels, HT Panel, and Power Transformers, CRP and RTU.

18.0 OPERATION AND AFTER SALE SERVICES

Contractor shall carry out all day to day operations of entire Substation after successful commissioning for a period of 6Months. Contractor shall assign 24x7 operating personnel for operation activities.
Contractor shall appoint appropriate after sale services staff for all necessary service requirements for a period of 6 Months. Contractor shall keep all necessary spares, tools & tackles, T& P, testing equipments for successful operation and maintenance requirement for said period.
Contractor shall provide after sale support for the tenure of stipulated time.
Responsibility of Contractor O&M Engineer shall include:

a) Training of BRPL officials on successful operation of all the substation equipments including GIS, Relays and SCADA.

b) Operation and Maintenance of entire substation including GIS, Relays and SCADA.

c) Refer Annexure-O for details

TECHNICAL SPECIFICATION

FOR

CIVIL WORK

Prepared by	**Amrita Singh**			**Rev: 0**
Reviewed by				**Date: 3rd October, 2020**
Approved by	**Rajinder Rajpal**			

1.0 SUB-STATION CONTROL ROOM BUILDINGS GENERAL REQUIREMENTS

1.1. General

1.1.1. The scope includes the design, engineering and construction including antI-termite treatment, plinth protection, DPC of buildings including sanitary, water supply, electrification, fire fighting system, etc. The building shall be of RCC framed structure of minimum concrete grade M25. The Sub-Station Building shall include rooms as specified below:

S. No.	Facility
i.	Control Room
ii.	GIS/ Switchgear Room
iii.	Maintenance Room
iv.	Toilet

1.1.2. Minimum floor area requirements have been given in tender drawings, which may be increased at the time of detailed engineering to suit project requirements.

1.1.3. An open space of 1200 mm minimum shall be provided on the periphery of the rows of panel and equipment generally in order to allow easy operator movement and access as well as maintenance.

1.1.4. The building shall be aesthetically designed keeping in view the surrounding landscape; proper architecture shall be used to design the exterior look and finish. The architectural drawing shall be submitted for Owner's approval.

1.1.5. Future extension of one floor shall be considered at the time of design. Any other possibility of annex building shall be taken care of while finalizing the layout of the Control Room building.

1.1.6. Control Room cum Administrative building shall be constructed as per the approved drawings by Owner. CPWD specification shall be followed in all the building works. The clear height of building except GIS hall & Cable Cellar shall be minimum 4.25 m (from floor level to bottom of roof slab of ground floor/first floor). The height of GIS hall shall be as per requirement of GIS equipment & EOT. Height of Cable Cellar shall be as per electrical requirement/ design.

1.2. Design

a) The building shall be designed on Green Building Concept. The design of Control Room building shall be such decided that's minimum one floor can be added in future.

Following parameters shall be followed: -

- To the requirements of the National Building Code of India and the standards quoted therein. The contractor shall also arrange approval of building from any local authorities such as MCD or fire officer if required so. The official fees shall be borne by BRPL.

- For the specified climatic & loading conditions.
- The building shall have RCC framed super structure.
- To adequately suit the requirements of the equipment and apparatus contained in the buildings and in all respects to be compatible with the intended use and occupancy.
- With a functional and economical space arrangement.
- To be aesthetically pleasing. Different structures shall show a uniformity and consistency in architectural design.
- To allow for easy access to equipment and maintenance of the equipment.
- With wherever required, fire retarding materials for walls, ceilings and doors which would prevent supporting or spreading of fire.
- With materials preventing dust accumulation.

b) Suitable expansion joints shall be provided in the longitudinal direction wherever necessary with provision of twin columns.

c) Individual members of the buildings frame shall be designed for the worst combination of forces such as bending moment, axial force, shear force, torsion etc.

d) Permissible stresses for different load combinations shall be taken as per relevant IS Codes.

e) The building lighting shall be designed in accordance with the requirements of relevant section.

f) The building auxiliary services like Air Conditioning, exhaust and ventilation systems, fire protection and detection systems and all other miscellaneous services shall be designed in accordance with the requirements specified in relevant section or elsewhere in the Specification for the project.

g) Two nos. of emergency exits shall be provided in the building.

1.3. Design Loads

Building structures shall be designed for the most critical combinations of dead loads, super- imposed loads, equipment loads, crane load, wind loads, seismic loads, and temperature loads. Dead loads shall include the weight of structures complete with finishes, fixtures and partitions and should be taken as per IS:875. Super-imposed loads in different areas shall include live loads, minor equipment loads, cable trays, small pipe racks & hangers and erection, operation and maintenance loads. Equipment loads shall constitute, if applicable, all load of equipments to be supported on the building frame. The wind loads shall be computed as per IS 875. Seismic Coefficient method shall be used for the seismic analysis as per IS 1893 with importance factor 1.5.

For crane loads an impact factor of 25% and lateral crane surge of 10% (of lifted weight + trolley weight) shall be considered in the analysis of frame according to provisions of IS : 875 (latest revision).

The longitudinal crane surge shall be 5% of the static wheel load. For temperature loading, the total temperature variation shall be considered as 2/3 of the average maximum annual variation in temperature. The average maximum annual variation in temperature for the purpose shall be taken as the difference between the mean of the daily minimum temperature during the coldest month of the year and mean of daily maximum temperature during the hottest month of the year. The structure shall be designed to withstand stresses due to 50% of the total temperature variation. Wind and Seismic forces shall not be considered to act simultaneously.

Floors/slabs shall be designed to carry loads imposed by equipment. Floors shall be designed for live loads as per relevant IS codes. Cable and piping loads shall also be considered additionally for floors where these loads are expected.

In addition, beams shall be designed for any incidental point loads to be applied at any point along the beams, the floor loads shall be subject to Owner's approval.
For consideration of loads on structures IS: 875, the following minimum superimposed live loads shall however be considered for the design.

Roof	2.5 KN/M2	for accessible roofs
	0.75 KN/M2	for in-accessible roofs
RCC-Floor	(i) 5 KN/M2	for offices, for equipment
	(ii) 15 KN/M2 (min)	for floors or actual requirement if higher than 15KN/M2 based on equipment weight and layout plan
Stairs & balconies	5 KN/M2	
Toilet Rooms	2 KN/M2	
Chequered plate floor	4 KN/M2	
Walkways	3 KN/M2	

Any additional load coming in the structure shall be calculated as per IS: 875.

1.4. Submission

The following information shall be submitted for review and approval to the Owner:

a) 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.

b) Structural design calculations and drawing (including construction/fabrication) for all reinforced concrete and structural steel structures.

c) Fully, dimensioned concept plan including floor plans, cross sections, longitudinal sections, elevations and perspective view of each building. These drawings shall be drawn at a scale not smaller than I : 50 and shall identify the major building components.

d) Fully dimensioned drawings showing details and sections drawn to scales of sufficient size to clearly show sizes and configuration of the building components and the relationship between them.

e) Product information of building components and materials, including walls partitions, flooring, ceiling, roofing, door and windows and building finishes.

f) A detailed schedule of building finishes including colour schemes.

g) A door & window schedule showing door types and locations, door lock sets and latch sets and other door hardware.

h) Copy of all tests/ studies/ investigation carried out by bidder as per scope.

Approval of the above information shall be obtained before ordering materials or starting fabrication or construction as applicable.

1.5. Flooring

Flooring in various rooms of control room building shall be as per detailed schedules given in Table – 1. Pantry countertop shall be of granite stone of required specification as per direction of Engineer-In-Charge.

1.6. Walls

Control room building shall be of framed superstructure. All walls shall be non-load bearing walls. Minimum thickness of walls shall be 340mm upto DPC level in cement mortar 1:6 (1 Cement : 6 Coarse sand) and 230mm above DPC level in cement mortar 1: 4 (1 Cement :4 coarse sand).

1.7. Plastering

All internal walls shall have minimum 12mm/ 15mm thick 1:4 (1 Cement : 4 fine Sand) cement sand plaster. The ceiling shall have 6mm thick 1:3 cement sand plaster.

1.8. Finishing

All external surfaces (control room building and boundary wall) shall have stone grit/ Marble Chips with colour pigment (with groves formed) (item no.13.72-DSR 2012) finish over 12mm thick cement sand plaster 1:4 (1 Cement : 4 coarse sand) mixed with water proofing compound in the ratio as recommended by the manufacturer. Suitable pigment shall be added to render the surface aesthetically pleasing as per directions of Engineer-in-charge.

1.9. Door & Window

The details of doors and windows of the control room building shall be as per finish schedule Table-I and tender drawing with the relevant IS code. Paints used in the work shall be of best quality specified in CPWD specification.

1.10. Partition

Partition made of powder coated aluminum frame provided with 6.0 mm thick toughened glass shall be supplied and installed at locations shown in tender drawings.

1.11. Internal Electrification

Electrical wiring shall be through heavy duty concealed conduits. All fixtures and wiring shall be of best quality and ISI marked. (Fixtures shall be provided as per provision of energy conservation act). Internal wiring shall include all fittings and fixtures, control panel boards, main switch MCB's, etc.

1.12. Plumbing & Sanitation

a) All plumbing and sanitation works shall be executed to comply with the requirements of the appropriate bye-laws, rules and regulations of the Local Authority having jurisdiction over such matters. The Contractor shall arrange for all necessary formalities to be met in regard to inspection, testing, obtaining approval and giving notices etc.

b) PVC syntex or equivalent make Roof water tank of adequate capacity depending on the number of users for 24 hours storage shall be provided. Minimum 2 Nos. 1000 litre capacity shall be provided.

c) Unplasticised PVC/ Chlorinated Polyvinyl- chloride (CPVC) pipe shall be used for internal & external piping work for potable water supply.

d) PVC pipes for all sanitary works.

e) All sanitary/ water supply fittings shall be of Hindware/ Parryware/ Cera.

f) Each toilet shall have minimum fittings

i) Water closet (European type W.C. pan) 390 mm high (item no. 17.3.1- DSR 2012) or water closet (Indian type W.C. pan) Orissa Pattern (580 x 440 mm) (item no. 17.1.1- DSR 2012) with all fittings (both types of WCs shall be provided at alternate locations).

ii) Half Stall Urinal (580 x 380 x 350 mm) with all fittings (item no. 17.5.2- DSR-2012).

iii) Wash basin (630 x 450 mm) with all fittings (item no. 17.7.1- DSR 2012).

iv) Bathroom mirror (600 x 450 x 6 mm thick) hard board backing (item no. 17.31- DSR 2012).

v) CP brass towel rail (600 x 20 mm) with C. P. brass brackets.

vi) Soap holder and liquid soap dispenser.

g) Water cooler for drinking water with adequate water storage facility shall be provided and located

near control room instead of toilet block.

h) An Eye & face fountain conforming to IS:10592 shall be provided for battery room.

i) 1 No stainless steel A ISI 304(18/8) kitchen sink as per IS 13893 with Drain board (510 x 1040 x 225mm bowl depth for pantry shall be provided complete with all fittings (item no. 17.10.1.2-DSR 2012).

j) All fittings, fastener, grating shall be chromium plated.

k) All sanitary fixtures and fittings shall be of approved quality and type manufactured by well known manufacturers. All items brought to site must bear identification marks of the Manufacturer.

l) Soil, waste and drain pipes for underground works shall be stoneware for areas not subject to traffic load. Heavy-duty cast iron pipes shall be used otherwise.

1.13. Cable Trenches

All cable trenches inside the buildings shall have covers comprising of 6 mm thick chequered plates fixed on angle 40 x 40 x 5 mm frame with arrangement of MS holes for lifting of cover.

2.0 STORM WATER DRAINAGE FOR CONTROL ROOM BUILDING

The building drain shall be provided for the collection of storm water from the roofs. This water shall be collected in chambers and these chambers shall drain to the main drainage system of the station which shall in turn be connected to rain water harvesting recharge pits.

Unplasticised Rigid PVC rain water down comers (150 dia) conforming to IS: 13592 Type A, including jointing with seal ring conforming to IS:5382, leaving 10 mm gap for thermal expansion shall be provided to drain off the rain water from the roof.

All external drains along road shall be covered with precast perforated RCC covers of suitable size and thickness.

For all buildings, suitable arrangement for draining out water collected from equipment blow down, leakages, floor washings fire fighting etc. shall be provided for each floor.

3.0 MISCELLANEOUS GENERAL REQUIREMENTS

3.1. Bricks having minimum 100 kg/cm2 compressive strength can only be used for masonry work. Contractor shall ascertain himself at site regarding the availability of bricks of minimum 100 kg/cm2 compressive strength before submitting his offer.

3.2. Doors and windows on external walls of the building (other than areas provided, with insulated metal claddings) shall be provided with RCC sunshade over the openings with 150 mm projection on either side of the openings. Projection of sunshade from the wall shall be minimum 600mm over window & door openings.

3.3. RCC staircase shall be provided for access to roof of the entire building. All stairs shall have maximum riser height of 150 mm and a minimum tread width of 300 mm Minimum width of stairs shall be 1500 mm. Steel doors shall be provided in the Mumty and height of Mumty should be 2.6m.

3.4. Angles 50x50x6 mm (minimum) with lugs shall be provided for edge protection all round cut outs/openings in floor slab, edges of drains supporting covers, edges of RCC cable/pipe trenches supporting covers, edges of manholes supporting covers, supporting edges of manhole precast cover and any other place where breakage of corners of concrete is expected.

3.5. Anti termite chemical treatment shall be given to column pits, wall trenches, foundations of buildings, filling below the floors etc. as per IS: 6313 and other relevant Indian Standards.

3.6. The railing of staircase shall be 0.9 m average height comprising of 20 mm square bars of length 1.05 m and 150 mm centre to centre with teak wood handrail on top of railing including fixing of vertical bars in steps by grouting of required hold fast as per direction of Engineer in Charge.

3.7. All buildings shall have 750mm wide plinth protection all round.

3.8. Monorails, Monorail girders and fixtures shall be provided by the Bidder wherever required.

3.9. 50mm thick DPC shall be provided before laying of masonry (item no. 4.11 & 4.13-DSR 2012).

Table 1- Finishing Schedule

No	Location	Flooring & Skirting 150mm high	Wall Internal	Ceiling	Doors, Windows, Ventilators
1	Control room	1. False flooring as per design requirement/ layout. OR 2. Epoxy paint (Fosroc/ Sika/BASF) 2mm thick over 52 mm thick CC flooring with concrete hardener topping (item no. 11.4-DSR 2012) over an under layer of RCC/CC.	Plastic emulsion Paint on smooth surface applied with putty	Oil bound washable distemper on smooth surface applied with putty	Powder coated Aluminium Hindalco or equivalent extruded sections as per IS 733 & 1285. Glazing with float glass (min 5.5mm thick). For windows/ventilators double glazing with 12mm gap hermetically sealed (minimum thickness of powder coating 50 micron of approved colour).
2	Reception Lobby/ Maintenance Room	Polished Kota stone	Oil bound washable distemper on smooth surface applied with putty	Oil bound washable distemper on smooth surface applied with putty	Powder coated Aluminium Hindalco or equivalent extruded sections as per IS 733 & 1285. Glazing with float glass (min 5.5mm thick). For windows/ventilators double glazing with 12mm gap hermetically sealed (minimum thickness of powder coating 50 micron of approved colour)
3	Toilet	Anti skid Vitrified tiles with white cement.	DADO glazed tile 2.1m high for toilet, for pantry above working platform up to 750mm.	Oil bound washable distemper on smooth surface applied with putty	Powder coated Aluminium Hindalco or equivalent extruded sections as per IS 733 & 1285. Glazing with float glass (min 5.5mm thick). For windows/ventilators double glazing with 12mm gap hermetically sealed (minimum thickness of powder coating 50 micron of approved colour).
4	Stair	Polished Kota stone	Oil bound washable distemper on smooth surface applied with putty	Oil bound washable distemper on smooth surface	Powder coated Aluminium Hindalco or equivalent extruded sections as per IS 733 & 1285. Glazing with float glass (min 5.5mm thick). For

				applied with putty	windows/ventilators double glazing with 12mm gap hermetically sealed (minimum thickness of powder coating 50 micron of approved colour).
5	Switchgear Room/ GIS Room/ Cable Cellar	52 mm thick CC flooring with concrete hardener topping (item no. 11.4-DSR 2012) with epoxy paint on top and an under layer of RCC/CC.	Oil bound washable distemper on smooth surface applied with putty	Oil bound washable distemper on smooth surface applied with putty	For windows/ventilators Powder coated Aluminium Hindalco or equivalent extruded sections as per IS 733 & 1285. Glazing with float glass (min 5.5mm thick). Double glazing with 12mm gap hermetically sealed (minimum thickness of powder coating 50 micron of approved colour).
6	Internal doors shall be fire proof doors. (Fire rating of 120 minutes).				
7	The External finishing of Control room building will be of Stone grit/ Wash Marble chip of approved color and quality with color pigments using white / grey cement or combination of both.				
8	External finishing of the building on area other than the area of stone grit/ Wash Marble using Acrylic Smooth exterior paint (painting) shall be Nerolac excel or equivalent The paint shade as approved by BRPL				

TECHNICAL SPECIFICATION

FOR

66kV GAS INSULATED SWITCHGEAR

Specification No. GN101-03-SP-53-00

Prepared by	Reviewed by	Reviewed by	Approved by	Revision	Date
Javed Ahmed	Alok Kumar Mandal	Abhinav Srivastava	Vijay Panpalia	0	28.03.2017
Javed Ahmed	Abhinav Srivastava	Abhinav Srivastava	Vijay Panpalia	1	12.12.2017
Javed Ahmed	Abhinav Srivastava	Abhinav Srivastava	K.Sheshadri	2	18.07.2018

1.0 SCOPE OF SUPPLY

1.1 This specification covers the design, manufacture, testing, supply, erection & commissioning of 66kV, Gas Insulated (GIS), GIS bay module, connecting flanges, support structure, GIS ducts, SF6/Air Bushing, gas monitoring devices, barriers, pressure switches etc. Metal enclosed and factory assembled switchgear for BSES Rajdhani Power Ltd at Delhi.

1.2 This specification shall be used in conjunction with all specifications, switchgear data sheet, 66kV switchgear single line diagram and other drawing attached to the specification / Purchase requisition.

1.3 The GIS shall be modular type design with all the components as per SLD it shall be extensible type for adding additional bays in future on the either side. The incomer, bus coupler feeder & Transfer feeder shall be rated for 2000A.

1.4 **The Bill of Quantity (BOQ)**

The apparatus to be supplied by the bidder shall include but not be limited to the following:

1. **Circuit Breaker**
2. **Disconnect switches**
3. **Surge Arrestor for both incoming and outgoing.**
4. **Maintenance earthing switches**
5. **Voltage detector**
6. **Current Transformers**
7. **Bus and Elbow sections**
8. **Cable and enclosures**
9. **Ground connections to the stations ground grid**
10. **Auxiliary material to complete the GIS installations (Like density switches, secondary cable & Bolts etc.)**
11. **Support structure for the GIS**
12. **Terminal boxes, junction boxes, marshalling boxes as required.**
13. **Insulating SF6 Gas.**
14. **Local control cubical**
15. **Special tools for installation and maintenance (including Gas filling evacuation & Gas Filter kit 1 Set, Gas leakage detector-2 Set. Both shall be DILO Make)**
16. **Spare parts for start-up for minimum 5years of operation.**
17. **Technical direction for the site assembly and testing by a competent service engineer**
18. **All the documentation as required in the specification**
19. **66k V End termination kit supply and installation**
20. **Test plug for Cable Hipot testing of rated voltage.**
21. **Cable Dummy Plugs 1 Set for each GIS Bay.**

1.5 **Layout and civil design information**

Special attention shall be given to an optimized GIS design with minimum space requirements. The contractor shall propose as part of this contract with the layout design of the GIS building to ensure that the most suitable arrangement is obtained for housing, supporting and fixing of the GIS. The bidder shall also provide a complete floor plan detailing the fixing points, size of foundation, required cable trenches, wall openings, doors, transport

ways and lay down areas. All static and dynamic loads plus dimensional tolerances shall be given on these drawings to enable the civil works design to be optimized.

Supplier shall furnished all material , necessary hardware's, special tools for installation and maintenance, drawings and instructions for the constructions for the construction of the complete and ready to operate 72.5k V Part of the substation.

The following attached drawings are part of the specification:

a. SLD.
b. Proposed Layout.
c. Layout for 66kV GIS indoor installation shall be submitted by bidder along with bid.

1.6 PERFOMANCE

The design, manufacture , testing and performance of 72.5k V SF6 aluminum enclosure gas Switchgear are offered shall have designed , manufactured and type tested as per IEC / IS and supplied the same for the system voltage of 72.5k V or above.

2.0 CODES AND STANDARDS

2.1 The design, manufacturing, testing and performance of 72.5 kV SF6 gas insulated switchgear covered under this specification shall comply with latest IS/IEC mentioned below. However, the list of standards given below is not exhaustive and shall not be considered as limiting. The equipment furnished under this specification shall be of best design and sound engineering practice.

2.2 The performance , testing, and rating of the switchgear shall confirm to the following standards:

Standard Code	Standard Description
Indian electricity act	
CBIP manual	
IS-2516	Specification for Circuit Breaker.
IS-13118-1991	Specification for high voltage altering current circuit breaker
IS-2090-1973	Bushing for alternating voltage above 1000 volts.
IS-731-1971	Insulator for Overhead lines.
IS -996-1979	Single phase small AC and Universal Electric Motors.
IS-7572-1974	Guide for testing single phase AC and Universal motors.
IS 4237-1967	General Requirement for switchgear for voltage not exceeding 1Kv.
IS-2147-1962	Degree of protection provided by enclosure for low-voltage switchgear control gear.
IS-1554 Part-I 1988	PVC insulated cables up to & including 1100 volts.
IS-2208	HRC Cartridge fuses links up to 650 volts.
IS-375	Outdoor switchgear & control gear matching with latest IS/IEC requirement
IS-2544	Porcelain Post Insulator
IS-5621	Hollow insulators for use in electrical equipment

IEC-56	Specification for high voltage alternating current circuit breaker
IEC-62271 - 100	High Voltage alternating Current Circuit Breaker
IEC-60694	Common specification for high voltage switchgear and control gear standards
IEC-376	SF6 Gas
IEC 60376	Specification for acceptance of new Sulphur Hexa fluoride
IEC 62271-203	Gas insulated metal enclosed switchgear for rated voltage above 52KV
IEC 62271-1	Common clauses for high voltage switchgear and control gear Standards.
IEC 62271-102	Alternating current disconnector and earthing switches.
IEC 60137	Bushing for alternating voltages above 1000V
IEC 62271-209	Cable connection for gas insulated switchgear
IEC 60480	Guide to checking of sulphur hexafluoride taken from electrical equipments.
IEC 60099-1/4	Non-linear resistor type arrestors for AC systems
IEC 61439	Factory built assemblies of low voltage switchgear and control gear.
IEC 62271-101	Report on synthetic testing of high voltage alternating current circuit breaker
IEEE 80	Guide for safety in A.C. substation grounding
IEC: 185	Specification for current transformers
IS-3156 (Part I to IV)	Specification for Voltage transformer.
IEC 61128	Alternating current disconnectors . Bus –transformer current switching by disconnectors
IEC 66044-1	CT
IEC66044-2	VT
IEC 60859	Cable connection for gas insulated switchgear
CIGRE-44	Earthing of GIS an application guide (Electra no. 151 , Dec 93)
IEC 61639	Direct connection between power transformers and gas insulated switchgear for rated voltage above 72.5KV and above (if applicable)

The components and devices which are not covered by the above device shall confirm to comply with the latest applicable standards rules, codes, and regulated of the internationally recognized standardizing bodies and professional societies and may be approved by the owner. The manufacturer shall list all the applicable standards.

3.1 Rating and Features

The 72.5 k V SF6 gas insulated switchgear shall be designed to comply with the following general ratings.

Rating Voltage	**66k V**
Number of phases	**3**
Lighting impulse withstand voltage	**325 kV (Peak)**
Power frequency withstand voltage	**140kV (rms)**

Rated frequency	**50Hz**
Rated normal current	**2000 Amp**
Bus Bar	**2000 Amp**
Incomer & Bus coupler bays	**2000 Amp**
Transformer bays	**2000 Amp**
Rated short time withstand current	**31.5k A (rms) for 3 Sec**
Rated peak withstand current	**100k A**
Degree of protection for auxiliary and control circuit	**IP52**
Trip coil & closing coil aux.supply	**220V , + 10/-30 % DC**

3.2 General Requirement

Manufacturer's standard products that conform to the specification shall be supplied. Minor modifications may be made in the relative location of grounding switches and instrument transformers in order to conform to the manufacturer's standard construction. The construction principle of the switchgear shall be in accordance with the latest modern engineering practice, in order to ensure optimum performance, safety of operation and maintenance personnel and continuity of spare part supply.

S.No.	Technical Parameter 66 kV GIS	BRPL Requirement
1	Type of GIS	Three phase encapsulated
2	Location	Indoor / Outdoor
3	Nominal voltage class, kV rms	66 kV
4	Rated voltage, kV	66kV
5	Rated frequency, Hz	50
6	Number of phases	3
7	Number of bus bars	3
8	Rated continuous current rating at design ambient of 50 Deg.c	2000 A
I)	Bus Bar , Bus Coupler and incomer	2000Amp
ii)	Transformer Bay	2000Amp
9	Rated Burn though time of enclosure due to internal arc short circuit current(ms)	According to IEC
10	Rated lighting impulse (1.2/50micro sec.)withstand voltage	325k V
11	One minute power frequency withstand voltage(k V rms)	140KV rms
12	Rated short time withstand current for 3 Second	31.5KA
13	Minimum thickness of enclosure(mm)	As per IEC /Cenelec
14	Material of Bus Bar	Copper
15	Material of control cabinet	Shall be decide during detail engg.
16	Gas loss per gas compartment per year	Less than 0.5%
17	Grounding	Solidly earthed
18	1 minute power of frequency withstand voltage, to earth (k V , rms	
19	Rated peak withstand current, kAp	

20	Material of bus bar	Copper
21	Insulation medium	SF6
22	Leakage rate of SF6 per annum for each compartment	<0.5%
23	Partial Discharge of switchgear assembly at highest voltage for equipment, pc	<5
24	Rated Auxiliary Supply voltage	220 V DC
25	GIS Connection -Transformer bay(GIS to Transformer) -Line Bay	66/11 kV Gas insulated substation 3RX3CX300 Sq.mm /ph Al-XLPE 66k V Cable
26	Implemented technology for control shall be digital and Local Control Unit shall incorporate bay control unit for integration to SCADA system through local control board for GIS through IEC 61850	
Circuit Breaker		
1	Type	SF6
2	Description	Three separate pole equipped with single pole operating mechanism
3	First-pole-to clear factor	1.3
4	Rated short circuit breaking capacity, kA (r.m.s)	31.5kA
5	Rated short circuit making capacity, kA (peak)	79KA
6	Rated line charging breaking current capacity, A	
a	On supply side	10 A, ≤2.5 P.u
b	On line side	10 A, ≤2.5 P.u
7	Maximum cable charging breaking current capacity and corresponding over voltage recommendation	
a	On supply side	125 A, ≤2.5 P.u
b	On Line side	125 A, ≤2.5 P.u
8	Duty Cycle	O-0.3s-CO-3 min– CO
9	Closing Time	Less than or equal to 60 ms
10	Breaking Time	Less than or equal to 50 ms
11	Small inductive current breaking capability (without producing excessive over voltages)	10 A
12	Operating Mechanism	Spring / Spring hydraulic
Disconnector		
1	Type	Three separate pole mechanically coupled and group-operated
2	Operation	Motor as well as manual
3	Rated withstand voltage across isolating distance	
3.1	- Power frequency	140kV
3.2	- Lightening Impulse	325kVp
4	Rated capacitive current make and break capacity	0.50A
5	Rated Bus Transfer Current	80% of rated normal current

6	Rated Bus Transfer Voltage	20 V r.m.s
Earthing Switch		
1	Making Capacity kA (peak)	78.75 kA
2	Rated short-time current	31.5kA
3	Rated Induced Current/Voltage for Electromagnetic coupling(rms)	160 A / 10kV
4	Rated Induced Current/Voltage for Electrostatic coupling(rms)	18A/20kV
Current Transformers		
1	Current ratio and other details	Refer SLD
2	Accuracy class	
	- For protection	PS , PS, 5P20
	- For metering	0.2S
3	For metering (separate terminal box)	NA
Surge Arrestor		
1	Type	Gapless metal Oxide station type
2	Rated arrestor voltage	66 KV rms
3	Nominal discharge Current (8/20μs wave)	10 KA
4	Energy dissipation capability	Not less than 10 KJ/kV
5	Partial Discharge at highest level	<10 Pc
6	Long duration Discharge class	Discharge Class-III
Voltage Transformer		
1	Type	Inductive type, single phase, two core
2	Location	R,Y,B phase
3	Purpose	Synchronizing, and Metering
4	Voltage ratio	(66/√3) kV/ (110/√3) V/ (110/√3) V
5	Accuracy class	
	- Metering - Protection	0.2 3P
6	Voltage factor	1.5 for 30 s, 1.2 for continuous
SF6 Gas (Contents of SF6 Gas shall conform to following limits)		
1	Water	As per Relevant IEC
2	Carbon Tetra Fluoride	As per Relevant IEC
3	Air	As per Relevant IEC

3.3 SF6 Gas Losses

The contactor shall guarantee the maximum gas losses of 0.5% per year for period of five (5) years after release of the performance security.

Each refilling which becomes necessary due to excessive gas losses or a gas alarm within five years after the Final Acceptance Certification.

To ensure that the gas system has not been opened, either for unattended refilling or for other reasons, all the

refilling valves shall be sealed by mutually agreed measures in presence of owner. The Contractor or his representative shall be present at site within 24 hours in case of emergency. Otherwise owner will be authorized to break the seal.

The switchgear shall be of compact design, aluminium alloy three phase enclosure and of the sulphur-hexafluoride (SF6) insulated type. It shall be constructed for a double busbar system. Switchgear shall be built on a modular basis with uniform spacing of connecting flanges to permit a larger degree of freedom in choosing the switchgear arrangements. At least the following components of the switchgear such as:

- Circuit Breaker
- Voltage Transformer
- Cable Sealing ends
- Busbars

The Switchgear shall be subdivided in to gas-tight compartments each gas compartment shall be provided with at least the following.

a) Gas supply connection for filling , top-up or removal of the SF6 gas .Above equipment to be arranged in one common cubicle for each bay except for manufacturer standard design such that gas monitoring devices can be easily readable and accessible.

b) A gas density monitoring device complete with 2-stage contact. the first stage shall be used for initiating the alarm circuit . The second stage contact shall be used for Lock out – For circuit Breaker Compartment Alarm or Lockout – For other compartment

Above equipment to be arranged in one separately mounted common cubicle for each bay except for manufacturer standards design that gas monitoring devices can be easily readable and accessible.

c) Suitable absorbent to control the moisture content and absorb the decomposition product only in circuit breaker modules.

d) External gas pipes between different gas compartments as well as any kind of centralized gas supply and / or gas control system are not acceptable.

All the exposed parts of GIS shall be treated to prevent corrosion and the process applied shall be described in the bid. The colour of the finished coat of paint shall be agreed upon with the successful bidder.

The temperature rise limits shall conform to IEC 517. The maximum temperature rise of the external surface of enclosure accessible during normal operations shall not exceed 10^{o} C.

The gas insulated switchgear shall have facilities of measuring resistance of the main circuit, injecting of primary current for current transformer testing, HV test of the busbar and components, measuring operating time characteristics of circuit breaker and measuring of contact resistance of circuit breaker, test probe(s) or test adapter(s) shall also be supplied in enough quantity to do the measurement in any path of the main circuit.

3.4 CIRCUIT BREAKER

Constructional Features

Each circuit breaker shall comprise three metal-clad breaker poles (Puffer type / auto puffer type). They shall be designed for installation in SF6 gas-insulated metal-clad Switchgear, and shall use SF6 gas for both insulation and arc quenching.

The SF6 gas-insulated circuit breakers shall conform to latest IEC and have the following performance characteristics and ratings.

1.0	Design Feature	The circuit breaker shall be puffer type designed for installation in SF6 gas insulated metal clad switchgear and shall use SF6 gas for both insulation and arc quenching.
2.0	General Feature	The breaker shall be capable for switching duties for internal faults, short line faults, out of phase switching and interruption of small inductive and magnetizing current of transformers.
3.0	Operating Mechanism	The breaker shall be operated by spring drive / hydraulic spring drive only. The mechanism shall be trip free and have anti pumping feature under every method of closing. Failure of any auxiliary spring shall not prevent breaker tripping. The mechanism shall always be ready for one close open operation after failure of power supply.
4.0	Indicators	Each breaker shall be equipped with a local mechanical position indicator visible from front. Remote indication shall be provided on control cubicle. Spring charged discharged indication shall be available. Operation counter a must.
5.0	Closing coil	Shall be rated for 220V DC +10% -30%
6.0	Tripping coil	Two coils are must rated for 220V DC +10% -30%
7.0	Remote / Local Closing & Tripping	Closing and opening of breaker shall be from local (electrically as well as mechanically) Control cubicle shall have provision with TNC switch for breaker operation. SCADA interface is must for breaker. In maintenance mode all remote / SCADA / local ON OFF signals shall be blocked. Emergency trip a must at local.
8.0	Manuals spring charging	Provision for charging mechanism mechanically shall be provided.
9.0	Motors	Motors shall be' Universal type' capable of satisfactory operation for the application and duty as required by the driven equipment. Motor shall be rated for 240 Volts AC.
10.0	Duty Requirement	1. The circuit breaker shall be restrike free as per IEC under all duty conditions and shall be capable of performing their duties. 2. The circuit breaker shall meet the duty requirements for any type of fault or fault location also for line switching when used on a 72.5 kV effectively grounded system, and perform make and

		break operations as per the stipulated duty cycles satisfactorily 3. Interrupting line-charging current as mentioned in this specification without any restrike 4. Clearing short line fault with source impedance behind the bus equivalent to symmetrical fault current specified. 5. Breaking 25% of the rated fault current at twice rated voltage under phase opposition condition. 6. The circuit breaker shall be capable of Breaking the steady and transient magnetizing current corresponding to transformers Breaking line charging currents as per IS 2165 (Part-II sec.2) with a temporary over voltage of 3.5 PU without the use of opening resistors.
11.0	Supply voltage variation	**+/-20%**
12.0	Frequency variation	**+/-5%**
13.0	Combined voltage and frequency	± 15%
14.0	Interlocks	1. The circuit breaker shall be interlocked electrically and mechanically with associated Disconnectors. 2. A temperature compensated gas density monitor with two stage alarm shall be provided. Gas density monitor for arc quenching and insulating Sf6 gas shall be provided separately.
15.0	Interchangeability	Breaker of similar rating shall be mechanically and electrically identical and interchangeable.
16.0	Recovery voltage and power factor	The CB shall be capable of interrupting rated power frequency with recovery voltage equal to the rated maximum line to service voltage at rated frequency and power factor as per IEC.
17.0	Terminal connector pad	The CB terminal pads shall be made of electrolytic copper.
18.0	Terminal block and wiring	All internal and external wiring shall be through conduit terminated on Nylon 66 terminals properly ferruled at both ends.

3.5 Technical Parameter

1	**Type**	**SF6 , Single Pressure**
2	**No. of Phases**	**3**
3	**Frequency**	**50Hz**
4	**System neutral earthing**	**Effectively grounded**
5	**Rated continuous current at design ambient temperature of 50Deg.c**	
6	**Bus Coupler**	**2000 Ampere**
7	**Incomer**	**2000 Ampere**

8	Transformer	2000 Ampere
9	Rated breaking capacity	
10	i)Short circuit current withstand capacity	31.5k A with % DC components as per IEC
11	ii)Line charging current	50 Ampere rms
12	iii)Cable charging current	160 Ampere rms
13	iv) Small inductive breaking current	10 Ampere rms
14	Rated short time making current capacity	80k A
15	Rated operating duty cycle	O-0.3s-CO-3min-CO
16	Total closing cycle	Not more than 100
17	Rated voltage	72.5k V rms
18	Rated normal current @50 deg.c	
19	Line Bays and bus coupler bay	2000A
20	Transformer Bay	2000A
21	Rated insulation levels	
a)	Maximum allowable lighting impulse withstand voltage(kVp)	

3.6 DISCONNECTING SWITCHES

The disconnecting switches shall be of the 3-phase, single-pole, group-operated type. The disconnectors shall be electric motor operated, and shall be equipped with a manual operating mechanism for emergency use. The disconnector shall be capable of switching small value of current such as charging current for circuit breaker grading capacitors and the capacitance of 66 kV SF6 GIS bus without producing excessive transient over voltage which may cause control circuit over voltage or transient ground rise on the enclosure etc. Bus disconnectors shall be capable for loop current switching (on and off) in case of load transfer by means of bus coupler bay without interruption of any bay Operating mechanism for each disconnector shall be common motor operated for three phase operation Inspection window and a reliable mechanical position indicator for checking the position of the disconnector shall be provided. The provision for blocking and padlocking the disconnector in both fully open and closed position shall be furnished. Each disconnector shall be provided with 10 No's N/O and N/C auxiliary contacts each. The disconnector operation shall be interlocked electrically with the associated circuit breakers such that the disconnector control is inoperative if the circuit breaker is closed. Actuation of the emergency manual operating device shall also disable the electrical control. Disconnectors in open condition shall be secured against reclosure Signaling of the disconnector open position shall not take place unless the movable contacts have reached a position such that the clearance between the contacts is at least 80percent of the rated isolating distance.

Disconnecting switches and adjacent safety grounding switches shall have electrical interlocks to prevent closure of the grounding switches when the disconnecting switches are in the closed position and to prevent closure of the disconnecting switch when the grounding switch is in the closed position. The disconnector shall be pad

lockable in the close, open or electrical position. Disconnecting switches having adjacent high-speed fault making grounding switches shall be interlocked such that the fault making switches close first to discharge the line charging currents before the respective disconnectors may be opened. Each disconnector switch shall have a clearly identifiable local, positively driven mechanical position indicator, together with remote position indicator on the bay module control cabinet and provision for SCADA. Each disconnector shall be fitted with an optical indicator per pole located between the pole and the driving rod so that the open or closed contacts of the disconnector are visible from the floor level. Control cabinets/ operating mechanism box shall be provided for each bay isolator. A “Local / Remote / SCADA” selector switch and a set of open / close push buttons shall be provided on the Control cabinet of the isolator to permit its operation from local or remote control panel Motor shall be an universal type motor conforming to the requirements of relevant Indian Standards/International Standard. Gear should be of forged material suitably chosen to avoid ending/ jamming on operation after a prolonged period of non-operation.

3.7 (a) TECHNICAL PARAMETERS of DISCONNECTING SWITCHES

1	Type	SF6 Gas insulated
2	Operation	3 phase
3	Rated Frequency	50 Hz.
4	System neutral earthing	Effectively grounded
5	Number of poles/phase	1
6	Normal system voltage	66 kVrms
7	Highest System Voltage	72.5 kVrms
8	Basic Insulation level	
9	Lightning impulse withstand voltage i) between line terminal and ground ii) between terminals with isolator open	 +/-325 kVp +/-375 kV
10	Power frequency withstand voltage i) Between line terminal and ground ii) Between terminals with isolator open	140 kVrms 160 kVrms
11	Rated current at 50 Deg C ambient for Line Bus coupler Transformer	 - 2000A - 2000 A - 2000A
12	Rated short time withstand current of isolator and earth switch	31.5KA for 3 sec
13	Rated short time making current capacity (KA peak)	31.5
14	Operating mechanism	Motor
15	Operating time	Less than 12 sec

4.0 Earthing Switch

Two types of earthing switches are required:-

High speed earthing switches for earthing the 66k V incoming cable circuit shall be capable of closing on to full short circuit fault without any damage and after that it shall still retain its full insulation strength.

Three-pole, group operated, work in progress maintenance earthing shall also provided each earthing switch group shall be electric motor operated . A means of emergency manual operation shall also be provided.

In order to provide test facilities, certain earthing switches may require to be insulated from the enclosure and have easily removable ground connections.

4.1 Maintenance earthing switches

Each maintenance-earthing switch shall be electrically interlocked with its associated disconnecting switch and circuit breaker such that it can only be closed if both the circuit breaker and disconnecting switch are open. Once closed it shall be secured against re-opening.

Maintenance earthing switch shall be operable locally from the bay module control cabinet only; SCADA operation not required.

Positive mechanical position indication through reliable optical indicator shall be provided locally.
Interlocks shall be provided such that manual operation of the switches or insertion of the manual operating device will disable the electrical control circuits.

Each earthing switches shall be provided either 4NO & 4NC auxiliary Switches.
Provision shall be made for padlocking the earthing switches in either the open or closed positions.
All portions of the earthing switches and operating mechanism – requiring grounding shall be connected together utilizing flexible copper copper conductors.
On opening, the line earthing switch should be able to break current induced by parallel lines according to IEC provisions.

4.2 High Speed earthing switches

Grounding switches for line circuits shall be of the high-speed and shall be used to discharge the respective charging currents, in addition to their safety grounding function. These grounding switches shall also be capable of interrupting the inductive and capacitive currents and to withstand the associated TRV.

The switches shall be fitted with a stored energy closing system to provide fault-making capability.
The short-circuit making current rating of each ground switch shall be at least equal to its peak withstand current rating. Each switch shall have a positive local mechanical position indicator and a remote indicator.

These high-speed grounding switches shall be electrically interlocked with line side disconnections / associated circuit breakers for safety. The grounding switches shall be required to close before the disconnect or switches are opened in order to dissipate the trapped charges, when the lines are taken out of service for maintenance, etc.

Interlocks shall be provided such that insertion of the manual operating devices will disable the electrical control circuits.

Each high-speed grounding switch shall be fitted with 6 NO and 6 NC auxiliary switches for use by others, over and above those required for local interlocking and position indication. All contacts shall be wired to terminal blocks in the local bay control cabinet. Provision shall be made for padlocking the grounding switches in either the open or closed position.

All portions of the grounding switches and operating mechanism requiring connection to ground shall be connected together utilizing flexible copper conductor.

4.3 CURRENT TRANSFORMER

Current transformer may be module type in the GIS or ring type placed around the power cable right after the GIS cable ending module. The secondary windings is preferred to be embedded in cast resin to secure them against slip-off. The CTs shall have multicores with multi-ratio, which shall be changeable by means of taps on the secondary side. All current transformers shall have effective electromagnetic shields to protect against high frequency transients.

All CT's shall comply to IEC. The ratings shall be: -

S.No.	Description	Particulars
1.	Rated Voltage	72.5kV
2	Rated frequency	50Hz
3	System neutral earthing	Effectively earth
4	Maximum temperature rise over ambient of 50 deg.C	As per IEC60044-1
5	One minute power frequency withstand voltage between secondary terminal and earth	5kV rms
6	Partial discharge level	10 Pico Coulombs
7	Rated insulation levels	
i)	1.2 /50 micro second impulse voltage	325 KV Peak
ii)	1minute power frequency withstand voltage	140 kV Peak

The manufacturer shall provide the wiring between each CT core and the marshaling box.
Suitable provision shall be made for primary current injection testing of current transformer circuits.
The current transformer shall be furnished with shorting arrangement.

4.4 VOLTAGE TRANSFORMER

Voltage transformer shall be inductive module type with graded insulation, and shall be effectively shielded against high frequency electromagnetic transients, fully encapsulated in the gas compartment segregated from the adjacent compartments, complying with IEC, having the ratings: -

Line Voltage Transformer / Bus Voltage Transformer

S.NO.	Description	Particulars
1	Rated primary voltage (kV rms)	66

2	Rated frequency	50Hz
3	System neutral earthing	Effectively earthed
4	Type	Electromagnetic
5	No. of secondary	2
6	Rated voltage factor	1.2 –continuous 1.5 - 30 seconds
7	Voltage ratio (kV)	66/√3 / 110/√3
8	Accuracy	0.2 and 3P
9	Output burden (VA) (minimum)	50 VA
10	Highest System Voltage	72.5 KV
11	Basic Insulation Level (BIL)	325 KVp
12	Power frequency withstand voltage	140kV

4.5 SURGE ARRESTER

The gapless arrester shall conform to IEC and shall have the following technical Performance characteristics and ratings.

1	Highest system Voltage	72.5KV
2	Rated Arrester Voltage	60 kV
3	System neutral earthing	Effectively earthed
4	Continuous operating Voltage	60 KV
5	Type	Gapless type / metal zinc oxide
6	Long duration class	Class 3
7	Frequency	50 Hz
8	Lightning impulse withstand voltage for insulation	325 kV
9	Power frequency withstand voltage for insulation	
10	Nominal discharge current with 8/20 micro-sec wave	10 kA
11	Discharge current at which insulation coordination will be done	20 kA or 8/20 micro sec wave
12	Minimum discharge capability	5 kJ/kV referred to rated arrester voltage and at minimum discharge characteristics whichever is higher
13	Maximum switching surge residual voltage (1 KA)	
14	Maximum residual voltage i) 5 KA ii) 10KA	
15	Current for pressure relief test	As per IEC
16	Pressure relief class	A
17	Prospective symmetrical fault current	40 KA rms for 0.2 sec.

18	Low current long duration test value (2000 micro sec.)	As per IEC
19	Discharge counter and leakage current meter to be provided	Yes

It is preferred to go with air insulated LA instead of gas insulated, bidder should clearly state if they have any reservation issue while going with air insulated LA.

4.6 BUSBAR AND TEE-OFF CONNECTION

Busbar shall have ratings of 2000 Ampere(Min.) and if required vendor will submit the calculations, at an ambient of 50 DEG C. Busbar conductor and enclosure shall have provision for absorbing thermal expansion and contraction. No mechanical stress shall be allowed to impose on insulating parts. Arrangement of the busbar compartments shall be designed in such a way that future extension and maintenance of any busbar compartment shall be made without shut down the power distribution system.

The SF6 single-phase encapsulated busbars and busducts shall be mounted in horizontal configuration to suit the switchgear layout and shall be single phase Encapsulated. The conductors of the busbars shall be decided during detail engineering. The material of the bus Bar shall filled with pressurized SF6 gas. The conductor shall be supported from the enclosures by homogeneous epoxy resin insulator shaped to ensure uniform electrical field distribution at rated voltage. Metal bellow type compensators with adjustable tensioners shall be provided, where required. The enclosures shall be designed to eliminate as much as possible all external effects of the flux created by normal and fault currents. The induced voltages on the enclosures shall not be allowed to exceed reasonable limits of safety for operating personnel. The Supplier shall furnish supporting calculations in respect of induced voltage and losses guaranteed for the enclosure.

Bus end connections shall be made with multi-contact connectors to allow for axial thermal expansion of the bus. Enclosure end connections shall be flanged. The common point of the two bus bars should be in a separate enclosure with an earthing switch in order to ensure availability of one busbar in service at all times Each end of the busbar shall be designed for convenient future extension of the Switchgear.

4.7 CABLE TERMINATION

Each circuit of the underground cable shall consist of 2 (Runs) Three core Aluminum cable one per phase) 300 mm2, 66 kV, compact round concentric lay stranded or compact round segmental stranded conductor, cross-linked polyethylene insulated, with Aluminum corrugated metallic sheath and HDPE outer sheath. The cable will be supplied from owner stock. Supplier shall supply complete terminating kit including gas partitioning for every incoming and outgoing terminal for terminating the cable to the switchgear cable-ending module. No part shall be furnished by owner except the cable. Cable termination shall be designed in such a way that DC voltage test of the cable can be carried out safely and conveniently. Supplier shall provide test bushing and associated devices in order that power frequency high voltage test can be carried out after completion of the installation.

4.8 CONTROL EQUIPMENT

The owner has its own SCADA system; all the equipments shall be SCADA compatible IEC 61850. All-important analogue and digital signals shall be available for SCADA. All control wiring and terminations internal to the switchgear, and connecting the switchgear to the bay module control cabinets, shall be provided by manufacturer. This cabinet shall be made out of stainless steel of grade not less than 314L. the enclosure shall be IP56.

All control cables shall be shielded. Cable shields shall be grounded at both ends. Grounding connections shall be as short and direct as possible and shall terminate at the point of entry to cabinets or terminal boxes. Co-axial type cable glands suitable for use with shielded cables shall be used at each termination. All control cables shall be installed and terminated in such a manner as to limit the effects of transient electromagnetic voltages on the control conductors to an acceptable level

5.0 BAY MODULE CONTROL CABINETS

Each Switchgear bay module shall be supplied with a main control cabinet of the floor mounted free standing type. The cabinet shall have full height, hinged, gasketed, lockable double doors. One door shall have a safety glass window through which the various. Switchgear controls can be viewed without opening the doors. The cabinet will be utilized as both the Switchgear bay local control module and as the terminating center for all power supply, control, annunciation and supervisory wiring interfacing with Purchaser's systems. Detailed specification for control & relay panel please see “Specification for Control and Relay Panel”. It is preferred to have complete protection and control panel as integrated part of gas insulated switchgear provided bidder does not see have any reservation regarding performance of these relays near high voltage gas module. Ambient temperature outside shall also be taken into account. Else bidder shall go with separate CRP installed inside building

5.1 RELAYS AND PROTECTION

Approved make of protection relay and various components shall be as per 66kV Control & Relay Panel specification of BRPL

5.2 GAS TREATMENT REQUIREMENTS

Under normal operating conditions it shall not be necessary to treat the insulating SF6 gas between major overhauls. In all gas compartments permanent efficient filters and desiccants shall be effective for the duration of time between major overhauls. Notwithstanding this, the insulators in the circuit breaker shall be made of epoxy resin composition that will resist decomposition products in contract with moisture.

5.3 GAS MONITORING DEVICES

Each single phase, gas filed compartment, shall be fitted with a temperature compensated pressure switch, It shall be directly secured on the enclosure, and shall have two threshold levels to continuously monitor the Gas density. With the first level operating the user shall refill the compartment with SF6 as soon as possible while keeping GIS in service. On Operation of the second level, the user shall quickly de-energise the compartment. or pressure monitoring devices shall be provided for each gas compartment. The devices shall provide continuous and automatic monitoring of the state of the gas. The SF6 gas monitoring device shall have two supervision and

alarm settings. These shall be set so that, an advanced warning can be given that the gas density/pressure is reducing to an unacceptable level. After an urgent alarm, operative measures can be taken to immediately isolate the particular compartment electrically by tripping circuit breakers and opening disconnectors. It shall be ensured that there is no chance of the gas liquefying at the lowest ambient temperature. The gas monitoring device shall monitor at least the following, locally and remote.

a) "Gas Refill" Level- This will be used to annunciate the need for gas refilling.

b) "Breaker Block" Level- This is the minimum gas density at which the manufacturer will guarantee the rated fault interrupting capability of the breaker. At this level the device contact shall trip the breaker and block the closing circuits.

c) Over pressure alarm level- This alarm level shall be provided to indicate abnormal pressure rise in the gas compartment. It shall be possible to test all gas monitoring relays without de energizing the primary equipment and without reducing pressure in the main section. Disconnecting type plugs and sockets shall be used for test purposes; the pressure/density device shall be suitable for connecting to the male portion of the plug. Two potential free electrical contacts shall be provided with each and every alarm condition.

The metal enclosures for the SF6 gas **insulated equipment modules shall be made from Aluminum alloy. Suitable anti corrosive paints shade 631 of IS:5**, must be applied on the exterior of the enclosures. The enclosure shall be suitable for three phases, i.e. Single Enclosure.

6.0 The external fixtures should be made of corrosion resistant material and should be capped where required. Bellow compensators shall be made of Stainless steel to preserve the mechanical strength of the equipment at the connection portions to deal with the following problems:

a) Expansion and Contraction of outer enclosure and conductor due to temperature variations.
b) Mismatch in various components of GIS
c) Vibration of the transformer and switching equipment
d) Dimensional variations due to uneven settling of foundation
e) Seismic forces as mentioned in climatic condition.

6.0 Type Test

Bidder shall submit valid type test reports (as per relevant latest IEC Standard) for approval. The bidder should have conducted type test on identical or similar equipment/ components to those offered. In case type test reports are found to be technically unacceptable to BSES RAJDHANI POWER LIMITED, the type tests shall be conducted without any additional cost and delivery implication to BSES RAJDHANI POWER LIMITED.

6.1 Drawing / Documents

The drawings / documents submitted shall be project and product specific and shall incorporate all project details and title block and numbering scheme of the customer.

7.0 General

It is understood that each manufacturer has its own particular design concept and it is not the purpose of this specification to impose unreasonable restrictions. However, in the interest of safety, reliability and maintainability, the switchgear offered shall meet the following minimum modular concept and design requirements:

Fail safe inter and intra bay Inter locking scheme, Maintenance of one bus bar with the other bus bar in service, Interchange ability of similar parts, Future extension of bays, with maximum one bus outage at a time, Possible to remove and replace the fully assembled parts of circuit breaker, Pressure relief device for each pressurised section, Gas density monitoring device for each isolated section/module.

All mechanical parts, which are outside of gas filled compartment, must be externally accessible and serviceable without disconnecting the main bus bar or feeder circuits.

All current carrying components of the equipment specified shall be capable of continuous operation at the specified rated current without exceeding the maximum temperature rises specified in the relevant IEC standards.

7.1 Arrangement and assembly

The bus bars shall be single-phase segregated metal-enclosed type. The enclosure design shall essentially be based on following considerations Temperature and solar radiations, Thermal cycling, vibration, shock and seismic, Design Pressure on normal and abnormal conditions.

Conductors and live part shall be mounted on moulded epoxy resin insulators specially made for the EHV application. The conductors shall be made of tubular copper. Silver plated finger contacts at the ends of conductor or mounted on support insulators shall be provided to form sliding contact permitting the conductor to expand axially on a temperature rise, without imposing any mechanically stresses on the supporting insulators. Metal bellows compensators shall be provided on enclosure for permitting longitudinal expansion. The enclosure shall be dimensioned for the full return current. Compensators shall be bypassed by copper straps.

7.2. Welding

Members to be joined by welding may be cut to shape and size by mechanical means such as shearing, machining, grinding, or by gas or arc cutting, to suit the conditions. Edges shall be shaped according to relevant IEC . Design of welded joints and selection of weld filler metal shall be in accordance with approved standards and shall allow thorough penetration and good fusion of the weld with the base metal. The edges of surfaces to be welded shall be sound metal free of visible defects such as laminations or defects caused by cutting operation at least 30 mm back from the edge of the weld, and free from rust, oil, grease, and other foreign matter.

The qualification of welding procedures, welders, and welding operators for all welding, including weld repairs, shall conform to the relevant IEC . Weld-fabricated pressure-containing parts shall be designed, fabricated, inspected and tested, unless otherwise. Weld-fabricated pressure-containing parts shall be designed, fabricated, inspected and tested, unless otherwise specified, in accordance with approved standards and shall be stress relieved as a unit prior to final machining.

8.0 Workmanship

i) Electric Welding

All welds shall be made continuous and watertight. The minimum size of fillet welds shall be 6 mm measured on the leg. All butt welds shall be full penetration welds welded from both sides.

Welds shall in general be treated so that they will display good appearance and a surface suitable for painting. Structural welds shall be ground and blended to avoid stress raisers. All welds, which require non-destructive examination, shall be dressed by chipping and grinding as required for good interpretation by the selected weld examination method. All butt welds in the flanges and webs of beams and girders shall be radio-graphically inspected. The fillet welds between flanges and webs shall be tested by the magnetic particle method.

ii) Machine work

All tolerances, allowances, and gauges for metal fits between plain (non threaded) cylindrical parts shall be indicated. Sufficient machining stock shall be allowed on parts to be machined to ensure true surfaces of solid material. Finished contact or bearing surfaces shall be true and exact to secure full contact. Journal and sliding surfaces shall be polished, and all surfaces shall be finished with sufficient smoothness and accuracy to ensure proper operation when assembled. No machining shall be done on working surfaces of self-lubricating bushings or washers.

iii) Finished Work

All surfaces that are so indicated on the drawings or those that require machining for their intended function, or those that are usually machined according to good workshop practice shall be machined. Surface finish qualities shall be adequate for the intended use and shall be indicated on the Contractor's Drawings. Suitable measuring device such as Scatter meter or other acceptable measuring device will be used to determine compliance with specified surface.

iv) Unfinished Surfaces

So far as practicable, all work shall be laid out to secure proper matching of adjoining unfinished surfaces. Where there is a large discrepancy between adjoining unfinished surfaces they shall be chipped and ground smooth, or machined, to secure proper alignment. If surfaces not designated as finished in the Contract Documents require machining to obtain the tolerances or straightness specified or needed for correct function, such machining shall be performed by the Contractor.

v) Dimensional Checks and Visual Inspection

Dimensional checks shall be performed on all major parts, components and partial assemblies, especially when close tolerances and fits are involved (between stationary and moving parts, connecting dimensions for the assembly with other supplies, etc.). If the dimensional checks show discrepancies in measurement, which may affect the fit, assembly or dismantling of the respective part or component, the same have to be corrected correspondingly. Such correction or modification shall, however, in no way lead to sacrifices with respect to reliability of operation or inter-changeability, and shall be performed only after the agreement of the Engineer in-charge has been obtained. If the correction or modification cannot be carried out in accordance with the terms mentioned above, the part or component concerned may be subject to rejection. Faulty machine parts or equipment shall by no means be delivered.

vi) Castings shall be inspected visually at the foundry after they are cleaned and while defects are being removed. Castings shall also be inspected after repairs and after heat treatment. Radiographic or other non destructive tests will be required as specified under non-destructive testing and as directed by Engineer in-charge when granting permission to repair major defects. The Engineer in-charge reserves the right to require conducting non-destructive tests at the Contractor's expense to determine: the full extent of defects; that area is properly prepared for welding that the repairs are satisfactory.

9.0 Electrical System Design :

9.1 The SF6 gas insulated metal enclosed switchgear (GIS) should be totally safe against inadvertent touch of any of its live constituent parts. It should be designed for outdoor application with meteorological conditions at site. All parts of the switchgear should be single phase enclosed. The arrangement of gas sections or compartments shall be such as to facilitate future extension of any make on either end without any drilling, cutting or welding on the existing equipment. To add equipment, it shall not be necessary to move or dislocate the existing switchgear bays. The design should be such that all parts subjected to wear and tear are easily accessible for maintenance purposes. The equipment offered should be protected against all types of voltage surges and any equipment necessary to satisfy this requirement shall be deemed to be included.

9.2 Switchgear shall be 66Kv, 3Phase, 3 wires, 50 Hz, Solidly earthed unless other wise specified. Current and short circuit rating will be shown on single line diagram. The rating of equipment / Component shall be take full account of heat sources with in enclosure.

9.3 The electrical arrangement of the switchgear, including protection, metering, control, interlocking and inter-tripping, shall be shown on the single line diagram with their metering and protection requirement. And further can be amend during detail engineering as per requirement of the BSES Rajdhani power system requirement.

10.0 Structural and mechanical requirement

a) GIS switchgear shall be an indoor gas insulated and metal –clad cubicle design with single line diagram and data sheet .Each panel sheet shall be metal enclosed, free standing, floor mounting, flush fronted and arranged to form a single structure with common busbar assembly. Each compartment shall be protected by a metal enclosure with enclosure with enclosure rated IP65 or better for gas compartments and IP4X for the supporting frames, low voltage and other compartments. Construction, including cable entry, shall be vermin proof.

b) Switchgear shall be permit to future extension at both the ends. SELLER shall confirm the minimum safe operational clearances around the switchgear with the quotation. GIS switchgear shall partition both between bus bar and circuit breaker and from panel to panel.

c) Switchgear shall be designed such that all high voltage parts (including busbar, core module with built in circuit breaker etc.) shall be located in an insulated inert gas. Cable termination compartment shall include provisions for conventional CT, VT, Plug in connections. Low voltage compartment shall include built in switch drives and secondary equipment. A gas leakage rate less than 0.5% per annum is required for gas insulated compartment. SELLER shall specify the type, required quantity and operating pressure for any gas filled compartment or equipment.

d) Structure, including doors and panel shall be capable of withstanding of internal pressures created by fault with in the structure (Equal to the maximum fault –current rating) without danger to operating personnel. Active and passive protection system against internal faults in each portioned panel shall be provided for safety of operators. In case of internal fault, the detection system shall open all circuit

breakers with in 60ms (Min.) Pressure detection shall be effected by temperature compensated pressure sensors. A Passive safety section shall ensure that hot gases shall be guided via pressure relief disk from each compartment connected. The pressure relief duct end shall be guided to open air or fitted with absorbers to cool the hot gases. Relief in to cable basement or cavity below a false floor is not acceptable. Hazards to person or risk of fire shall be reliably prevented. Temperature –compensated sensor for permanently monitor the relevant gas compartment. The entire system shall be monitored with the aid of sensors. It shall be possible to schedule maintenance operations from this monitoring system. Structure shall be provided with barriers to prevent the transfer of ionized gases between two adjacent compartments except bus chamber.

An arching fault in one compartment should not cause major damage to other compartment. Separate pressure relief vent shall be providing in busbar cable and circuit breaker compartment to release pressure to release arc fault pressure quickly and safely. The orientation of pressure relief vents and gas pressure

The GIS shall be designed, manufactured and tested in accordance with the latest applicable Indian Standard, IEC standard and CBIP manuals as listed below –

11.0 GIS Design and Safety Features

a) The specification covers scope of design, engineering, fabrication, manufacturing, shop assembly, inspection and testing before supply, transportation, delivery at destination, unloading & storage at site or store of BRPL , site erection, site testing, commissioning and putting in to successful operation complete with all materials, support structures, anchoring bolts, accessories, commissioning spares & maintenance spares, special spanners, tools & tackles, any specific required ancillary services, SF6 Gas for first filling & spare, etc., for efficient and trouble free operation along with for 66 kV metal (aluminum alloy) encapsulated SF6 gas insulated switch-gear suitable for INDOOR installation.

   The scope also covers provision of additional bays (without equipments) over and above bays shown in SLD, with foundations & earthing arrangements so as to install the bay module as and when required without any works pending except the procurement of the required bay module and other related equipments.

b) The station layout and equipment rating shall be based on the single line diagram and as per site conditions. The supplier has to work out an optimum layout and building size based on the specific features of his product within the constraints of overall dimensions of the plot. All equipment, accessories and wiring shall have tropical protection, involving special treatment of metal and insulation against fungus, insects and corrosion.

   Further more, no part of the enclosure, or any loose parts may fly off the switchgear in such an event, and no holes may burn through the enclosure until the nearest protective relay has tripped. All grounding connections must remain operational during and after an arc fault. Proper grounding for mitigating over voltages during disconnector operation shall be included. Viewing windows shall be provided at the Disconnectors and earthing switches to ensure that each contact position can be inspected easily from the floor level. Each section shall have plug-in modules or easily removable connection pieces to allow for easy replacement of any Component with the minimum of disturbance to the remainder of the equipments.

c) The arrangement shall afford maximum flexibility for routine maintenance. Equipment removal and SF6 handling should be accomplished with ease. The ease of operation shall be ensured.
In general the contours of energized metal parts of the GIS and any other accessory shall be such as to eliminate areas or points of high electrostatic flux concentrations. Surfaces shall be smooth with no projection or irregularities, which may cause corona.

d) The GIS switch gear shall be of modular design offering high degree of flexibility. Each module shall be complete with SF6 gas circuit breaker, Disconnectors, Maintenance Grounding switches, fast Earthing switches, voltage transformers, Current transformers, bus & elbow sections, cable end enclosures, L.A., local control cubicle and all necessary components required for safe & reliable operation and maintenance.

All the three phases of the busbars and associated equipments like breakers, disconnectors, instrument transformers & earthing switches etc., as detailed in enclosed single line diagram are to be encapsulated in a single gas filled metallic enclosure. The bus bars shall be sub-divided into compartments including the associated bus bar disconnector. Bus bars are partitioned at each bay with an objective to isolate Busbar compartment for the purpose of extension and at the same time avoid damage to adjacent bays in the event of fault. The bus enclosure should be sectionalized in a manner that maintenance work on any bus disconnector (when bus and bus disconnector are enclosed in a single enclosure) can be carried out by isolating and evacuating the small effected section and not the entire bus.

e) The GIS assembly shall be consist of separate modular compartments e.g. Circuit Breaker compartment, Bus bar compartment filled with SF6 Gas and separated by gas tight partitions so as to minimize risk to human life, allow ease of maintenance and limit the effects of gas leaks failures & internal arcs etc. All components shall be such that maintenance on one feeder may be performed without de energizing the adjacent feeders. These compartments shall be designed to minimize the risk of damage to adjacent sections and protection of personnel in the event of a failure occurring within the compartments. Rupture diaphragms with suitable deflectors shall be provided to prevent uncontrolled bursting pressures developing within the enclosures under worst operating conditions, thus providing controlled pressure relief in the affected compartment. The detail of chambering system needs to be submitted along with tender documents for assessment of suitability of chambering system.

f) The switchgear shall be of the freestanding, self-supporting dead-front design, with all high-voltage equipment installed inside gas-insulated, metallic grounded enclosures, and suitably sub-divided into individual arc and gas-proof compartments.

The switchgear described in this specification is intended for continuous duty at the specified ratings and under all system operating conditions including sudden change of load and voltage within its ratings and at specified ambient conditions 24 hours a day, 365 days a year unless indicated other wise.

The assembled equipment shall be capable of withstanding the electrical, mechanical and thermal ratings of the specified system. All joints and connections shall be required to withstand the forces of expansion, vibration, contraction, and specified seismic requirements without Deformation or malfunction and leakage.

g) The control equipment or LED used in LCP should be IEC 61850 compatible. All the data and alarm from LCP should be integrated with the SCADA system.

12.0 Local Control

Separate control cubicle including gas monitoring kiosk shall be provided for each bay which shall be installed near the switchgear for local control & monitoring of respective switchgear bay. Local control cubicle for GIS shall be equipped with suitable hardware & software for remote control operation and conform to the bay level controller and it should be compatible with IEC 61850.

Local control cubicle shall be housed in IP-55 Enclosure (kiosks).

The LCC should have minimum following functions

1. AC Supply for drives, heating, lighting.
2. DC supply for drives, alarms, protection.
3. General control functions: Remote & local control selection, interlocks.
4. Control of disconnectors & earth switches.
5. Control of CBs: closing, tripping coils, anti-pumping, interface to synchronizing. devices, interface to protection devices, supervision of spring mechanism.
6. Arc detection system.
7. Interfacing.
8. Human Machine Interface (HMI).
9. Alarm indication and signalization.
10. Supervision of Gas Compartment.

a) All the elements shall be accessible without removing support structures for routine inspections and possible repairs. The removal of individual enclosure parts or entire breaker bays shall be possible without disturbing the enclosures of neighbouring bays.

b) It should be impossible to unwillingly touch live parts of the switchgear or to perform operations that lead to arcing faults without the use of special tools or brute force.

c) In case of any repair or maintenance on one bus bar disconnections, the other bus bar should be live and in service.

d) All interlocks that prevent potentially dangerous mal-operations shall be constructed such that they can not be operated easily, i.e. the operator must use special tools to over-ride them.

e) The enclosure shall be designed to practically eliminate the external electromagnetic field and thereby electro-dynamic stresses, even under short circuit conditions.

f) The elbows, bends, cross and T-sections of interconnections shall include the insulators bearing the conductor when the direction changes take place in order to ensure that live parts remain perfectly centred and the electrical field is not increased at such points.

g) The Average Intensity of electromagnetic field shall not be more than 50 micro Tesla on the surface of the enclosure. The contractor shall furnish all calculations and documents in support of the above during detailed engineering.

h) The switchgear shall have provision for connection with ground mat risers. This provision shall consist of grounding pads to be connected to the ground mat riser in the vicinity of the equipment.

i) Wherever required, the heaters shall be provided for the equipment in order to ensure the proper functioning of the switchgear at specified ambient temperatures The heaters shall be rated for 240V AC supply and shall be complete with thermostat, control switches and fuses, connected as a balanced 3-

phsase, 4-wire load. The heaters shall be so arranged and protected as to create no hazard to adjacent equipment from the heat produced.

j) All chambers of GIS should have separate density monitor switch with separate alarm to LCP. The common density switch 3 phase connection is not acceptable.

k) LCC and GIS shall be separate and LCC shall be ground mounted

13.0 GIS Enclosure

a) The switchgear gas enclosures must be sectionalized, with gas tight barriers between sections or compartments.
The sections shall be so designed as to minimize the extent of plant rendered inoperative when gas pressure is reduced, ether by excessive leakage or for maintenance purposes, and to minimize the quantity of gas that has to be evacuated and then recharged before and after maintaining any item of equipment.

The arrangement of gas sections or compartments shall be such that it is possible to extend existing bus-bars without having to take out of service another section of the bus-bar at a time.

For limitation of any internal arc to the concerned bay and to reduce the extent of necessary gas works of each section of the bus-bar must be sectionalized bay by bay.

Sectionalization shall ensure that circuit breaker enclosure will not include any other equipment in its gas compartment. **internal arc fault with a safety factor of 2.**

b) The layout shall sufficiently take care to the thermal expansion /contraction of the assembly by the provision of expansion joints. Expansion joints shall be placed in between any bay section of the busbar. All joint surfaces shall be machined, and all castings shall be spot Faced for all bolt heads or nuts and washers.

c) If necessary, the number and position of expansion joints or flexible connections are to be determined by the manufacturer to ensure that the complete installation will not be subject to any expansion stresses which could lead to distortion or premature failure of any piece of the SF6 equipment, support structures or foundations.

d) The enclosure & support structure shall be designed that a person 1780 mm in height and 80 Kg in weight is able to climb on the equipment for maintenance. All structural steel should be hot dipped galvanized (7 tank process) with 610 g/sqm (equivalent to 85 micron) zinc coating. The details of bolt sizes and threading shall be shown on the appropriate drawings and adequate calculations to be furnished where self locking types of nuts are to be used, the pressed type of nuts is not acceptable.

e) The sealing provided between flanges of two modules / enclosures shall be such that long term tightness is achieved.

f) Alarm circuit shall not respond to faults for momentary conditions. The following indications including those required elsewhere in the specifications shall be generally provided in the alarm and indication circuits.

Gas Insulating System:

a) Loss of Gas Density.

b) Loss of Heater power (if required).
c) Any other alarm necessary to indicate deterioration of the gas insulating system.

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Operating System:

a) Low operating pressure
b) Loss of Heater power.
c) Loss of operating power.
d) Loss of control.
e) Pole Discordance.

Bracing shall be provided for all mechanical components against the effects of short circuit currents specified under system parameter. The design of the equipment shall be such that the agreed permitted movement of foundations or thermal effects does not impair the assigned performance of the equipment. **The design calculations for all the supports shall be submitted to ensure care taken.**

The continuity of service during thermal expansion / contraction and vibrations shall be ensured. Expansion joints, flexible connections and adjustable mountings shall be provided to compensate for reasonable manufacturing and construction tolerances in the associated equipment to which the GIS may be connected. Required sliding plug-in contacts for conductors shall be provided.
This is to ensure that unreasonably excessive accuracy is not required when installing such equipment and constructing the associated foundations or support structures, e.g. transformers or the interconnection of isolated sections of switch-gear by means of long GIS bus-bar or duct installations. Flexible joints may also
be provided to allow more efficient maintenance and future extensions of the GIS.

14.0 BARRIER AND NON-BARRIER INSULATORS

Support insulators shall be used to maintain the conductors and enclosure in proper relation. These support insulators may be of two types. Barrier insulators which are employed to isolate gas compartments and non-barrier insulators which allow the gas pressure to equalize.

The gas barrier insulators sealing to the conductors and the enclosure wall shall be designed to withstand the maximum pressure difference that could occur across the barrier, i.e. maximum operating pressure at one side while a vacuum is drawn at the other side & in case of internal arc fault with a safety factor of 2.

The support insulators and section barriers / insulators shall be manufactured from the highest quality material. They shall be free form all voids and the design shall be such as to reduce the electrical stresses in the insulators to a minimum. They shall also be of sufficient strength to ensure that the conductor spacing and clearances are maintained when short circuit occurs.

Tests shall be carried out during the manufacture of the Switchgear to ensure that all parts of the equipment are free of partial discharge with a partial discharge extinction voltage which is at least 10% higher than the rated voltage.

15.0 GAS SEALS, GAS DENSITY & PRESSURE AND OTHER REQUIREMENTS

Single sealing of O-ring type shall be used for sealing the connections between the switch-gear modules. The leakage rates shall be kept to an absolute minimum under all normal pressure, temperature, electrical load and fault conditions. The guaranteed leakage rate of each individual gas compartment and between compartments must be **less than 0.5%p.a for the service life of equipments.**

Piping's and fittings for gas monitoring and gas supply shall be made of copper or brass. The gas monitor device should be installed at each individual compartment of the module. Each gas compartment must be independent, external gas pipe connections should be avoided to minimize leakage.

All gas compartments shall be fitted with filter material which absorbs the residual moisture and moisture entering inside the High-voltage enclosure. Filters in gas compartments with switching devices must also be capable to absorb the gas decomposition products resulting from the switching arc.
The rated pressure of the SF6 insulating gas in the metal-clad equipment shall be as low as is compatible with the requirements for electrical insulation and space limitations to reduce the effects of leaks.

The SF6 switch-gear shall be designed for use with SF6 gas complying with the recommendations of IEC – 60376 at the time of the first charging with gas. Connections including bolts and nuts shall be adequately protected from corrosion and easily accessible with the proper tools. All components shall be fire retardant and shall be tested in accordance with relevant standards. Gas emissivity when the Material is heated shall be minimal.

16.0 ENCLOSURE DETAILS

a) Standard paint shade 631 of IS:5 shall be used with satin mat finish having high scratch resistance.

b) The gas-filled enclosures shall conform to the pressure vessel code applied in the country of manufacturer. Gas section barriers including seals to the conductor and enclosure wall shall be gas-tight and shall be capable of withstanding the maximum pressure differential that could occur across the barrier, i.e., with a vacuum drawn on the one side of the barrier and on the other side, at least the maximum gas pressure that can exist under normal operating or maintenance conditions and in case of internal arc fault.

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c) The finish of interior surfaces of the metal-clad enclosures shall facilitate cleaning and inspection. High quality primer followed by two coats of anti corrosive paint of glossy white shade shall be used such that they will not deteriorate when exposed to the SF6 gas and other vapors, Arc products, etc., which may present in the enclosures. They shall also not contain any substances which could contaminate the enclosed gas or affect its insulating properties over a period of time. Gas filling and Evacuating Plant/Gas reclaimer for 66 kV GIS unit.

All apparatus necessary for filling, evacuating, and recycling the SF6 gas into and from the switch-gear equipment shall be supplied from the compartments.

17.0 MAINTENANCE

Where any item of the filling and evacuating apparatus is of such a weight that it cannot easily be carried by maintenance personnel, it shall be provided with facilities for lifting and moving with the overhead cranes.

The apparatus for filling, evacuating and recycling all gases to be used shall be provided with all necessary pipes, couplings flexible hoses, tubes and valves for coupling to the switch-gear equipment.

The gas compartments shall preferably be fitted with permanent vacuum couplings through which the gas is pumped into or evacuated Details of the filling and evacuating apparatus that will be supplied, and also a description of the filling, evacuating and recycling procedures, shall be provided with the bid. The initial gas filling of the entire switch-gear including the usual losses during commissioning shall be supplied over and above the required quantity of spare gas.

An additional quantity of SF6 gas for compensation of possible losses during installation shall be supplied. The quantity of the same shall be indicated in GTP, considering leakage rate of 1% per year for complete GIS system, even if, the designed leakage rate is lower than 0.5% per annum. Such spare gas shall be supplied in sealed cylinders of uniform size, which shall be decided during detailed engineering.

18.0 SUPPORT STRUCTURES

All supporting structures necessary for the support of the GIS equipment including associated parts such as anchor bolts, beams etc. shall be supplied. Sufficient attachment points to the apparatus and concrete foundations shall be furnished to ensure successful installation, with required clearances, while taking into account thermal expansion and contraction. Earthquake requirements are also to be considered.

Any scaffolding or a movable platform, required for maintenance, shall also be supplied. All steel structure members shall be hot-dip galvanized after fabrication. Minimum thickness of Galvanizing shall be 610 grams per square meter. All field assembly joints shall be bolted. Field welding shall not be acceptable.

Non-corrosive metal or plated steel shall be used for bolts and nuts throughout the work. Manufacturer shall provide suitable foundation channels and anchor bolts to support the switchgear assemblies. All mounting bolts, nuts and washers shall be provided to fasten the switchgear base frames to the foundation channels. Foundation channels and anchor bolts shall be installed in the civil works in accordance with instructions provided by the manufacturer.

One Crane mounted over the roof shall also be provided for lifting the GIS bay in case of maintenance with adequate loading capacity

19.0 AUXILIARY EQUIPMENT

The following items shall be included for a complete installation:

a) Control system including local control cabinets
b) Cable and wiring between individual items of supplier supplied equipment.
c) Nameplates
d) All ladders, platforms, stairs, walkways, and supports necessary to operate and maintain all equipment safely and efficiently.
e) Special tools and tackles for installation
f) Special tools and tackles for maintenance

20.0 GROUNDING OF GIS

GIS will be housed on GIS floor. The bidder will provide under-ground mat below the substation. The bidder shall also provide adequate number of Galvanized steel risers to be connected to grounding mat, as per relevant standards and in consultation with BRPL during detailed engineering, in the event of an order.

The bidder shall supply entire material for ground bus of GIS such as conductor, clamps, joints, operating and safety platforms etc. to be laid /embedded in GIS floors. The bidder is also required to supply all grounding connectors and associated hardware material for:

I) Connecting all GIS equipment, Bus duct, enclosures, control cabinets, supporting structures etc. to the ground bus of GIS.

ii) Connecting ground bus of GIS to the ground mat risers.

The grounding arrangement of GIS shall ensure that touch and step voltages are limited to safe values as per IEEE std. 80-2000. The enclosures of the GIS shall be grounded at several points such that there shall be a grounded cage around all live parts. The ground continuity between each enclosure shall be affected over flanges, with or without links or straps to bridge the flanges. Copper/Aluminum straps shall however bridge the metallic expansion bellows. The grounding switches shall be connected to ground through the enclosure. Individual ground leads for the ground switches are not allowed. Where operating mechanism cabinets are mounted on the switchgear, the grounding shall be made by separate conductor. Bay control cabinets shall be grounded through a separate conductor. All conduits and control cable sheaths shall be connected to the control cabinet grounding bus. All steel structures shall be grounded.

Each removable section of catwalk shall be bolted to the support structure for ground continuity. The enclosure grounding system shall be designed to minimize circulating currents and to ensure that the potential rise during an external or internal fault is kept to an acceptable level. The guidelines of IEEE Std. 80-2000 on GIS grounding, especially the transient ground potential rise caused by high frequency phenomena, shall be taken into consideration while designing the grounding system for GIS. The manufacturer shall furnish readily accessible connectors of sufficient mechanical strength to withstand electromagnetic forces as well as capable of carrying the anticipated maximum fault current without overheating by at least from two paths to ground from the main ground bus.

Provisions of IEC 517 & 694 regarding safeguards in grounding of connected cables, testing during maintenance and other safety measures shall be ensured.

Earthing conductors shall be designed to allow flow of short circuit current. Conductors with copper bars are preferred over copper wires.

21.0 Future Extension

The modular design of GIS switch gear shall be capable of extension in the future on either end by the addition of extra feeders, bus couplers, busbars, circuit breakers, Disconnectors, and other switch gear components without drilling cutting, welding or dismantling any major part of the equipment. The Vendor is required to demonstrate clearly in his submitted documents the suitability of the switchgear design in this respect. The arrangement shall be such that expansion of the original installation can be accomplished with minimum GIS down time. In case of extension, the interface shall incorporate facilities for installation and testing of extension to limit the part of the existing GIS to be re-tested and to allow for connection to the existing GIS without further dielectric testing.

22.0 GIS Equipments specifications

CIRCUIT BREAKER DESIGN FEATURES

a) Type of the Circuit Breaker

Each circuit breaker shall comprise three metal-clad breaker poles (Puffer type / auto puffer type) . They shall be designed for installations in SF6 Gas- insulated metal-clad switchgear, and shall use SF6 gas for both insulation and arc quenching. The SF6 gas-insulated circuit breakers shall conform to latest IEC and have the following performance characteristics and ratings.

1	Design feature	The circuit breaker shall be puffer type designed for installation in SF6 gas insulated metal clad switchgear and shall use SF6 gas for both Insulation and arc quenching.
2	General feature	The breaker shall be capable for switching duties for internal faults, short line faults, out of phase switching and interruption of small inductive and magnetizing current of transformers
3	Operating Mechanism	The breaker shall be operated by spring drive / hydraulic spring drive only. The mechanism shall be trip free and have anti pumping feature under every method of closing. Failure of any auxiliary spring shall not prevent breaker tripping. The mechanism shall always be ready for one close open operation after failure of power supply
4	Indicators	Each breaker shall be equipped with a local mechanical position indicator visible from front. Remote indication shall be provided on control cubicle. Spring charged discharged indication shall be available. Operation counter a must.
5	Closing Coil	Shall be rated for 220V DC +10% -20%
6	Tripping Coil	Two coils are must rated for 220V DC +10% -20%
7	Remote / Local closing & Tripping	Closing and opening of breaker shall be from local (electrically as well as mechanically) Control cubicle shall have provision with TNC switch for breaker operation. SCADA interface is must for breaker. In maintenance mode all remote / SCADA / local ON OFF signals shall be blocked. Emergency trip a must at local.
8	Manual spring charging	Provision for charging mechanism mechanically shall be provided.
9	Motors	Motors shall be' Universal type' capable of satisfactory operation for the application and duty as required by the driven equipment. Motor shall be rated for 240 Volts AC
10	Duty requirement	1. The circuit breaker shall be restrike free as per IEC under all duty conditions and shall be capable of performing their duties. 2. The circuit breaker shall meet the duty

		requirements for any type of fault or fault location also for line switching when used on a 72.5 kV effectively grounded system, and perform make and break operations as per the stipulated duty cycles satisfactorily 3. Interrupting line-charging current as mentioned in this specification without any restrike 4. Clearing short line fault with source impedance behind the bus equivalent to symmetrical fault current specified. 5. Breaking 25% of the rated fault current at twice rated voltage under phase opposition condition. 6. The circuit breaker shall be capable of Breaking the steady and transient magnetizing current corresponding to transformers Breaking line charging currents as per IS 2165 (Part-II sec.2) with a temporary over voltage of 3.5 PU without the use of opening resistors.
11	Supply Voltage Variation	± 10%
12	Frequency variation	± 5%
13	Combined voltage & Frequency	± 15%
14	Interlocks	1. The circuit breaker shall be interlocked electrically and mechanically with associated Disconnectors. 2. A temperature compensated gas density monitor With two stages alarm shall be provided. Gas density monitor for arc quenching and insulating Sf6 gas shall be provided separately.
15	Interchangeability	Breaker of similar rating shall be mechanically and electrically identical and interchangeable
16	Recovery voltage and power Factor	The CB shall be capable of interrupting rated power frequency with recovery voltage equal to the rated maximum line to service voltage at rated frequency and power factor as per IEC
17	Terminal connector pad	The CB terminal pads shall be made of electrolytic copper.
18	Terminal block and wiring	All internal and external wiring shall be through conduit terminated on Nylon 66 terminals properly Ferruled at both ends.

23.0 TESTING & INSPECTION

A) Type tests

The equipment offered must be of type-tested quality. It shall conform to the type tests in accordance with the latest relevant IEC Standards. The list of type tests conducted by the bidder shall be listed out and the type test reports submitted by the bidder. along with the quotation. The type test reports shall be for the tests conducted

within the last five (5) years. The purchaser may like to conduct any of the type tests repeated. The price for conducting the type tests in such cases shall be indicated in the offer.

The following type tests should be submitted for the GIS / CB / other equipments as applicable.

1. Dielectric voltage withstand tests
   - Power frequency withstand voltage
   - Impulse withstand voltage
2. Making and breaking capability test
3. Short time current test and peak current test
4. Electrical / Mechanical endurance test
5. Continuous current carrying and temperature rise test
6. Current path resistance measurement
7. Pressure Tests
8. Partial discharge test
9. Internal arc tests
10. Proof tests for enclosures

a) Circuit breakers (in accordance with IEC 56)
   - Tests to prove performance when breaking line charging currents.
   - Tests to prove performance when breaking small inductive currents.
   - Mechanical and environmental test

b) Gapless Surge Arresters (in accordance with IEC 99 - 4)
   - Insulation withstand test
   - Residual voltage test

c) Steep current test

d) Lightning current test

e) Switching current test
   - Long duration current impulse withstands test
   - Operating duty test

f) Disconnectors and Earthing Switches (in accordance with IEC 1259)
   - bus charging current switching test

g) Current Transformers (in accordance with IEC 185)

h) Potential Transformer (in accordance with IEC 186)

i) Pressure Vessel Test
   - Test according to Pressure Vessel Code of the country of origin or CENELEC standards shall be performed on the enclosures.

24.0 Inspection / Tests during manufacturing / commissioning at site it will be complete responsibility of the manufacturer.

Shall be carried out as per the approved QA plan

a) Routine tests

All the routine shall be carried out by the manufacture as per relevant IEC standards.

b) Witnessing of tests

The purchaser will witness the tests as identified in the approved QA plan, arrangement for inspection by 5 engineer shall be in scope of the bidder.

25.0 Site tests

The following tests shall be performed on the completely assembled switchgear at site after installation. Test results as well as test conditions like ambient temperature, gas pressure, dew point etc. shall be documented and the results compared with the relevant instructions and factory test reports. A final site test report shall be supplied to the owner within 3 weeks after the tests have been finished. The vendor shall arrange all the required test equipments.

1. Visual inspection, checks and verifications. The following shall be inspected and verified:

   - Conformity of the assembly with the manufacturer's drawings and instructions.
   - Tightening of all pipe junctions, bolts and terminal connections.
   - Visual check of all control circuits, PT circuits, and CT circuits.
   - Proper function of the control, measuring, protective and regulating equipment including heating and lighting by means of the relevant commissioning reports.
   - Mechanical operation tests of Circuit Breaker, Disconnecting switch, earthing switch and fast acting earthing switch.
   - Rated SF6 gas pressure and control voltage:
   - O-C-O operation.
   - Maximum control voltage: O-C-O operation.
   - Minimum control voltage: O-C-O operation.

2. SF6 gas leakage test. The following parts shall be checked, using a leakage detector for SF6 gas indication:

   - each flange connection installed on site
   - each gas coupling
   - each bursting disc

   2a. Internal fault location after arching

3. DC resistance measurement of the main circuits:
4. Gas density monitor check

5. Interlock test
6. Measurement of moisture content:

The moisture test (dew point measuring) shall be made on > 10% of the SF6 gas compartments 3-4 weeks after gas filling. The moisture level shall then be within the specified level.

7. Manual operating check of circuit breaker, disconnect switch, earthing switch and fault making earthing switch

.

8. Power frequency withstand of main circuit:
After the completion of installation the GIS shall be tested with 80% of the AC voltage applied for the factory routine tests. Test duration shall be 1 minute. These tests shall be performed by means of special HV testing equipment connected to the GIS. The special testing equipment and special test adapters for flange connection (if required) shall be supplied by the manufacturer for temporary use during the tests.

9. Power frequency test of control circuit at 2 kV r.m.s. (1 min)

10. Any other tests to be recommended by the manufacturer.

26.0 SHIPMENT, STORAGE AND INSTALLATION

Packing, Shipment and Storage

Covers securely mounted for shipment. All covers to be removed during installation shall be clearly marked. Each shipping section shall be carefully sealed and filled with dry gas to slightly all equipment shall be suitably packed and protected during shipment. Each shipping unit, after passing all specified manufacturing tests, shall be sealed in a clean dry Condition with leak-tight shipping positive pressure to prevent the Entrance of moisture and contamination. The Vendor shall notify the user whether the Shipping sections contain SF6 or another type of dry gas. The packing method for the GIS equipment shall meet the manufacturers or International packing standard and it shall be guaranteed that each component of the Equipment will not be damaged, deformed or lost during shipping.

On each packing case the following details shall be provided:

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 numbers of contents
viii) Manufacturer’s name
ix) Country of origin
x) Case dimensions
xi) Gross and net weights in kilograms
xii) All necessary slinging and stacking instructions.

The Vendor shall supply instructions for storage of the equipment at site and for long term storage. Components requiring indoor storage shall be so identified. The Instructions shall outline any special precautions required for adequate storage including identification of components required to be stored indoors or in heated environments.

27. Installation, testing and commissioning

All assembly, installation, testing and commissioning of the GIS shall be done by the vendor under direct technical supervision of the manufacturer's qualified and experienced engineer. All tools and equipment required for assembly, installation, testing and commissioning of the GIS shall be in Vendor's scope

28. REQUIRED SUPPLY OF SPARE PARTS AND TOOLS

The Vendor shall include in his proposal the recommended spare parts for operation, testing and maintenance of GIS for next 5 years. Following tools / test equipment shall be supplied as a minimum:-

- Precision pressure gauge – 1nos
- Tools for gas handling (Gas filter, Gas Filling and Gas evacuation in single device) - 1 set
- Gas Leakage detector - 1 piece (DILO Make)
- SF6 filling and evacuating device - 1 set
- Greasing tools and grease if required for greasing gasket ring for 2 years.
- UHF Sensor spectrum analyzer for Partial Discharge (GIS shall be fitted with UHF sensors).
- Electronic moisture/SF6 gas humidity tester with dew point
- Circuit breaker analyzer one No.

Note :

1. **All the mounting hardware is in the scope of Bidders.**
2. **Tentative proposed Layout plan will be submitted by the owner.**
3. **Bidders shall give dimensional GIS Building layout and sectional layout as per requirement of owner for approval and review.**
   - **a. Location of GIS**
   - **b. Maintenance space required.**
   - **c. Location of local control cabinet.**
   - **d. Height of the EOT crane with building matches with site layout provide by BRPL.**
   - **e. All embedded parts drawings.**
   - **f. Trench Layout drawing.**
   - **g. Routing of GIS Bus duct.**
   - **h. Before approval of drawing of GIS bidder will submit complete control philosophy of the system**

29. QUALITY ASSURANCE

The Contractor shall have established a comprehensive and effective quality assurance (QA) - system for engineering, design, manufacturing and installation in close relation to QA standard ISO 9001, representing the highest level of quality system. The equipment shall be designed, manufactured and assembled according to IEC and ISO-standards. All steps of manufacturing of main equipment are done under guidelines and control of a standard inspection plan. The bidder shall submit a copy of the detailed

quality plan followed in his own manufacturing plant and sub-contactor's plant in the quotation for purchaser's review.

After award of contract the QA plan shall be reviewed and approved by the purchaser indicating the inspection hold points which purchaser may like to witness during manufacturing.

a) Document to be submitted

The document to be submitted by the Vendor shall include but not limited to the following. All documentation and application drawings and diagrams shall be in English.

Along with Quotation

1. Scope
2. Guaranteed technical particulars
3. Deviation with respect to the specification
4. General arrangement dwg
5. Single line diagram
6. Gas schematic diagram
7. Bill of material
8. Description of system equipment
9. Technical brochure
10. Details pertaining to GIS inherent self supervision / fault location
11. Details to effect bay extensibility.
12. Details pertaining to gas handling equipment, gas treatment plant
13. List of recommended spare parts
14. List of special tools or fixtures required for installation, testing, maintaining and operating the equipment.
15. Type test report
16. Estimated time schedule for installation and commissioning.
17. List of previously supplied GIS, along with contact address and email
18. Shipping dimension, weight and space required for handling parts for maintenance.
19. QA Plan
20. Cable side termination arrangement.
21. Details pertaining to filter, painting etc.

30. After award of contract

A- Approval R- For reference

Primary Equipment:

1 Elect. Single line diagram.
2 Guaranteed technical particulars
3 General arrangement drawing, plan, sections, elevation(A)
4 Foundation drawing. Including static and dynamic load and all civil requirements(R)
5 QA Plan(R/A)

6 One line and gas schematic (R)
7 Gas system alarm elementary diagram(R)
8 Wiring interface diagram(A)
9 Voltage Transformer documentation(R)
10 Current transformer documentation(R)
11 Terminal / Marshalling box GA and wiring diagrams.
12 Local control cubical GA and wiring diagram.
13 Cable side termination arrangement.(A)
14 Name plate drawing(A)
15 Factory routine test reports(A)
16 Test reports for on site test.
17 Instruction manual for installation, commissioning operation and maintenance (R)
18 Environmental guide for handling of SF6 and decommissioning (R)
19 Any other drawing / documents as required by the system.

31. DEVIATIONS

Deviation from this specification, if any, shall be clearly brought out in the offer. Unless owner explicitly accepts such deviations, it shall be considered that the offer fully complies with the specification.

TECHNICAL SPECIFICATION OF 66KV CONTROL & RELAY PANEL FOR NEW GRIDS

Specification no – SP-CRP-01-R2

Prepared by	**Javed Ahmed**		**Rev: 3**
Reviewed by	**Abhinav Srivastava**		**Date: 14.01.2019**
Approved by	**K.Sheshadri**		

Revision Record

S.No.	Rev.No.	Item/Clause No.:	Nature of change	Approved By
1	R1	4	Width of cubicle shall be 1250mm	KA
2	R1	5.7	Spare terminal in each type of terminal.	KA
3	R1	6	Test terminal block for numerical relays and meter.	KA
4	R1	8	Mimic diagram alignment with discrepancy type control switch.	KA
5	R1	11.4	Multifunction meter with digital output with modbus communication.	KA
6	R1	11.4.3	Communication protocol IEC 61850 metering equipment.	KA
7	R1	12.1.5	Communication protocol IEC 61850 in Numerical Relays.	KA
8	R1	12.1.9	All necessary converters shall be consider for communication of numerical relays in case of optical fiber.	KA
9	R1	12.1.16	Digital input and output of Numerical relays	KA
10	R1	12.2.1.2	Line current differential with distance relays in Line control and relays panel.	KA
11	R1	12.2	Optical fiber communication in line current differential relays with distance relays in Line control and relays panel.	KA
12	R1	12.4	Auxiliary relays shall NO/NC contact shall be as per BSES requirement.	KA
13	R1	13.0	Minimum no. of annunciation window shall be 24Nos.	KA
14	R2	18.4.1	Addition of Alstom Make Relays	VP
15	R3	5.9	DC Changeover for each scheme	KS
16	R3	12.1.1	Harsh weather coating	KS
17	R3	12.1.5	Relay communication clause revised	KS
18	R3	12.1.7	Relay plug settings clause added	KS
19	R3	12.1.8	Fault recording clause revised	KS

20	R3	12.1.9	General features of Relay clause revised	KS
21	R3	12.1.11	Electrical Reset for lockout relays	KS
22	R3	12.1.14	Spare Contacts and Warranty of Relay added	KS
23	R3	12.2	Relay General Requirement clause revised	KS
24	R3	16.4	Ventilation Fan added	KS
25	R3	18.4.1	Approved makes of Numerical Relays Clause revised	KS
26	R3	2.4	Addition of Communication cable and software CD for Relay Programming	KS
27	R3	2.5	Addition of supply of Laptop along with CRP supply	KS
28	R4	1.6	Warranty of all the Relays shall be 5 years.	KS
29	R4	1.7	Harsh weather conformal coating shall be provided for all the numerical Relays.	KS
30	R4	1.8	All Hardware, connecting cables for Relay programming and other connecting cables, Software's, ICD files shall be in Bidders scope.	KS
31	R4	18.4.1	Numerical Relay	KS
32	R5	12.4.5	Reverse Blocking scheme	KS

Volume-I Technical Specification for 66KV Control & Relay Panel

SCOPE OF SUPPLY

1.1 This specification covers design, manufacture, testing at manufacturer's works, packing and delivery of control and relay panel for substation equipments.

1.2 The control and relay panel shall be complete with all components and accessories, which are necessary or usual for their efficient performance and trouble free operation under the various operating and atmospheric conditions as specified in the Annexure A of data sheet.

1.3 Such parts which may have not been specifically included, but otherwise form part of the CRP as per standard trade and/or professional practice and/or are necessary for proper operation of control and relay panel, will be deemed to be also included in this specification.

1.4 All the Necessary Communication Cable for Relay programming and software CDs

1.5 Laptop of Lenovo/Dell make i7 with 1TB HD and 8 GB RAM shall be supplied with CRP free of cost

1.6 Warranty of all the Relays shall be 5 years.

1.7 Harsh weather conformal coating shall be provided for all the numerical Relays.

1.8 All Hardware, connecting cables for Relay programming and other connecting cables, Software's, ICD files shall be in Bidders scope.

2.0 CODES & STANDARDS:

Control and Relay panel should be designed and manufactured in accordance with the following standards –

National Standard

Standard Code	Standard Description
IS-1248, Part 1- 1993	Direct acting indicating analogue electrical measuring instruments and their accessories.
IS-3231, Part 1- 1986 Part 2 &3 -1987	Electrical relays for power system protection
IS-9000 Part 1 -1988	Basic environmental testing procedures for electronics & electrical items
IS-13703 1993	Low voltage fuses for Voltages not exceeding 1000V AC or 1500 V DC
IS-13947 Part 1 - 1993	Low voltage switchgear & control gear
IEC-60255 - 1989	Specification for electrical relays

IEC 60688 1997	Electrical measuring transducers

3.0 PANEL CONSTRUCTION

	Description	Requirement / Rating
4.1	Panel Type	Simplex panels of standard dimensions. Equipment shall be mounted on the front of the panel and doors for wiring access shall be at the back of panels.
4.2	Enclosure type	Completely metal enclosed and dust, moisture and vermin proof. Degree of protection not less than IP-4X in accordance with IS 13947
4.3	Enclosure material	Cold-rolled sheet steel of thickness not less than 2.0 mm. Stiffeners shall be provided wherever necessary.
4.4	Doors	Doors shall be at the rear. For panels having width should be more than or equal to 1250mm, double leaf doors shall be provided. Doors shall have handles with either built-in locking facility or be provided with padlock.
4.5	Gland Plate	At least two separate gland plates of removable type shall be provided for each panel. They shall be of sheet steel of thickness not less than 3.0 mm.
4.6	Cable Entry	Shall be from the bottom
4.7	Gaskets	All doors, removable covers and panels shall be gasketed all around with neoprene gaskets.
4.8	Ventilating louvers	Ventilating louvers, if provided shall have screens and filters. The screens shall be made of either brass or GI wires mesh.
4.9	Foundation	The panels shall be fixed on the embedded foundation channels with intervening layers anti vibration strips made of shock absorbing materials. Base frames shall be supplied along with panels.
4. 10	Mounting	Equipment on front of panel shall be flush mounted. Cutouts if any, provided for future mounting of equipment shall be properly blanked off with blanking plate no equipment shall be mounted on the doors.
4.11	Mounting level	The center lines of switches, push buttons and indicating lamps shall not be less than 750mm and that for relays, meters and recorders shall be not less than 450 mm from the bottom of the panel.
4.12	Appearance	The center lines of switches, push buttons and indicating lamps shall be matched to give a neat and uniform appearance. Like wise the top lines of all meters, relays and recorders etc, shall be matched.
4.13	DC Changeover	DC changeover scheme for each panel with DC1 & DC2

4.0 WIRING

5.1	Internal wiring	1100V grade, single core, stranded copper conductor

		wires with PVC insulation. Note: all control cables shall be FRLS type
5.2	Size	4 sqmm for CT circuits, 2.5 sqmm for PT and control circuits.
5.3	Colour Code	R ph - Red, Yph - Yellow, B ph - Blue, Neutral - Black for CT and PT circuits. DC - Grey, AC - Black and Earth - Green
5.4	Ferrules	Ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wire. Wires directly connected to trip circuit shall be distinguished by the addition of red colored unlettered ferrule.
5.5	Termination	Fork type, pin type and ring type (as applicable) tinned copper lugs to be used. Insulated sleeves shall be provided at all the wire terminations.
5.6	Wiring Enclosure	Plastic channels to be used as enclosures. PVC sleeves to be used for inter panel wiring.
5.7	Spare Contacts	Spare contacts of relays and contactors etc. should be wired upto the terminal block
5.8	Inter panel wiring	When panels are arranged adjacent to each other inter panel wiring of common bus wires between the panels shall be furnished. These adjacent inter panel wiring shall be clearly indicated in the wiring tables.
5.9	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. DC Changeover scheme for each panel

5.0 TERMINAL BLOCKS

6.1	Rating and Type	1100 V grade, minimum 10 amps continuous rating, Nylon 66, molded piece, complete with insulated barriers, stud type terminals, washers, nuts and lock nuts. White fiber markings strip with clear plastic, slip-on / clip-on terminal covers to be provided.
6.2	CT & PT Terminals	Terminal Blocks (TB) for current transformer and voltage transformer secondary leads shall be Ring Type provided with test links and isolating facilities. Also current transformer secondary leads shall be provided with short-circuiting and earthing facilities.
6.3	Spare Terminals	20% in each type of TB row
6.4	Clearance with gland plate	Minimum 250mm
6.5	Clearance between two TBs	Minimum 150mm

6.6	Test Terminal Blocks	Screw driver operated stud type for each type of numerical relays and metering
6.7	Suitability	Unless otherwise specified, terminal blocks shall be suitable for connecting the following conductors of cable on each side: a) All circuits including current / voltage transformer circuits: 4 sq.mm copper. b) AC / DC power supply circuits: one no. of 10 mm2 Al./ 6 sq.mm Cu.
6.8	Arrangement	Arrangement of the terminal block assemblies and the wiring channel within the enclosure shall be such that a row of terminal block runs in parallel and close proximity to each side of the wiring duct. The side of the terminal block opposite the wiring duct shall be reserved for the external cable connection.

6.0 PAINT

7.1	Paint Type	Powder coated. Pure Polyester base Grade-A, structure finish.
7.2	Paint Shade	RAL7032 'Siemens Grey'
7.3	Paint Thickness	Minimum 50 microns

7.0 MIMIC DIAGRAM

8.1	System Representation	Colored mimic diagram and symbols showing the exact representation of the system shall be provided in the front of control panels and it shall be properly align with all discrepancy type control switch of panels.
8.2	Material	Mimic diagram shall be made preferably of painted Aluminum or plastic of approved fast color material, which shall be screwed on to the panel and can be easily cleaned. Painted overlaid mimic is also acceptable. The mimic bus shall be 2-3 mm thick. The width of the mimic bus shall be 12mm for bus bars and 10 mm for other connections.
8.3	Mimic Indications	Discrepancy type switches are to be used for breaker and isolator control indication and semaphore indicators shall be used for earth switch position.

8.0 NAME PLATES & MARKINGS

9.1	Provision of Nameplates	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. Also, large and bold name plate carrying the feeder identification numbers shall be provided for circuit / feeder designation on the top of each panel on front as well as rear side. 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.
9.2	Nameplate Material	Non-rusting metal or 3 ply lamicoid. Nameplates shall be black with white engraving lettering. Stickers are not allowed.
9.3	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, R-Y-B OFF etc.

9.0 EARTHING

10.1	Panel Earthing	All panels shall be equipped with an earth bus securely fixed.
10.2	Material	The material and the sizes of the bus bar shall be 25 x 6 mm copper flat unless specified otherwise.
10.3	Earth Bus joints	All bolted joints in the bus will be affected by connection of two bolts.
10.4	Hinged Doors	Earthed through flexible copper braid.
10.5	Instrument and Relay Earthing	All metallic cases of relays, instruments and other panel mounted equipment including gland plate, shall be connected to the earth bus by copper wires of size not less than 2.5 mm2. The color code of earthing wires shall be green
10.6	CT and PT circuit Earthing	VT and CT secondary neutral shall be earthed at one place only at the terminal blocks through links.

10.0 INSTRUMENTS

11.1	Mounting	Flush Mounting
11.2	Type	Digital
11.3	Ammeters and Voltmeters	Taut Band, Digital type
11.3.1	Size	96x96mm
11.3.2	Provision	All panels
11.3.3	Selector switch	to be provided
11.3.4	Accuracy Class	0.5 or better.

11.4	Multifunction meter	Three phase 4 Wire - digital type with Modbus Output.
11.4.1	Provision	All panels except bus-coupler
11.4.2	Accuracy Class	0.5 or better.
11.4.3	Communication Capability	Provision as per IEC 61850 Protocol with serial port communication to be made.
11.4.4	Additional facility	Scrolling facility with LCD display for parameters like power factor, kW, kWh, kVA, kVAR, current, voltage etc.

11.0 RELAYS

12.1	Protective Relays - General features	
12.1.1	Technology and Functionality	Microprocessor based with provision for multifunction protection and control, metering, monitoring, User machine interface, communication interface, self-diagnosis functionalities. Harsh Weather Coating. With Time Sync on SNTP through GPS
12.1.2	Mounting	Flush Mounting, IP5X
12.1.3	Architecture	Hardware and software architecture shall be modular and disconnect able to adapt the protection and control unit to the required level of complexity as per the application.
12.1.4	Programming and configuration	Relay shall utilize a user friendly setting and operating multilingual software in windows environment with menus and icons for fast access to the data required.
12.1.5	Relay Communication	Ethernet/USB communication interface for data transfer and configuration to Local PC. SCADA using Ethernet on dual RJ45 for 61850 protocol. CB/Isolator control block should be available in relay. FO for line differential shall be single mode(2RX and 2TX)
12.1.6	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.
12.1.7	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. Wide setting range for Plug setting 0 to 20 times with second decimal resolution for all stages. TMS resolution upto third decimal place.
12.1.8	Fault recording	All events, fault record, to be stored in be in Non-volaile memory with date and time stamp. Minimum 10 Fault record in form of numeric values. Minimum 100 events..
12.1.9	General Features of Numerical Relays	Measurement of Event Recording , Disturbance Recording including differential & Bias current in addition to all currents & voltages, Harmonic Distortion , RMS Current values & Frequency, Peak and Rolling Current Values, Max. and Average current Values, Phase and or Neutral Angles , Max. and average voltage, Power and Energy, Apparent Power and Apparent Power and Apparent Energy with Time Synchronization. DC voltage measurement including soft & hardware based indication. Relay should record not less than 10 Waveform Records of not less than 1sec each which can be triggered through user selectable inputs such as Protection start, trip stage signals, BI, BO, Virtual/goose signals and other user defined signals. Waveform record should show user selectable inputs such as all protection start, trip stage signals, BI, BO, Virtual/goose signals, other user defined signals and analog measurement values along with labels. The waveform record should support standard Comtrade file explorer softwares. Waveform recorder configuration should be user friendly. Supply of relay software and communication cables
12.1.10	Self diagnosis	Relay shall be able to detect internal failures. A watchdog relay with changeover contact shall provide information about the failure.
12.1.11	Reset Contacts	Self reset contacts except for lockout relays. Electrical Reset Lockout relays
12.1.12	Operation Indicators	LEDs with pushbutton for resetting.
12.1.13	Auxiliary supply	As per requirement . Preferably universal Aux

		voltage from 48-250V
12.1.13	Operational Data	Bidder shall provide the reference list of the type of relays offered
12.1.14	Spare Contacts	Minimum 20% Spare contacts Minimum 20% of spare DI and DO. RELAY WARRANTY: 5 Yrs
12.1.15	Test Facility	Inbuilt with necessary test plugs.
12.1.16	DI / DO of Numerical relay	No. of Digital input / Digital output of any type of relay which shall be used in control and relay panel shall be as per BSES requirement and signal list only. Refer the attached tentative signal list of all feeders (Incoming/Out going, Trasformer & Transformer Monitoring Unit, Buscoupler & Bus PT).
12.1.17	Contacts for Transformer NIFPS	Contacts of NIFPS shall be provided in Transformer panel, Separate contacts of relays for 87T,86 trip,Buchholz,PRV
12.2	**Protective Relays - Requirement**	
12.2.1	For 66kV	
12.2.1.1	Bus Bar Protection Centralised Scheme for Bus Bar Protection	Numerical type, mounted on a separate panel with fault recording. CT wise supervision to be provided.
12.2.1.2	Line Panel	Relay-1 Line current Differential function suitable through optical fiber communication, Distance Protection with multiple characteristics i.e Mho , Quadrilateral etc. -With CBFP Protection Dual redundant FO channel for Differential protection communication between peers.
		Relay-2 Directional and non- Directional 3-phase over current and earth fault Protection with load blinder.
		Combining the functions of Relays-1 & Relays-2 in single relay is not acceptable
		Synchronizing Check Relay (shall be 3 Phase)
		Broken Conductor Protection
12.2.1.3	Bus Coupler	3 Phase Over current protection , Earth fault protection Check Sync
12.2.1.4	Capacitor feeder	Three phase over current protection Phase unbalance protection
		Earth fault protection
		Neutral unbalance (separate relay)

		Under voltage relay
		Over Voltage relay
		Timer for ON time delay.
		Negative Sequence
		Under Current protection
12.2.1.5	Transformer Feeder/Panel	Relay – 1 • Differential protection with Back up O/C & E/F protection, with software based ratio and vector correction without ICT. • REF protection for the star side. Relay should support high impedance as well as low impedance REF protection(user selectable through relay HMI/Software) Waveform recorder of relay should record all differential and Bias current along with standard Current and Voltage channel.
		Relay – 2 • Overcurrent protection • Earth fault protection • Standby Earth fault protection
		Relay – 3 Transformer monitoring relay including AVR Features or equivalent & the no. of DI / DO Shall be as per BSES Requirement. Minimum 3 Analog i/p (4-20mA)
		Relay 1, 2 &3 are separate relays. Combining all the functions of relay 1, 2&3 in a single relay is not acceptable
12.3	**Auxiliary relays - General Features**	
12.3.1	Type	Static or electromechanical.
12.3.2	Reset Characteristic	Self reset contacts except for lockout relays .Electrical reset for Lockout relay
12.3.3	Operation Indicators	Hand reset operation indicators or LEDs with pushbutton for resetting.
12.3.4	Lockout relay	Manual reset type
12.3.5	Auxiliary supply	As per requirement
12.3.6	Operational Data	Bidder shall provide the reference list of the type of relays offered
12.3.7	Spare Contacts	As per requirement of BRPL + 20% Spare contacts
12.4	**Auxiliary relays - Requirement :** Provision for multiplication of auxiliary contact of breakers, isolators and earth switches to be made in each panel using contactors instead of Bistable contactors	
12.4.1	Each Panel	To be provided with separate anti-pumping (94), Lockout (86), DC fail (80) and trip circuit supervision (95) relays.
		Including 86 Supervision, Separate DC

		Supervision relays for both sources as well as main panel DC, 95 relay for both coils
12.4.4	Incoming and Outgoing Feeder Panels	Provision of PT supply supervision and suitable automatic selection scheme between Line PT and Bus PT supplies for uninterrupted metering.
12.4.5	Reverse blocking and LBB protection Scheme	Shall be provided.

12.0 ANNUNCIATION

13.1	Type	Static type along with alarm. Annunciations shall be repetitive type and shall be capable of registering the fleeting signal. Facia test facility should also be provided
13.2	Mounting	Flush mounted
13.3	Facia	Minimum 24 Nos. Facia along with appropriate labels on each facia.in each panel
13.4	Push Buttons	Push buttons for test, accept and reset to be provided
13.5	Potential Free Contacts	To be provided for event logger

Sequence of operation of the annunciator shall be as follows:

S No	Alarm Condition	Fault Contact	Visual Annunciation	Audible Annunciation
1.	Normal	Open	Off	Off
2.	Abnormal	Close	Flashing	On
3.	Accept	Close	Steady on	Off
4.	Return to normal	Open	Steady On	Off
5.	Reset	Open	Off	Off
6.	Reset before return to normal	Close	Flashing	On

13.0 INDICATIONS

14.1	Indicating Lamps	Flush mounted Clustered LED type with rear terminal connections. Lamp Cover to be screwed type an moulded from heat resistant material
14.1.1	Breaker On	Red
14.1.2	Breaker Off	Green
14.1.3	Spring Charged	Blue
14.1.4	DC control supply fail	Amber
14.1.5	Auto trip	Amber
14.1.6	Heater Circuit healthy	Yellow
14.1.7	Trip Circuit Healthy	White

14.1.8	PT supply	R, Y, B
14.1.9	Hooter with isolation switch	For AC and DC supply failure
14.2	Position Indicators	Semaphore type indicators shall be provided for mimic diagrams

14.0 SELECTOR SWITCHES & PUSH BUTTONS

15.1	Selector Switch	All the selected selector switch shall be only discrepancy type Flush Mounted with shrouded terminals
15.1.1	TNC Switch	Pistol Grip type, Lockable with spring return to normal position
15.1.2	Local/SCADA selector switch	4 pole
15.1.3	Ammeter selector switch	6way 7 position
15.1.4	Voltmeter selector switch	6 way 7 position
15.1.5	Rotary On/Off Switches	For heater/illumination circuit
15.1.6	Rating of switches	16 A
15.2	Push button	Flush Mounted with shrouded terminals
15.2.1	Accept Push Button	Black Color-Trip alarm/DC fail alarm
15.2.2	Reset Push Button	Yellow Color- Trip alarm/DC fail alarm
15.2.3	Test Push Button	Blue Color
15.2.4	Rating	10A

15.0 ACCESSORIES

16.1	Space heaters	Thermostat controlled with switch for isolation
16.2	Socket and switch	240V, 5A socket to be provided in each panel with on-off switch
16.3	MCBs	Provision for receiving, distribution, isolation and fusing of DC and AC supplies to various control circuits should be made using MCBs of appropriate ratings.
16.4	Panel illumination & Ventillation	240V AC illumination lamp controlled by panel door switch to be provided in each panel. Provision of ventilation fan.

16.0 TESTING & INSPECTION

17.1	Type tests	Product must be type tested as per Indian Standards or IEC
17.1.1	Type test report validity	Last five years from the date of bid submission
17.2	Acceptance and Routine tests	As per specifications and relevant standards. Charges of these tests shall be deemed to be included in the equipment price. Purchaser reserves the right to witness all the tests.
17.3	Notice to Purchaser for conducting tests	At least three weeks in advance
17.4	Test reports of acceptance and routine test before dispatch	Six copies to be submitted.

17.5	Stage and Final Inspection	All the Qty. of Panels will be inspected by BSES as per approved QAP .
17.6	Submission Of QAP	QAP will be submitted by suppliers with submission of Schematic Drawings.
17.7	Deliverable	1.As Built Drawing of panel 6 Sets
		2. Maintenance Manuals – 2CD / DVD Soft Copy , 6 Set of Hard Copy
		3. Relay and equipments Catalogues & Manuals
		4. Relay Settings & Maintenance Manuals
		5. Relays software and connection/ communication cables
17.8	Training	Training on relays and equipment operations shall be provided to the officials of BRPL will be in the Scope of Suppliers.

17.0 DRAWINGS & DATA SUBMISSION

18.1	**Submissions along with the bid**	
18.1.1	Duly filled GTP and copy of specification/ Bill of material	2 copies + 1 soft copy
18.1.2	GA/ Cross sectional drawing of panel/SLDs/ Wiring diagrams	2 copies + 1 soft copy
18.1.3	Calculations for MCBs, MCCBs, Fuses and stabilizing resistors etc	2 copies + 1 soft copy
18.1.4	Catalogues and Manuals for all equipments	1 copy
18.1.5	Test Reports	2 copies
18.1.6	Deviations from this specification	
18.1.7	Type test report	For type, size and rating of equipment offered.
18.1.8	Reference List of customers	For last five years with units of similar design and rating
18.1.9	Recommended spares and consumables	For five years of operation along with price list
18.1.10	Manufacturer's quality assurance program	To be provided
18.2	Submissions after award of contract	
18.2.1	Duly filled GTP and copy of specification/ Bill of material	4 copies
18.2.2	GA/ Cross sectional drawing of panel/SLDs/ Wiring diagrams	4 copies
18.2.3	Calculations for sizing of various equipment	4 copies
18.2.4	Catalogues and Manuals for all equipments	1 copy
18.2.5	Deviations from this specification	Approved in writing before award of contract
18.2.6	Foundation Plan	
18.2.7	Calculations for sizing of various components	Showing all views and sections
18.2.8	Type test reports	For all brought out items
18.3	Submissions prior to dispatch	

18.3.1	Inspection and test reports/ compliance report by manufacturer	1 set
18.3.2	As Built drawings/GA/SLDs and Wiring diagrams	6 copies + 1 soft copy
18.3.3	Calculations for sizing of various equipment	6 copies + 1 soft copy
18.3.4	Catalogues and Manuals for all equipments	6 copies + 1 soft copy
18.3.5	Test certificates	6 copies + 1 soft copy
18.4	Drawing and document sizes	Standard size paper A3 and A4
18.4.0	**Approved Make of components for 66 KV Switchgear Panel**	
18.4.1	Numerical Relays	**1) O/C & E/F Relay:** a) Siemens- Siprotec 4 and 5 Series Relay b) Schneider Make- P143 c) GE make P14 Series Relay d) ABB Make-REF615 **2) Differential for Transformer Relay:** a) Siemens Make- 7UT Series b) GE&Schneider Make-642 Series **3) Line Differential & Distance Relay** a) Schneider Make P543 Series In addition to above going forward following points shall be implemented in our specification a) 20% spare contacts in Relays b) Design Temp (continuous operating Temperature) minimum 65 Degree C e) Ring formation of all protection devices instead of star formation.
18.4.2	Auxiliary Electromechanical Relays	ABB / Areva / Schneider
18.4.3	Contactor / Auxiliary Relays	Schneider Electric / Siemens / ABB
18.4.4	Analog Ammeter / Voltmeter	AE / Rishabh
18.4.5	Indication Led , Lamp	Teknic
18.4.6	Push Button	Teknic
18.4.7	Field Terminal Block	Phoneix / Elemex / Connect well
18.4.8	MCB	Schneider / Siemens / L&T/ABB

18.4.9	Hooter	Alan
18.4.10	Panel Light	Philips / Bajaj / Surya
18.4.11	Power Socket	Anchor / Reputed make
18.4.12	Multifunction Meter	Rishab / Socomec
18.4.13	Wires for wiring	KEI / Polycab / Finolex
18.4.14	Test Terminal Block	Areva / IMP/Nelster
18.4.15	Control Switch	Areva / Switron
18.4.16	Annuciator Window	Alan / Minilec
18.4.17	Discrepancy switch	Multimode/As per approved BRPL makes during drawing approval.

18.0 TRAINING AND COMMISSIONING SUPPORT

a) Supervision of Erection, Testing and Commissioning inclusive of all testing equipment/ instruments shall be included in the bid/proposal.
All Hardware and softwares including Relay setting files and other support shall be in the scope of Vendor.

b) Training of buyers officials (6 officials) on operation and maintenance including relay setting/operations at site (after installation) shall be included in the proposal/bid

19.0 DEVIATIONS

Deviation from this specification, if any, shall be clearly brought out in the offer. Unless owner explicitly accepts such deviations, it shall be considered that the offer fully complies with the specification.

TECHNICAL SPECIFICATION

FOR

BATTERY CHARGER

Prepared by	**Javed Ahmed**			**Rev: 0**
Reviewed by	**Abhinav Srivastava**			**Date:**
Approved by	**KS**			

Volume-I Technical Specification for Battery Charger

1.0 CODES & STANDARDS:

Material, equipment and methods used in the manufacture of battery charger shall confirm to the latest edition of following standard: -

Standard Name / No	Standard's Description
Indian Electricity Rules	Relevant safety regulation of CEA
Indian Electricity Act 2003	
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 1100 V
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

2.0 DOCUMENTS REQUIRED

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 loads
iii. Approved vendor drawings
iv. Other documents
v. Battery Charger sizing calculation

Volume-I Technical Specification for Battery Charger

3.0 CHARGER DESIGN FEATURES:

The equipment shall have all the following features –

3.1	Configuration	As per calculation during detailed engineering with 2X100% Float cum Boost Charger.
3.2	Panel type	Metal enclosed frame construction
3.3	Location	Indoor, non air conditioned environment
3.4	Doors for front access	With anti theft hinge &handle
3.5	Cover for rear access	With Allen screw M6 size & handle
3.6	Construction	Sheet metal 2.0mm thick CRCA
3.7	Base frame	75mm ISMC
3.8	Lifting lugs	Four number
3.9	Gland plate	3mm metallic, un drilled & removable type
3.10	Enclosure protection	IP42 Minimum
3.11	Power terminal	Bus bar type, minimum 300mm above gland plate
3.12	Control terminal	Nylon66 with brass clamp
3.13	Bus bar	Tinned copper with insulation sleeve
3.14	Earth bus bar	Aluminum sized for rated fault duty for 1sec
3.15	Earth bus internal connection to all non current carrying metal parts	By copper flexible wire 2.5 sqmm
3.16	Earth bus external connection to owner earth	Al bus on both sides of panel with two holes for M10 bolt
3.17	Cooling	Natural ventilation without fan
3.18	Panel heater	Thermostatically controlled through MCB
3.19	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)
3.20	Input isolation transformer	Dry type
3.21	Isolation & protection device	Mounted at height minimum 1000mm from bottom
3.21.1	MCCB	For charger input, output & battery input
3.21.2	Battery & test resistor load	Lockable change over switch with one position for charger, second for ‘OFF’ & third position for external test resistor.
3.22	Hardware (Nut, bolts & handle)	Stainless steel
3.23	Charger configuration	
3.23.1	Type	3 phase full wave full controlled semiconductor rectifier with heat sink
3.23.2	Pulse	Minimum six pulse

3.23.3	Essential provision	Surge suppression, harmonic suppression, blocking diodes, filters for ripple control ,
3.23.4	Automatic phase sequence corrector	For 3 phase supply in right sequence, phase conversion. Protect equipment from phase reversal, phase loss.
3.23.5	Insulating shrouds	On all live parts, power semi conductors & electronic components
3.24	DC distribution board	If integral with charger, shall be given in separate compartment / shipping section
3.24.1	Outgoing feeder	Number & rating as per requirement. Each equipment shall have separate outgoing feeder.
3.24.2	Feeder type	All double pole MCB with insulating shrouds located inside panel
3.25	Ripple content in DC output	1% maximum
3.26	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%
3.27	Reverse polarity connection	Protected against reversed battery polarity
3.28	Charger efficiency	85% minimum
3.29	Noise output	65DB maximum
3.30	Charger selector switch	For auto/manual and float/boost selection, lockable type inside panel
3.31	Charging current settings	25% to 100% of rating
3.32	Charging current accuracy	2% of set current with input voltage variation of ±10% and frequency variation of ±5%
3.33	DC output adjustment range for float & boost charge (voltage & current)	By potentiometers inside panel, range suitable for NiCd as well as Lead Acid battery bank
3.34	Louvers	With stainless steel wire mesh
3.35	Gasket	Neoprene rubber
3.36	Panel illumination lamp with door switch	MCB controlled, with 5/15amp switch socket
3.37	Panel door keys	4 no. per panel, identical key for all panels
3.38	PCBs for electronic circuitry	With protective layer finish at back
3.38.1	PCB soldering	Preferably by wave soldering process
3.38.2	PCB/ electronic card mounting	With press fit type locking arrangement
3.39	Semiconductor component mounting	Shall not be on bakelite sheet

4.0 METERING, ANNUNCIATIONINS & INDICATION:

4.1	Ammeter (96x96mm)	Digital type, for AC input, DC output & battery current
4.2	Voltmeter (96x96mm)	Digital type, with selector switch for AC input, DC output & battery voltage
4.3	LED indication on panel front	
4.3.1	Status	
4.3.1.1	Input AC supply available on R,Y & B phase	Red/yellow/blue color LED
4.3.1.2	Float cum Boost charger AC MCCB 'ON'	Red color LED for each charger module
4.3.1.3	Charger output DC 'ON'	Red color LED for each charger module
4.3.1.4	Outgoing DCDB feeder ON	Red color LED for each other
4.3.2	Fault	
4.3.2.1	DC earth fault	Amber color LED
4.3.2.2	Battery MCCB OFF	Amber color LED
4.3.2.3	Charger output DC under/ over voltage	Amber color LED
4.3.2.4	AC mains under	Amber color LED
4.4	Annunciation	Hooter with isolating switch for fault annunciation.
4.5	Potential free contacts for remote indication	Wired to terminal blocks
4.5.1		Battery on boost
4.5.2		DC bus under voltage
4.5.3		DC bus over voltage
4.5.4		DC bus earth fault
4.5.5		Battery MCCB trip/ OFF
4.5.6		Common charger trouble
4.6	Common charger trouble to include-	All the charger trouble conditions shall have a potential free contact wired to terminal block and annunciation in the form of separate annunciation or on display unit of common controller
4.6.1	Incoming AC under voltage	
4.6.2	Incoming AC over voltage	
4.6.3	Charger input MCCB trip/ OFF	

4.6.4	Charger output MCCB trip/ OFF	
4.6.5	Charger Dc under voltage	
4.6.6	Charger Dc over voltage	
4.6.7	Charger rectifier fuse blown	
4.7	Communication	All the above alarm, analog signal etc shall be available at single port on modbus protocol for SCADA.

5.0 APPROVED MAKE & COMPONENTS

5.1	Switch	Siemens / L&T (Salzer)
5.2	HRC Fuse Links	GE/ Siemens/ L&T
5.3	Diodes & SCR	Hirect/USHA/IOR
5.4	Meters	AE/Rishabh
5.5	AC Contractors &O/L Relay	L&T/Siemens/Telemechanique/GE/ABB
5.6	Terminals	Connectwell/Elmex/Wago/Phoenix
5.7	Push buttons / Actuator	L&T/Siemens/Vaishno
5.8	MCCB	L&T/Siemens/ ABB/GE
5.9	MCB	Legrand/Hager/Schneider
5.10	Indicating lamps LED type	Vaishno/Binay/Teknic/Siemens/Mimic

Note – Any other make or component to be approved by owner.

6.0 DCDB FEEDER DETAILS:

DCDB shall be integral part of Battery charger and in scope of Vendor

S.No	Application	Type of Switchgear	Rating (A)	Quantity
1	Incomer	MCCB*	250	2
2	Battery Discharge feeder	MCCB*	250	1
3	DC emergency light	MCB*	40	2
4	ACDB	MCB*	40	1
5	66kV CRP	MCB*	40	8
6	11kV VCB	MCB*	40	15
7	Fire Alarm	MCB*	40	2
8	SAS	MCB*	40	2

20% spare Feeders shall be provided each type in addition to above

Volume-I Technical Specification for Battery Charger

7.0 MMIC DIAGRAM, LABEL & FINISH

6.1	Mimic diagram	To be provided
6.2	Name plate on panel front	
6.2.1	Material	Anodized Aluminum 16SWG
6.2.2	Background	SATIN SILVER
6.2.3	Letter, diagram & border	Black
6.2.4	Process	Etching
6.2.5	Name plate details	Manufacturer name, month & year of manufacture, equipment type ,input & output rating, Owner name & order number, guarantee period, weight of panel, degree of protection, Sr. No.
6.3	Labels for meters, indication & all cards / sub assemblies in panel	Anodized Aluminum with white character on black background
6.4	Danger plate on front & rear side	Anodized Aluminum with white letters on red background
6.5	Painting surface preparation	Shot blasting or chemical 7 tank process
6.6	Painting external finish	Powder coated polyester base grade A, shade – RAL 7032, uniform
6.7	Painting internal finish	Powder coated polyester base grade A, shade – white, uniform thickness 50 micron minimum
6.8	Labels for all components in panel	Anodized Aluminum with white character on black background, fixed by rivets only

8.0 INSPECTION & TESTING

7.1	Type test	Equipment 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.
7.2	Routine test	As per relevant Indian standard
7.3	Acceptance test	To be performed in presence of Owner at manufacturer works
		- Physical inspection & BOM, wiring check
		- Insulation resistance test
		- HV test for one minute
		- Voltage regulation test
		- Heat run test for 12 hours
		- Measurement of efficiency, power factor & ripple content

9.0 DEVIATIONS

Deviation from this specification, if any, shall be clearly brought out in the offer. Unless owner explicitly accepts such deviations, it shall be considered that the offer fully complies with the specification.

TECHNICAL SPECIFICATION

FOR

LITHIUM ION BATTERY

Specification No-GN101-03-SP-118-00

Prepared by	**Amar Deep Singh**		**Rev: 3**
Reviewed by	**Abhinav Srivastava**		
Approved by	**Sheshadri Krishnapura**		**Date:**

Revision Summary

S. No	Revision No	Item Clause	Nature of Change	Approved By
1	R1	Clause no 6.1	Battery Size shall be Minimum 150AH	KS
2	R1	Clause no 6.18	Indications for ON/OFF and SOC	KS
3	R1	Clause no 6.19	Name Plate Details	KS
4	R1	Clause no 6.20	Equipment ID Painting	KS
5	R1	Clause No. 8	Packing and Delivery	KS
6	R2	Clause no 12	Variation in voltage levels	KS
7	R3	Clause No. 6.5.1	Li-ion chemistry – other available chemistry are also added	KS
8	R3	Clause No. 2	IEC and UL standards are added at S. No. 4, 5, 6 & 15	KS
9	R3	Clause No. 5.3	Nominal voltage changed from 50V to 48V as per industry norms	KS
10	R3	Clause No. 6.21	Safety Features – RoHS compliance is added	KS
11	R3	Clause No. 6.23	Battery Management System specification is added	KS
12	R3	Clause No. 6.5.1	Volumetric Energy Density parameter is removed	KS
13	R3	Clause No. 6.5.2	Gravimetric Energy Density parameter is removed	KS
14	R3	Para 12	Battery DoD is added in GTP	KS
15	R3	Para 12	Battery Cut-off is added in GTP	KS

Index

1.0 SCOPE

This specification covers design, engineering, manufacture, assembly, stage testing, inspection & testing before supply, delivery at site and Erection Testing &Commissioning including SCADA communication of 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	
CBIP manual	
IEC 62281,62619, 61000-4-2	Safety of primary and secondary lithium cells and batteries, Safety requirements for secondary lithium cells and batteries, for use in industrial applications, Electrostatic Discharge Immunity Test
IEC 62133, IEC 62620:2014,	Battery Safety
IEC 61960	Performance tests, Designations, markings, dimensions, and other requirements
IEC 61959	Tests and requirements for verifying the mechanical behavior.
IS 5	Paint and Enamels
IS 13703	LV Fuses
IS 5578	Guide for marking insulated conductors
IS 694	Polyvinyl Chloride Insulated Unsheathed And Sheathed Cables/Cords With Rigid And Flexible Conductor For Rated Voltages Up To And Including 450/750 V
IS 1248	Direct Acting Indicating Analogue Electrical Measuring Instruments and their Accessories
IEEE	Relevant Standard
UL 1642	Individual cell compliance
UL 1973	Battery module complies, test methods and requirements to ensure safety during transport other than for recycling or disposal
UL 2054	Household and commercial Batteries

3.0 SERVICE CONDITIONS

S. No	Particulars	Data
1	Design Ambient temperature	0°C to 50 °C
2	Seismic Condition	Zone IV as per IS 1893
3	Wind Pressure	195 kg/M² upto elevation of 30 M as per IS 875
4	Maximum Relative Humidity	100%

5	Maximum Altitude above Sea level	1000M
6	Rainfall	750mm (concentrated in 4 months)
7	Pollution level	Heavy/Dry
8	Average of no thunderstorm days	40 per annum

4.0 DOCUMENTS REQUIRED

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 loads
iii. Approved vendor drawings
iv. Other documents
v. Battery sizing calculation

5.0 DC DISTRIBUTION SYSTEM DATA

5.1	DC Supply	2 wire, with positive & negative polarity
5.2	Earth reference	Unearthed system
5.3	Nominal Voltage	User Defined a) 220V DC b) 48VDC
5.4	Application - Industrial	Standby DC back up for switchgear control supply & SCADA RTU

6.0 BATTERY BANK DESIGN FEATURES:

The equipment shall have all the following features –

6.1	DC battery bank Ah rating & sizing	150Ah (Minimum) battery bank at charging voltage of 220VDC/48VDC in CC-CV mode. Battery Shall be compatible with existing chargers i.e Dual Float cum Boast Charger
6.2	DC load curve	With High discharge characteristics. With 0.5C/ battery module
6.3	Location of battery bank	Indoor
6.4	Mounting of battery bank	On steel rack/cabinet with window glass, painted with anti corrosive paint.
6.5	Battery type	Li-ion Battery only
6.5.1	Li-ion cell chemistry	Different chemistry with material Manganese /Cobalt/iron/titanium etc subject to fulfillment of required parameters as mentioned in this specification.
6.5.2	Battery module round trip efficiency (%)	Min. 92

	Ingress protection	IP-55
6.6	Battery lifting/withdrawing arrangement	Suitable arrangement on Module
6.7	Battery Module designation	To be marked on cell as per relevant standard
6.8	Battery Module marking	Manufacturer name & type, month & year of manufacturer, nominal voltage, rated Ahr capacity & cell number
6.9	Battery terminals	As per Manufacturer standard
6.10	Terminal polarity marking	Positive& negative marked on Module
6.11	Insulating shrouds	For all battery terminals
6.12	Insulating pads for battery rack	Battery module to be 19 inch rack mounted, with supporting brackets on sides.
6.13	Battery suitable for Ripple content	5% minimum in DC charger output
6.14	Power terminal with insulator	Bus bar type mounted on rack suitable for 70sqmm cable
6.15	Cooling	As per Manufacturer standard
6.16	Communication	Modbus RS 485
6.17	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.
6.18	Indications	LED Type i) Status type ii) SOC series of LED lights
6.19	Name Plate	
A	Material	Anodized Aluminum 16SWG
B	Background	SATIN SILVER
C	Letter, diagram & border	Black
D	Process	Etching
E	Name plate details	Manufacturer name, month & year of manufacture, equipment type, input & output rating, Owner name & order number, guarantee period, weight of panel, degree of protection, Sr. No.
6.20	Equipment ID Painting	Shall be given at the time of drawing approval. Following will be the features: 1) Equipment ID shall be painted on any appropriate face of the equipment at a clearly readable height from the base level of the equipment. 2) Font: Recommended type face for the signage is True type or Post script.

		3) Font Size: All painting should be in UPPERCASE. Recommended height of 50 mm with spacing between alphabets of 3 mm. 4) Total No's of Character: 18 5) Height of Font: 50 mm 6) Height of Base: 100 mm 7) Spacing between alphabets: : 3 mm 8) Paint: Base coat – Dense Yellow. Letters – Black Quick Drying paint 2 coats.
6.21	Safety feature	Internal fuse, protective terminal covering to avoid unintentional contact, secondary level hardware protection for overvoltage, heat propagation resistant cell holding structure, overvoltage protection, under voltage protection, over charging current protection, over discharge current protection, over temperature during discharge protection, over temp during charge protection. RoHS compliant – no use of certain hazardous in electric and electronic equipment
6.22	Life Cycle	Cycle life should be more than 4500 and should have no effect of high temperature storage.
6.23	Battery management system	i. Inbuilt battery data measurement and monitoring system ii. All data should be available through mod bus RS 485 (for Monitoring in SCADA) iii. Internal data logging for battery usage iv. Battery SOH monitoring v. Display panel vi. Self-protection and Diagnostic for over charge, over current, Module reverse polarity protection, fuse failure, over voltage, over discharge protection, over temperature during charge and discharge etc.

7.0 INSPECTION & TESTING

6.1	Type test	Equipment shall be of type tested quality as per Cl no. 2.0 for battery If the manufacturer's lab is accredited by govt. / authorized body then it shall be acceptable for type testing. For international standards, relevant certificate/test reports shall be acceptable.
6.2	Routine test	As per relevant standard mentioned in cl.no. 2.0
6.3	Acceptance test	To be performed in presence of Owner at manufacturer works and as per relevant std mentioned in cl. No. 2.0

8.0 PACKING AND DELIVERY

Shall be packed such that protected against corrosion, dampness, heavy rains, breakage and vibration

9.0 DEVIATIONS

Deviation from this specification, if any, shall be clearly brought out in the offer. Unless owner explicitly accepts such deviations, it shall be considered that the offer fully complies with the specification.

10.0 ACCESSORIES & SPARES

Mandatory Spares shall be supplied along with Battery Bank.

11.0 TRAINING

Training on installation, commissioning, operation and maintenance of Battery Bank shall be at factory or at site after installation

12. GUARANTEED TECHNICAL PARTICULARS (DATA BY BIDDER)

S.NO.	Description	BRPL Requirement		Data to be filled by Manufacturer	
		48V	220V	48V	220V
1	Battery (as per scope of supply) – Yes / No	Yes	Yes		
2	battery type	Li-Ion	Li-ion		
3	Type/Model No.				
4	Cell Chemistry				
5	Battery nominal voltage with variation upto ±5%				
6	Total battery bank CC-CV charging required in volts	As per clause no 6.1	As per clause no 6.1		
7	Nominal Voltage of each Cell				
8	No of cells in each module				
9	No. of modules				
10	Input charge voltage				
11	Charge current				
12	Discharge current				
13	Battery DOD	90% minimum	90% minimum		
14	Life cycle with 90% DOD	4500 (minimum)	4500 (minimum)		
14	Battery efficiency (watt hour round trip)	>92%	>92%		
15	Service life	15 Years	15 Years		
16	Self discharge rate per month	0.1% @ 25°C	0.1% @ 25°C		
17	Cut off voltage	45V	210V		
18	Conformance to design standards as per specification clause no. 2.0 – Yes / No	Yes	Yes		
19	Conformance to design feature as per specification clause no. 5&6 – Yes / No	Yes	Yes		
20	Submitted of deviation sheet for each specification clause no - Yes / No	Furnish each deviation if yes	Furnish each deviation if yes		
21	Battery GA drawing submitted - Yes / No	Required	Required		
22	Battery selection / sizing calculation submitted – Yes / No	Required	Required		
23	Battery rating offered in	150Ahr	150Ahr		

	Ahr				
24	Rating at temperature 45 deg C	150Ahr	150Ahr		
25	Battery bank dimensions in mm (length x depth x height)	As required	As required		
26	Battery Module weight in kg	As required	As required		
27	Heat generated by battery at rated full load (in Kw)	Less than 0.025kW/module	Less than 0.025kW/module		
28	Manufacturer of Li-Ion Battery Cells and Modules	Yes	Yes		
29	Manufacturer of Battery management system (BMS)	Yes	Yes		
30	Availability of Service team in India	Yes	Yes		
31	Built In Battery Management System	Yes	Yes		

BSES Rajdhani Power Limited
BSES Bhawan, Nehru Place, New Delhi- 19

TECHNICAL SPECIFICATION

FOR

415V AC DISTRIBUTION BOARDS

Prepared by	**Supriya Raina**	**Rev: 0**
Reviewed by	**Abhinav Srivastava**	**Date: 25.11.2013**
Approved by	**Vijay Panpalia**	

Volume-I Technical Specification for 415V AC Distribution Board

1.0 415V AC DISTRIBUTION BOARDS:

1.1 The AC distribution board shall be located in the Substation Building and shall be in two sections, each section fed by 415V, 3-phase supply from i) Station Aux Transformer ii) Shall be left for use in future. Each load center will be fed with separate outlet/ outgoing feeder. Auto changeover shall be provided between the two incomers with necessary interlocks.

1.2 The distribution boards shall be of modular construction with provision for complete compartmentalization of all feeders. It shall be free-standing, dead front type comprising dust-tight and vermin-proof sheet steel cabinets suitable for indoor installation with IP-54 degree of protection. The distribution boards shall be complete with necessary bus bar support insulators, cable glands, cable supports, terminal blocks, name-plates etc. All switches provided on the distribution board shall be on front side of the cabinets, operable from outside. The doors of cabinets shall be lockable. All instruments and control devices shall be mounted on the front of cabinets and fully wired to the terminal blocks. The board shall preferably be of the single front type, in fixed execution.

1.3 The various modules constituting the boards shall be provided with equipment/components such as switches, contactors, relays, control MCCB, ammeters, and voltmeters, terminal blocks etc. as required for complete circuit of the respective module.

1.4 The Boards shall be made out of at least 2.0 mm thick cold rolled steel sheet, suitably reinforced to provide flat level surfaces. Gland plate shall be 3.0mm thick. No welds, rivets, hinges or bolts shall be visible from outside. The doors shall be fitted with double lipped gaskets (subject to approval).

1.5 All cables shall enter and leave from bottom. Suitable cable terminal blocks with cable lugs shall be provided inside each cabinet for the incoming and outgoing cables. The terminals shall be serially numbered to facilitate installation and maintenance. Main busbars shall be accommodate in busbar chambers and cable alleys arranged by their side. Compression type cable glands shall be provided to hold the cables to avoid any pressure or tension on the terminal block connections. The terminal blocks shall be easily accessible for inspection and checking.

1.6 All the load break switches on the board shall be rotary type and shall be key operated.

1.7 The boards shall be given one primer coat followed by two finishing coats of epoxy based paint of light grey of Shade RAL 7032 with glossy finish.

1.8 The AC boards shall be provided with the following equipments wherever applicable:

i. Busbars of adequate rating.
ii. Terminal arrangement with necessary equipment for connecting the incoming supply.
iii. Module for voltage and current measurement in the incomer feeder.

iv. Outgoing modules with switch / MCCB units of adequate capacity for the outgoing feeders and 20% spare feeder units of each rating.
v. Necessary cable glands and terminal blocks.
vi. Adequate number of spare terminals on terminal blocks for receiving connections from the spare contacts of the relays and for external connections.
vii. Multifunctional meter, voltmeter and ammeter.

1.9 The number of outgoing feeders from AC boards shall be such that each substation equipment is fed by separate feeder with 20% as spare(refer below table).

S.No	Application	Type of Switchgear	No of Poles	Rating (A)	Quantity
1	Incomer	MCCB*	4	630	2
2	Transformer Oil filtration	MCCB*	4	100	2
3	Power Socket(Indoor)	MCB*	4	63	1
4	Welding(Outdoor)	MCB*	2	63	4
5	Outdoor Lighting	MCB*	4	32	2
6	Indoor Lighting	MCB*	4	32	2
7	BMK	MCB*	4	32	8
8	Marshalling Box(PTR)	MCB*	4	32	3
9	Battery Charger	MCB*	4	32	2
10	AC Supply	MCB*	4	32	2
11	UPS	MCB*	2	16	1
12	11kV Switchgear	MCB*	2	16	3
13	CRP	MCB*	2	16	2
14	RTU/SCADA	MCB*	2	16	2
15	Fire Fighting	MCB*	2	16	1
16	EPAX	MCB*	2	16	1

*Approved Make of MCCB/MCB:-Schneider/ABB/L&T

2.0 INSTRUMENTS

The indicating instruments shall be analog type square shaped and shall be flush mounting type. These shall have dust-proof and moisture- resistant enclosed cases. These shall be suitable for use in tropical climate. All AC instruments shall be connected through suitably rated current/voltage transformers.

3.0 BUSBARS

The busbars shall consist of tinned electrolytic copper of ample cross-sectional area, suitable for carrying their rated continuous current without their temperature exceeding 85 Deg.C. The busbars shall be continuous throughout each section.

The busbars shall have current rating to suit the requirements corresponding to the loads incident thereon under the various operating conditions and shall withstand the applicable voltage and maximum short circuit stresses. The busbars shall be insulated from supporting structure by means of durable non-hygroscopic, non-combustible and non-tracking polyester fiberglass material or porcelain. Busbars shall be encased in heat-shrunk 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.

The busbars shall be housed in totally enclosed busbar chambers. The incoming connections from the busbar to the various feeders shall be so designed as not to disturb cable connections and to ensure safety to the operating and maintenance personnel and to facilitate working outside any outgoing module without the need for switching off in-feed to the adjacent modules, as far as possible.

A cable alley preferably 230 mm wide shall be provided in each vertical section for taking cables into the compartments.

4.0 CONTROL WIRING

Each board shall be furnished completely factory wired upto terminal blocks ready for external connections.

All wires shall consist of 1100 V grade PVC insulated flexible stranded copper wires with a cross-section of 2.5 mm^2 (min.) suitable for switchboard wiring and complying with the requirements of the relevant IS. Each wire shall bear an identifying ferrule or tag at each end or connecting point.

Control cables for external connections shall consist of stranded copper wire with 1.5, 2.5, 4.0 sq.mm or higher cross-sectional areas and shall enter from bottom.

All interconnecting/outgoing control wiring shall terminate on stud type terminals on terminal blocks. The terminals shall be marked with identification numbers to facilitate connections.

The terminal blocks shall be made of moulded, non-inflammable, plastic material and arranged to provide maximum accessibility for inspection and maintenance.

The terminals shall be made of hard brass and have diameter of not less than 6 mm. The studs shall be securely locked within the mounting base to prevent turning. The terminal blocks shall be provided with twenty (20) percent spare terminals. The terminals shall be suitable for connections through crimped lugs.

5.0 INDICATING LAMPS

Indicating lamps shall be of low wattage LED cluster type. The lamps shall be provided with translucent lamp covers which shall diffuse coloured light to give the specified indications. The lamp covers shall be unbreakable and moulded from heat-resistant fast coloured material. Necessary wiring shall be provided accordingly.

6.0 INCOMER

The ACDB shall have two incomer suitable as per station auxiliaries transformer rating. Each incomer shall have electrically operated MCCB of category B with automatic changeover arrangement. All outgoings shall be provided with MCCB/MCB of suitable rating. MCCB shall have over current and earth fault release.

7.0 NAME PLATES & MARKING

Each panel shall be provided with legible and indelibly marked/ engraved name plates.

Name-plates of all the modules shall be white with black engraved letters.

On top of each module, name-plates with bold letters shall be provided for feeder designation. Each device shall also be suitably marked for identification inside the panels. Name- plates with full and clear inscriptions shall be provided inside the panels for all isolating switches, links, fuse blocks, test blocks and cable terminals. Every switch shall be provided with a nameplate giving its function clearly. Switches shall also have clear inscriptions for each position indication e.g. 'ON' 'OFF' etc.

8.0 DEVIATIONS

Deviation from this specification, if any, shall be clearly brought out in the offer. Unless owner explicitly accepts such deviations, it shall be considered that the offer fully complies with the specification.

TECHNICAL SPECIFICATION

FOR

GROUNDING & LIGHTNING PROTECTION SYSTEM

Prepared by	Pronab Bairagi				Rev: 1
Reviewed by	AS	Amit Tomar			Date: 27nd May, 2015
Approved by	VP				

Volume-I Technical Specification Grounding and Lightning Protection

1.0 GROUNDING & LIGHTNING PROTECTION SYSTEM:

1.1 GROUNDING SYSTEM

Earthing Installation shall be carried out as per IS 3043/IEEE 80-2000/IEC-517. The Station Earth mat shall be designed to meet required minimum area of cross section, current Density, Resistance, Touch & Step voltage criteria's mathematically before installation and shall be tested after installation to ensure the resistance of earth mats to be less than 0.5Ohms. Bare Earthmat conductors (Strips/ Rods) to be installed below the ground as per safe designed to spacing in a grid pattern. Each junction of the grid shall be bonded by an electric arc welding process. Each bond has to be painted by Anti corrosive Paint (Bitumen).All ground wires installed in conduits shall be insulated. Bare ground conductors shall penetrate concrete through a PVC Sleeve. Equipment shall be generally being furnished with two separate ground pads with tapped holes, bolts, nuts & spring washers etc. Metallic frame of all electrical equipment shall be earthed by two separate and distinct connections to earthing system, each 100% capacity. Steel Columns, metallic stairs, hand rails etc. of the building housing electrical equipment shall be connected to the nearby earthing grid conductor by one Earthing. Metallic Sheaths, Screens and armour of all multi core cables shall be earthed at both ends. Sheaths and armour of single core cables shall be earthed at switch gear end only

All ground wires installed in conduit shall be insulated. Bare ground wires shall penetrate concrete through a PVC sleeve.

Earthing of equipment shall generally be furnished with two separate ground pads with tapped holes, bolts, nuts and spring washers etc. Equipment ground connections, after being checked and tested shall be coated with anti-corrosive paint.

Metallic frame of all electrical equipment shall be earthed by two separate and distinct connections to earthing system, each of 100% capacity. Steel columns, metallic stairs, hand rails etc. of the building housing electrical equipment shall be connected to the nearby earthing grid conductor by one earthing. Metallic sheaths, screens, and armour of all multi core cables shall be earthed at both ends. Sheaths and armour of single core cables shall be earthed at switchgear end only unless otherwise instructed by Owner. Every alternate post of the metallic fence shall be connected to earthing grid by one GS flat and gates by flexible lead to the earthed post. Rail for transformers within the plant area shall be bonded across fish plate and connected to earthing grid at several locations.

For prefabricated cable trays, a separate ground conductor shall run along the entire length of cable tray and shall be suitably clamped on each cable tray at periodic intervals. Each continuous laid out lengths of cable tray shall be earthed at minimum two places by GS flats to Owner's earthing system, the distance between earthing points shall not exceed 30 metre. Wherever earthmat is not available Contractor shall do the necessary connections by driving an earth electrode in the ground.

Neutral points of transformer shall be solidly earthed by means of 2 Nos 75X10mm GI flat. Neutral Earth Electrode dimension shall be calculated by Long duration overloading of the

Soil (i.e.) 40 A/sq.mtr as per IS 3043-1987 Clause 10.3.a Each earthing lead from the neutral of the Transformers shall be directly connected to two electrodes in treated earth pits which in turn shall be connected to station earthing grid.

Neutral connections and metallic conduits/pipes shall not be used for the equipment earthing. Lightning protection system down conductors shall not be connected to other earthing conductors above the ground level.

Connections between earth leads and equipment shall normally be of bolted type. Contact surfaces shall be thoroughly cleaned before connections.

All ground conductor connections shall be made by electric arc welding and all equipment earth connections shall be made by bolting with the earthing pads through flexible insulated cable leads. Ground connections shall be made from nearest available station ground grid risers. Suitable earth risers approved by Engineer shall be provided above finished floor/ground level, if the equipment is not available at the time of laying of main earth conductor

Resistance of the joint shall not be more than the resistance of the equivalent length of conductor. For rust protection the welds should be treated with red lead compound and afterwards thickly coated with bitumen compound.

Earthing conductors buried in ground shall be laid minimum 600 mm below grade level unless otherwise indicated in the drawing. Earthing conductor's crossings the road shall be installed at 1000 mm depth and where adequate earth coverage is not provided it shall be installed in Hume pipes. Earthing conductors embedded in the concrete floor of the building shall have approximately 50mm concrete cover.

Minimum earth coverage of 300mm shall be provided between earth conductor and the bottom of trench/foundation/underground pipes at crossings. Wherever earthing conductor crosses on runs at less than 300mm distance along metallic structures such as gas, water, steam pipe lines, steel reinforcement in concrete, it shall be bonded to the same.

Earthing conductors along their run on columns, walls, etc. shall be supported by suitable welding/cleating at interval of 750mm.

Electrodes shall be embedded below permanent moisture level. Minimum spacing electrodes shall be decided by calculation referred in IEEE-80 based on soil resistivity value .If soil resistivity is poor and desired reduction in ground resistance is not achieved by adding more Grid Conductor Earth pits shall be treated with Permanent maintenance free artificial treatment compounds as per IEEE 80-2000 Clause14.5d.

On completion of installation, continuity of earth conductors and efficiency of all bonds and joints shall be checked. Earth resistance at each termination shall be measured as per

IEEE81-1983 (Wenner 3 point method). Earth resistance at earth terminations shall be measured in presence of Owner's representatives. Thickness of galvanizing shall be atleast 610gm/sq.m or 86 microns for all galvanized steel conductors.

1.2 The grounding/Earthing material shall be Terec++ or Marconite.

1.3 Earthing rods in RCC floor for GIS substation

1.4 Ground Electrode shall be 3M long MS rod of required size. These are to be fabricated and driven into the ground by the side of mat conductors. All connection to the conductors shall be done by arc welding process.

1.5 Risers are required for connecting the equipment and structures with the ground mat. These will be MS rod, laid from ground mat to above ground level properly clamped or supported along the outer edge of the concrete foundation. Connection to the ground mat shall be done by arc welding and the other end is to be kept free, at least 300 mm above ground level.

1.6 All steel Structures are required to be grounded at two points from ground mat. Laying supporting and connection at both end are within the scope of this specification.

All Earth Pits provided at the grid substation shall be interconnected with each other by MS Rod/Flat of adequate size as per symmetrical fault current.. The GI flat shall be buried in the earth at a minimum depth of 300 mm. Minimum ground coverage of 300mm shall be maintained between main earth grid and bottom of trench, tunnels, underground pipes other services / foundations. The earth grid conductor shall be run along the building column wall etc. with adequate and suitable supports at 750mm interval, if site conditions warrant so. The riser for equipment earthing shall be 75X10 mm GI flat. The orientation of these risers shall be such that minimum earthing strip is consumed for equipment earthing.

All the further joints / connection of GI Flat shall be arc welded.

1.7 To ensure good welding, it should be carried out only after scratching off the galvanization, dirt, grease etc by thorough cleaning of contact surface. After welding it will be made with anticorrosive zinc rich paint.

The equipment connection with GI Flat shall be bolted connection. Each bolted connection shall be taken through two numbers bolts at each joint to ensure tightness and avoid loosening with passage of time.

In case the GI flat is to cross any obstruction, it shall be laid below the obstruction. At the crossing of building walls, floors etc the earth conductor shall pass through PVC conduit. Both ends of conduits shall be sealed after laying of conductor to prevent ingress of water.

Contractor shall use GI strip of following specification: - The GI flat will have minimum 610 gm/mm2 Zinc coating and minimum 86 microns thickness. The galvanization provided shall be as per IS 2629. The galvanized surface shall consist of a continuous and uniform thick coating of zinc, firmly adhering to the surfaces of steel. The finished surface shall be clean and smooth and shall be free from defects like discolored patches, bare spots, and unevenness of coating, spiky deposits, and blistered surfaces, flaking or peeling off.

All hardware like bolts, nuts, spring and flat washers shall be galvanized; Stainless Steel or Zinc passivated shall be arranged by contractor.
1.7. Earthing Calculation parameters shall be taken as:

1) Duration of shock current in secs ts=1sec.
2)Top Gravel resistivity shall be 3000 Ohm Meter.
3)Split Factor shall be considered as 1

2.0 EQUIPMENT EARTHING

All the equipment should be grounded with double run earth strip directly connected to earth mat at two different points.

2.1 The table provides the guidelines for Selection of Cross section of Earth conductor as per IEEE 80-2000 Clause 11.3.1 Equation 37 & Mild Steel as an Earth Conductor.

S. No	Fault current Level (KA)	Minimum Required Area of Cross Section (Sq.mm)
2.1.1	5	54
2.1.2	10	108
2.1.3	15	163
2.1.4	20	217
2.1.5	25	271
2.1.6	30	325
2.1.7	35	379
2.1.8	40	433

For various Equipments such as Power Transformer, Station Transformer, 11 KV Switch gear, 415V Panel, Light panel, Junction box, Street Lighting pole, Metallic fence, Isolator, Gantry tower & Electronic Earthing different cross sections of Earth conductor shall be selected as per the fault level. For switch gear rooms, a local earth conductor of adequate size of G.I flat may be run around the room below floor level to facilitate earthing of equipments in switchgear room.

2.2 However the table below provides general guidelines for selection of Earth Conductor for each Equipment

2.2.1	Description/location	Size
2.2.2	Earth mat	40 mm (min) to be selected by the contractor based on the calculations.
2.2.3	Power Transformer	100 X 8mm
2.2.4	Station transformer	50x6mm
2.2.5	11KV Switchgear	50x6mm
2.2.6	415V panel	50x6mm
2.2.7	Lighting panel	25x3 mm
2.2.8	Junction box	7/8 SWG
2.2.9	Street lighting pole	25x3 mm
2.2.10	Metallic fence	25x3 mm
2.2.11	Transformer yard fence and gate	50x6 GI flat with the help of flexible copper braid.
2.2.12	HV/LV/ LV Neutral cable box	50x6 GI flat
2.2.13	OLTC Drive mechanism body	25X3 GI flat
2.2.14	Battery charger panel	25X3 GI flat
2.2.15	DCDB	25X3 GI flat
2.2.16	Capacitor Bank Structure	50 X 6 GI flat
2.2.17	Capacitor unit and reactors	50 x 6 GI flat
2.2.18	Outdoor Circuit breaker, CT, PT & CVT	50 X 6
2.2.19	Secondary terminal Box of outdoor CT, PT & CVT	25 X 6 mm
2.2.20	Isolator Mechanism box, earth switch box	25 X 6 mm
2.2.21	Gantry tower and structure	75 X 10 mm
2.2.22	Electronic Earthing	Separate design and installation for all communication devices and electronic equipments including SCADA RTU, MOXA, Router/Switch. As per recommendation of SCADA vendor
2.2.23	Power Transformer Neutral earthing	75x10 sqmm

The most stringent size of conductor among the two tables above shall be selected

2.3 For switchgear rooms, a local earth conductor of size 50x 6 mm GI flat may be run around the room below floor to facilitate earthing of equipments in switchgear room. This grid shall be connected to the main earth grid at minimum two points. Size of the conductor shall be selected considering the provisions in clause 2.1 and 2.2 above.

2.4 It is to be ensured that all the switchgears and transformers earth points/ connections are connected to earth grid and all the main and auxiliary earth grids are interconnected at minimum two points. With the above arrangement, the return path to the respective transformer neutral will have a predominantly metallic path. (i.e. Cable armour >>switchgear earth bus>>external earth flat>>earth grid>>transformer neutral.).

2.5 Where a 66 kV overhead line terminates at the substation, a metallic continuity between the end tower and the substation earth grid should be established with two independent connections.

2.6 The GI Flat shall be laid minimum 300 mm below the ground level but for the indoor location, it shall be embedded in the concrete floor; 50mm below the FFL.
.

2.7 The GI flat shall be welded after scratching off the galvanization locally and thorough cleaning of contact surface. After welding or bolting arrangement the joint shall be provided with anticorrosive Bitumen compound or zinc Phosphate paint. Wherever bolted connection is taken, it shall be taken through two bolts at each joint to ensure tightness and avoid loosening with passage of time.

2.8 Details of welding, bolting arrangement for various types of joints shall be as per Indian Standard.

2.9 Two separate and distinct earth connections shall be used for safety earthing of non-current carrying metallic enclosure of all equipments.

2.10 Two separate and distinct earth connections shall be used for earthing of Lightning / surge absorber.

2.11 Neutral bushing of oil/dry type Station transformer shall be connected to two independent earth pits by two no's separate GI strips.

2.12 Transformer yard fence, structures shall also be connected with the earth mat by 50X6 GI Flat with the help of flexible copper braid.

2.13 All damages to the galvanized finishes shall be made perfect with zinc rich or bitumen paint.

2.14 RTU, marshalling box of SCADA or any other equipment installed in substation for SCADA shall not be connected to the earth grid, it shall be connected to separate two earth pits connected at two separate points of the panel.

3.0. LIGHTNING PROTECTION

DESIGN OF LIGHTNING PROTECTION

3.1 Direct stroke lightning protection (DSLP) shall be provided in the EHV switchyard by shield wires. The final arrangement shall be decided after approval of the DSLP calculations. The Contractor is required to carry out the DSLP calculations and submit the same to the Owner for approval of the same at detailed engineering stage after award of contract.

3.2 The lightning protection system shall not be in direct contact with underground metallic service ducts and cables.

3.3 A 40 mm dia. 3000mm long MS earth electrode with test links, CI frame & Cover shall be provided to connect down conductor of towers with peak. The test joint shall be directly connected to the earthing system.

3.4 Conductors of the lightning protection system shall not be connected with the conductors of the safety earthing system above ground level.

3.5 Down conductors used for lightning protection shall be cleated on the structures at 2000mm interval.

3.6 Connection between each down conductor and rod electrodes shall be made via test joint (pad type compression clamp) located approximately 150 mm aboveground level.

3.7 Lightning conductors shall not pass through or run inside G.I. conduits.

3.8 All metallic structures within a vicinity of 2000 mm in air and 5000mm below ground shall be bound to the conductors of lightning protection system.

3.9 In addition to Earth wires above the EHV switchyard, ESE Lightning conductor shall provides zone of Protection. Snapping of Earth wire does not make accidental situations during Lightning.

3.10 This ESE Lightning Protection system requires an Air terminal, down conductor, Lightning Counter & an Earthing System. If the structure is more than 30m height then 2 no's of down conductor shall be used for side flashing. The Earthing system should not exceed more than 10Ω.

3.11 A 40mm dia M.S Earth Electrodes with Test Links, HDPE Cover shall be provided to connect down conductor. The test Link shall be directly connected to earthing system

3.12 Conductors of Lightning Protection system shall not be connected with conductors of Safety earthing system above ground level. Lightning Earth Pits shall be connected other earthing conductor below ground level by using Equipotential bonds which will not allow Surge current to flow from Lightning pits to other Earth pits

3.13 Connection between each down conductor & Test link shall be located approximately 2000mm above ground Level.

3.14 The Down conductor should be high conductivity bare copper tape with minimum size of 75 Sq.mm

3.15 Constructional Features

3.15.1 **Galvanized Steel (Applicable for exposed G.S. flats)**

a) Steel conductors shall be galvanized according to IS: 2629.
b) The minimum weight of zinc coating shall be 610gm/sq. m. and minimum thickness shall be 86 microns.
c) The galvanized surfaces shall consist of a continuous and uniformly thick coating of zinc, firmly adhering to the surfaces of steel. The finished surface shall clean and smooth and shall be free from defects like discolored patches, bare spots, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surfaces, flaking or peeling off etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.

3.16 Tests

3.16.1 The Contractor shall perform all tests and inspection to ensure that material and workmanship are according to the relevant standards. Contractor shall have to demonstrate all tests as per specification and equipment shall comply with all requirements of the specification.

a) The galvanized steel shall be subjected to four one-minute dips in copper sulphate solution as per IS: 2633.
b) Zinc Coating thickness : As per IS: 4759
c) Uniformity of zinc coating : As per IS: 2633
d) Adhesion Test : As per IS: 2629
e) Mass of zinc coating : As per IS: 6745
f) Chemical Analysis: As per IS: 513 & IS: 1079

3.16.2 The accessories for GSS Groundwire such as Tension Clamps, Copper braided wire etc. shall conform to & meet the test requirements of IS: 2121.

4.0. DEVIATIONS

Deviation from this specification, if any, shall be clearly brought out in the offer. Unless owner explicitly accepts such deviations, it shall be considered that the offer fully complies with the specification.

Technical Specification for

LT POWER CABLE WITH FRLS OUTER SHEATH

(Single & Multi-Core)

Specification no – SP-EWLP-01-R5

Prepared By		Reviewed By		Approved By		Rev /Pages	Date
Name	Sign	Name	Sign	Name	Sign		
Rohit Patil		Amit Tomar		K. Sheshadri		R5/ 22	02.03.2020

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RECORD OF REVISION

Sr. No.	Revision No.	Item/Cl. No.	Nature of Change	Approved By
1	R2	2.0	National & International Standards added	VP
2	R2	3.6 (c)	UV resistance test shall be carried out on all size of cable	VP
3	R2	6.4	Type tests Cl. Changed.	VP
4	R2	4.1 & 4.2	Cable Drum as per IS 10418	VP
5	R2	4.3	For 2C X 10 mm^2 cable drum length – 1000 +/- 5% Mtr	VP
6	R3	ANNEXTUE- C	New size cable added 1.1 kV 1CX1000 mm^2	KS
7	R4	3.6	Drum number laser printing on every meter of cable outer sheath	KS
8	**R5**	2.0	National & International Standards added	KS
9	**R5**	3.6	FRLS outer sheath	KS
10	**R5**	3.9	FRLS outer sheath properties	KS
11	**R5**	6.5	Acceptance Test	KS
12	**R5**	Annexure-E	Sub vendor list	KS

Prepared By	Reviewed By	Approved By
Rohit Patil	**Amit Tomar**	**K. Sheshardri**

1.0 SCOPE OF SUPPLY

The specification covers design, manufacture, shop testing, packing and delivery of 1100 Volts grade, Aluminium conductor 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 460/760 V.
2.23	IEC 1034	Measurement of smoke density of electric cables burning under defined conditions
2.24	ASTMD 2843 **(R5)**	Standard Test Method for density of Smoke from the burning or decomposition of cables
2.25	ASTM 2863 **(R5)**	Standard Test Method for measuring of minimum oxygen concentration
2.26	IEC 60754-1 **(R5)**	Test on gases evolved during combustion of materials for cables. Part 1 – Determination of the Halogen Acid gas Content
2.27	IS 1554 part 1	Specification for PVC insulated (Heavy duty) Electric cable

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

<table>
<tr><td>3.1</td><td>Conductor</td><td>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 & Size:

<table>
<tr><th>S.no.</th><th>Shape</th><th>Single core</th><th>Multi core</th></tr>
<tr><td>1</td><td>Compacted Circular</td><td>• 1cx300
• 1cx630
• 1cx1000</td><td>2cx10</td></tr>
<tr><td>2</td><td>Sector</td><td>---</td><td>• 2cx25
• 4cx25
• 4cx50
• 4x150</td></tr>
</table>
</td></tr>
<tr><td>3.2</td><td>Insulation</td><td>Extruded XLPE as per IS : 7098 part-1</td></tr>
<tr><td>3.3</td><td>Core Identification</td><td>As per Cl.10 of IS 7098 part-1</td></tr>
<tr><td>3.4</td><td>Inner Sheath</td><td>For 1.1 kV 2CX10 , 2CX25 Pressurized Extruded
For other cable Extruded Inner Sheath of black PVC type ST-2 (IS 5831-1984)</td></tr>
<tr><td>3.5</td><td>Armour</td><td>a) For 2C X 10 mm^2 – Galvanized Steel round wire.
b) For all sizes above 10 mm^2-Galvanized Steel Strip
c) Not applicable for single core cables of size 300 , 500 , 630 & 1000 mm^2
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 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.</td></tr>
<tr><td>3.6</td><td>Outer Sheath</td><td>a) Extruded FRLS (R5)outer sheath of PVC (ST-2) shall be as per IS:5831
b) Colour : Yellow (For multi core cables)</td></tr>
</table>

		Black (For single core 300,500, 630 & 1000 mm^2) c) FRLS**(R5)** 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. e) The FRLS **(R5)**outer Sheath shall be embossed with following minimum text: i) The voltage designation ii) Type of construction /cable code (For e.g. A2XWY/A2XFY) iii) Manufacture name/Trade mark iv) Number of Cores and nominal cross section area of conductor v) Name of buyer i.e BRPL (BSES Rajdhani Power Ltd.) vi) Month & year of manufacturing vii) IS reference , i.e. IS:7098 viii) P.O No. and Date ix) Font size shall be 5/5mm x) ISI mark The embossing shall be progressive, automatic, in line and marking shall be legible and indelible. Following points shall be laser printed on every meter of cable i. 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. ii. Drum number marking on every meter of the cable length
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
3.9	FRLS Properties **(R5)**	Oxygen Index : Not less than 29% as per ASTM 2863
		Temperature Index : 250 Deg C at Oxygen Index 21 (when tested as per ASTM D 2863)
		Max Acid Gas Generation – Not more than 20% as per IEC -60754-1
		Light Transmission - Minimum 40% when tested as per ASTMD 2843 (Smoke Density rating shall be max 60%)
		Flammability Test – As per IEC 60332-III, Cat – B, IEC 60332- I, IS- 10810 – Part 53, IS:10810 – Part 61 & 62 (Category A)

4.0 CABLE DRUM

4.1	Reference Standard	Cable drum 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	For 1.1 KV 2C X 10 mm^2 Cable - 1000+/-5% Mtr For all size above 10 mm^2 Cables - 500 +/-5% Mtr
4.4	Overall Tolerance	-2 % for the total cable length for the entire order.
4.5	Short Length of Cable	a) Minimum Acceptance short length shall be 1% of the total ordered quantity and no length shall be less than 500 mtrs for 2C X 10 mm^2 cable & 250 mtr for all sizes above 10 mm^2. Manufactures shall be taken prior approval from BRPL Engineering for any short length supply. Short length will be accepted in last lot. b) Manufacture shall not be allowed to put two cable pieces of different short length in same cable drum
4.6	Preventive Measure for cable Drum	a) The surface of the drum and 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 & SAP item code g) Total weight of cable and drum (kg) h) Manufacture'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-marking (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 Plan	The seller shall be 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/inside cable damaged found in store/site
5.3	Cable Drum Handling	The drum shall be with M.S spindle plate(with nut –bolts) of adequate size to suit the spindle rod , 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 the event of type test being older than 5 years, bidder has to conduct the same at CPRI/ERDA, approved Lab without commercial implication to BRPL (b) Bidder supplying cable to BRPL for the first time shall have to conduct type test, Chemical Composition & UV resistance 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/NABL Accredited Lab 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 & IS 1554 part 1 for each lot of cable)(**R5)**	a) For cable sizes up to 50 mm^2 – one sample for chemical composition and purity test of aluminium shall be conducted upto r 100km of ordered quantity and multiple thereof. b) For cable sizes above 50 mm^2 – one sample for chemical composition and purity test of aluminium shall be conducted upto 50km of ordered quantity and multiple thereof. c) Chemical composition and purity test of aluminium shall be conducted from the lot offered to BRPL on each size involved in the purchase order. Test shall carried out at NABL accredited third party lab without any price implication to BRPL.

		d) The sample will be selected either during acceptance test or after receipt of cable in BRPL 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 10 days 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

a) Deviations from this specification shall be listed separately by bidder clause wise (format given below) along with optional offer and has to submit the list along with bid/quotation. BRPL will review the deviations and if BRPL is agreed with the deviation, seller has to take written confirmation from BRPL on deviation during tender evaluation.
b) In the absence of any separate list of deviations from the bidders with bid as well as written confirmation from BRPL on deviations, it will be assumed by the Buyer that the Seller complies with the Specification fully.
c) Any deviations mentioned in any other submitted bid documents (i.e.in filled GTP, Catalog, BRPL old approval, buyer's/seller's standards etc) by seller without separate deviation sheets will not consider as a deviation from this tech spec at any stage of contract.

Deviation sheet format.

Sl. No.	Document Name	Clause No.	Deviation	Reason	Merit to BRPL

10.0 TECHNIACL PARTICULARS

a. GTP - As per Annexure-B for Multi-core cables.
b. GTP - As per Annexure-C for Single-core cables (300, 500, 630 & 1000 mm^2 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.

11.0 ANNEXURE – A

SCOPE & PROJECT SPECIFICATION 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 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

12.0 ANNEXURE – B

GUARANTEED TECHNICAL PARTICULARS (Multi-core)

(Standard Cable sizes are 2c x10, 2c x25, 4c x25, 4c x50, 4C X 95, 4c x150, 4cx300)

For each size /rating separate GTP need to be furnished

Sr. No.	Description	Buyer's Requirement	Seller's data
	Manufacture Contact Person & Number		
	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	As mentioned in the clause no – 2.0	
1	Make	…	
2	Type (as required by purchaser)		
A	For 2CX10Sqmm	A2XWY	
B	For Sizes above 10 mm^2	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)	…… mm^2	
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 purchaser's site - specific condition	
A	Material		
a)	For 2CX10 mm^2	G.I.Wire	
(i)	Wire Dia (mm)	1.4+/-0.040	
(ii)	No. of wires	As per Manufacturer Standard	
b)	For sizes above 10 mm^2	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.(mm)	……	
9	Outer Sheath (FRLS)		
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/ Sioplas Cure	
22	Type test	Is copy of latest valid TTR for respective Sizes enclosed? Yes / No	
23	FRLS Properties **(R5)**	As per IS 1554, Part-1	
	Oxygen Index	As per IS 1554, Part	
	Temperature Index	As per IS 1554, Part	
	Max Acid Gas Generation	As per IS 1554, Part	
	Light Transmission / Smoke Density	As per IS 1554, Part	

13.0 ANNEXTURE- C

GUARANTEED TECHNICAL PARTICULARS (Single Core)

(Separate GTP needs to be furnished for 300, 500, 630 & 1000 mm^2 cables)

S.No.	Description	Buyer's Requirement	Seller's data
	Manufacture Contact Person & Number		
	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	As mentioned in the clause no-2.0	
1	Make	……	
2	Type	A2XY (Un-armoured)	
3	Voltage Grade (kV)	1.1kV	
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)	300 / 500 / 630 / 1000 mm^2	
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 (mm)	……..	
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	

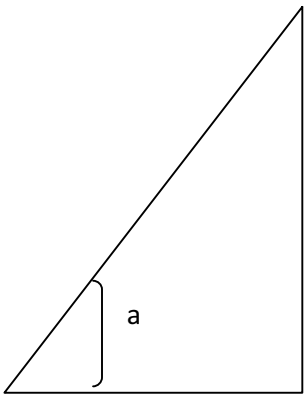
		Part-1	
A	Insulation Material	As per Cl. 3.2	
B	Nominal thickness (mm)		
(i)	For 1Cx300 mm^2	1.8 mm	
(ii)	For 1Cx500 mm^2	2.2 mm	
(iii)	For 1Cx630 mm^2	2.4 mm	
iv)	For 1Cx1000 mm^2	2.8 mm	
C	Diameter over Insulation (mm) Approx.	……	
D	Make of insulation compound	Ref: Annexure E	
7	Inner Sheath	Not applicable	
8	Armour	Not applicable	
9	FRLS Outer Sheath **(R5)**		
A	Material and Type	As per Cl. 3.6	
B	Minimum Thickness	As per Table 8 of IS 7098 Part-1	
C	Colour	Black	
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/ Sioplas Cure	
22	Type test	Is copy of latest valid TTR for respective Sizes enclosed? Yes / No	
23	FRLS Properties **(R5)**		
	Oxygen Index	As per IS 1554, Part	
	Temperature Index	As per IS 1554, Part	
	Max Acid Gas Generation	As per IS 1554, Part	

	Light Transmission / Smoke Density	As per IS 1554, Part	

14.0 ANNEXTURE – D

ARMOUR COVERAGE PERCENTAGE



Percent coverage = $\frac{N \times d}{W} \times 100$

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%.

15.0 ANNEXTURE – E

LIST OF SUB-VENDORS

For critical items

Sr. 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	Kkalpana Industries Ltd. KLJ Polymers and Chemicals Ltd. Dow Chemical, U.S.A Borealis, Sweden Hanwha, Seoul, South Korea
3	PVC Compound **(R5)**	Kkalpana Industries Ltd. KLJ Polymers and Chemicals Ltd. Universal SCJ Plastic Sriram Polytech Shri Ram Vinyl, Kota
4	GI Strip **(R5)**	Tata Balaji Systematic Mica Wires Pvt Ltd. Bansal Industries

SPECIFICATION

OF

FRLS CONTROL CABLE

Specification no: SP-EWLP-01-R3

Prepared By		Reviewed By		Approved By		Rev. No.	Date
Name	Sign.	Name	Sign.	Name	Sign.		
HK		MB		KA		02	27.01.14
RP		AT		VP		03	13.03.18

SPECIFICATION OF FRLS CONTROL CABLE

INDEX

RECORD OF REVISION

Sr. No.	Revision No.	Item/Cl. No.	Nature of Change	Approved By
1	R3	2.1.7	FRLS Properties	VP

SPECIFICATION OF FRLS CONTROL CABLE

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
ASTMD 2843	Standard Test Method for density of Smoke from the burning or decomposition of cables
ASTM 2863	Standard Test Method for measuring of minimum oxygen concentration
IEC 60754-1	Test on gases evolved during combustion of materials fro cables. Part 1 – Determination of the Halogen Acid gas Content

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	Each core shall have different color of insulation.
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 having FRLS properties
		b) Color : Black
		c) The Outer Sheath shall be embossed with:
		➢ The voltage designation
		➢ Type of construction / cable code (for e.g. AYWY)
		➢ Manufacturers Name or Trade mark
		➢ Number of Cores and nominal cross sectional area of conductors
		➢ The drum progressive length of cable at every meter. (By Printing)
		➢ Name of buyer i.e. BSES
		➢ Month & Year of Manufacturing
		➢ P.O. No. and P.O. Date
2.1.7	FRLS Properties	a) Oxygen Index : Not less than 29% as per ASTM 2863
		b) Temperature Index : 250 Deg C at Oxygen Index 21 (when tested as per ASTM D 2863)
		c) Max Acid Gas Generation – Not more than 20% as per IEC -60754-1
		d) Light Transmission - Minimum 40% when tested as per ASTMD 2843 (Smoke Density rating shall be max 60%)
		e) Flammability Test – As per IEC 60332-III, Cat – B, IEC 60332- I, IS- 10810 – Part 53, IS:10810 – Part 61 & 62 (Category A)
2.1.7	Sealing of Cable end	Both ends of the cable shall be sealed with PVC Cap.

3.0.0	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
		• Cables must be of type tested quality. Type test reports shall be submitted for the type, size & rating of cable offered along with bid.
		• If the manufacturer's lab is accredited by govt. /authorised body then it shall be acceptable for type testing.
		• 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
		d) Inspection
		• The Buyer reserves the right to witness all tests specified on completed cables
		• The Buyer reserves the right to inspect cables at the Sellers works at any time prior to dispatch, to prove compliance with the specifications.
		• 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.
4.0.0	Drawing, Data & Manuals	
4.0.1	To be submitted along with bid	The seller has to submit:
		• Cross section drawing of cable
		• Completely filled GTP
		• Type test certificates
		• Complete cable catalogue and Manual along with the bid.
4.0.2	After award of contract	Within 15 days, the seller has to submit four sets of above-mentioned drawings for buyer's approval.

4.0.3	Final As Built	6 sets hardcopy + One Soft copy of all documents including type test certificates
5.0.0	Drum Length & tolerance	500+ - 5% Mtr.
5.0.1	Overall tolerance in cable Length	- 2 %
5.0.2	Short length of cables	• Minimum acceptable short length shall be above 100 Mtrs. Manufacturer shall be required to take prior approval from engineering for any short length supply.
		• Manufacturer shall not be allowed to put two cable pieces of different short lengths in same cable drum.
		• Only 1% of the total ordered quantity.
6.0.0	Packing, Shipping, Handling & Storage	
	a) Drum Identification Labels	
		• Drum identification number
		• Cable voltage grade
		• Cable code (e.g. YWY)
		• Number of cores and cross sectional area
		• Cable quantity (Meters)
		• Purchase order number and SAP item code
		• Total weight of cable and drum number
		• Manufacturer's & Buyer's name
		• Month & Year of Manufacturing
		• Direction of rotation of drum
		• 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)
7.0.0	Quality Assurance	
7.0.1	Vendor quality plan	To be submitted for purchaser approval
7.0.2	Inspection points	To be mutually identified & agreed in quality plan
8.0.0	Progress reporting	

8.0.1	Outline Document	To be submitted for purchaser approval for outline of production, inspection, testing, inspection, packing, dispatch, documentation programme
8.0.2	Detailed Progress report	To be submitted to Purchaser once a month containing • Progress on material procurement • Progress on fabrication (As applicable) • Progress on assembly (As applicable) • Progress on internal stage inspection • Reason for any delay in total programme • Details of test failures if any in manufacturing stages • Progress on final box up constraints / Forward path
9.0.0	Deviation	• 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.
		• 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 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

TECHNICAL SPECIFICATION

FOR

ILLUMINATION SYSTEM

Prepared by	**Javed Ahmed**			**Rev: 0**
Reviewed by	**AK**	**AS**		**Date: 28th Mar, 2017**
Approved by	**VP**			

1.0 ILLUMINATION OF SYSTEMS:

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.

1.2 The minimum illumination levels shall be as specified below.

i)	Outdoor Substation	: 20 LUX
ii)	Roads within substation	: 20 LUX
iii)	Boundary wall of the substation	: 10 LUX
iv)	Control room	: 300 LUX
v)	Switchgear Room	: 200 LUX
vi)	Battery room	: 100 LUX
vii)	Stair case	: 100 LUX
viii)	Cable cellar (for option A)	: 70 LUX
ix)	Near Substation gates	: 20 LUX

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 100 Lux. Lux Level calculation to be done considering floor level as work plane height.

1.3 The bidder shall include in his offer light fittings of standard makes such as GE/Philips/Crompton/Bajaj or equivalent. Light fittings to be supplied by the bidder shall be subject to approval by the Owner.

1.4 Luminaries shall be flushed to ceiling

1.5 Complete design calculation sheets for arriving at the number and type of luminaries required for the normal and emergency requirements shall be furnished by the Contractor. Design calculation sheets for the selection of cables, MCB, HRC fuses, bus bars, etc. are also required to be furnished for Owner's approval.

1.6 The illumination system load and welding load in the substation area shall be supplied from 415/240 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

1.7 Each outgoing cable circuit for illumination and welding loads from the 415 volt switchboard shall terminate in the respective outdoor pillar boxes located in the substation. Outgoing feeders from the illumination and welding pillar-boxes shall be taken to the various illumination and welding load points in the substation Necessary fuses shall be provided near

light fixtures in the substation. 06 No's Welding socket shall be provided in the substation, out of which 4 no's shall be outdoor and two inside the control room building.

1.8 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.

1.9 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.

1.10 Dome lights shall be provided at gates.

1.11 Redundancy shall be provided wherever single luminary is considered.

1.12 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 authorized 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.

1.13 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. A total 0f minimum 12 no's individually controllable 60 watt lamps shall be provided in the substation.

2.0 DISTRIBUTION PILLARS FOR NORMAL ILLUMINATION SYSTEM

Distribution pillars of adequate dimensions shall be constructed from sheet steel having a thickness not less than 2 mm. 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. 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.

Each pillar shall accommodate the following

i) One incoming, 4-pole (3 phase and neutral) isolating switch with cartridge fuses or MCB of appropriate current rating
ii) 3-phase and neutral bus bars of appropriate current rating
iii) Single-pole earth leakage circuit breakers of suitable current ratings on all outgoing circuits.

iv) Neutral links for all outgoing circuits
v) Cable lugs, compression type cable glands, name plates, circuit numbers, earthing lugs, etc. to make the pillar complete in all respects.
vi) 20% spare outlets shall be provided for outgoing feeders.
vii) Three (3) indicating lamps with fuses to indicate that supply is 'ON'.

Local junction boxes for emergency illumination in the substation shall be provided, as required

3.0 LIGHTING DISTRIBUTION BOARDS

The Lighting Distribution Boards shall consist of the followings:

i) 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.
ii) 3-phase, 4-wire busbar system with high conductivity Aluminum 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.
iii) The busbars shall be suitable for short-time current rating of 40KA for 1 Sec.
iv) The busbar temperature rise shall not exceed 35 Deg.C over an ambient of 50 Deg.C.
v) The degree of protection for the LDB shall be IP-54.
vi) All cables shall enter from the bottom.
vii) 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 energized.
viii) 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.
ix) 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.

4.0 MAIN EMERGENCY LIGHTING BOARD

The Main Emergency Lighting Board shall consist of the following:

i) Automatic changeover contactor
ii) Voltage sensing relays.
iii) Time delay relay.
iv) Bus Bars
v) Two pole/three pole rotary switches with HRC fuse for incoming and outgoing feeders
vi) Test switch, push button type.
vii) Indicating lamps, ac - Green, dc - Red.
viii) Terminals for remote indication.

ix) 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.

x) Change over DC lighting in case of black out.

The main emergency lighting board shall have an automatic changeover switch to energize 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 70 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.

Local Emergency Lighting Pillar shall be identical in details to Lighting Distribution Pillar specified in above para 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.

5.0 LUMINARIES

5.1 Luminaries for use in normal and emergency illumination systems in the substation are suggested below. In case the bidder intends to use luminaries of different types, he shall clearly furnish the advantages and reasons for the proposed luminaries in his bid. All the luminaries shall be supplied complete with all accessories and lamps

Sl. No.	Area / Type of Illumination System	Types of fitting & Lamps
1	Indoor	Fitting and fixtures suitable for LED Type lamps
2	Outdoor	Fitting and fixtures suitable for LED Type lamps
3	Roads	Fitting and fixtures suitable for LED Type lamps
4	Specific spots flood light	Fitting and fixtures suitable for LED Type lamps

5.2 The flood light luminaries 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 luminaries it shall be ensured that the stipulated electrical clearances are not violated. The Contractor shall supply and install suitable type of pole structures, required for installing the fittings for illuminating the roads, fence etc

6.0 WIRING

All lighting fixtures and 5A convenience outlets shall be wired with 1.1 KV grade PVC insulated extra flexible, multi stranded, copper conductor cables of size not less than 2.5 sq.mm.

For 15A heavy-duty outlets copper conductor cables of size not less than 6 sq. mm shall be used.

The wiring shall consist of phase, neutral and ground. For grounding the lighting fixtures/convenience outlets etc.,2.5sqmm Green wire shall be used. The phase and neutral conductor shall be suitably colour coded.

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.

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.

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.

All wiring materials such as terminals, crimping lugs, ferrules etc. shall also be provided by the Contractor.

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.

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.

7.0 JUNCTION BOX / WALL BOX

100 mm x 100 mm junction boxes and wall boxes of standard size shall be provided.

Wall boxes and junction boxes shall be made of sheet metal with a thickness of 14 gauge (minimum). Necessary conduit termination fittings such as bushings, locknuts etc. also be provided.

8.0 DEVIATIONS

Deviation from this specification, if any, shall be clearly brought out in the offer. Unless owner explicitly accepts such deviations, it shall be considered that the offer fully complies with the specification.

NEW GRID

TECHNICAL SPECIFICATION

FOR

SCADA INTERFACE WORK & AUTOMATION

Prepared by	**K A SENTIL KUMARAN**		**Rev: 7.1**
Reviewed & Approved by	**GOPAL NARIYA**		**Date: 15-10-2020**

Volume-I Technical Specification for SCADA interface work & Automation

1.0 INTENT OF SPECIFICATION:

This specification is intended to cover the supply and execute work related to interface of all electrical equipments with RTU panel 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.

2.0 SCOPE OF WORK

For substation, it is proposed to lay and terminate panel wirings / control cables if any between the equipments such as CT, PT, Circuit Breaker, Isolators, 11 KV Switchgear, 66,33,11 KV Control & Relay Panels, Power Transformer & its sensors – OTI, WTI, TPI, AVR, etc, REGDA relay, Capacitor Bank,NIFPS,Smoke Detectors and Battery Charger.

The scope of work under this category would include:

- Supply of SCADA materials – BCU,BCPU & RTU with Processors (Basic License - IEC 870-5,101,103,104, Modbus, IEC 61850-8-1, IEC -104 Master, IEC 104 Slave + PLC License) along with IO Modules. Other accessories such as Communication Rack, Power Supply Modules, MFM,GPS, Converters for DC to DC & Other FO Converters, Cables Cables - FO, CAT-6, RS485, Control Cables, Connectors if any shall be in SCADA vendor's scope of supply.
- Installation, Testing & Commissioning of SCADA equipments with Control Center via IEC-104 Protocol.
- Integration, Database development & Testing of SCADA Front end equipments (Sub Station level equipments integration over Modbus TCP IP,Serial/IEC-103/IEC-61850 Protocols.
- Extraction of ICD/SCD files from IED and further integration with RTU over IEC-61850/IEC103 Protocols at site with Supplied Hardware.
- Supply of Necessary RTU Till Tool with Licenses & Softwares if any (Ex:IET600) required for ICD/SCD file configuartion in RTU.
- Laying and Termination of armored Communication cables (Ethernet, Fiber Optic Patch Cards/Cable,RS 485 cables) between grid devices (Numerical Relays/BCPU, Transformer Monitoring Modules, Smoke detector, NIFPS panel, MFM, Battery Charger) to RTU/DCU/Gateway with proper tagging,and dressing upto RTU panel. Supply of Suitable Glands, White Sleeve PVC ferrule, tagging, lugs shall be scope of vendor's supply.
- Laying and termination of control cables between grid equipments (control and relay panel, NIFPS, Battery Units) to RTU for hardwired signals.
- Installation of cable trays with accessories or trench as required for the cabling work.
- Integration of PQA over Modbus TCP IP/IEC-61850 with dedicated network.
- Integration Li-Ion Battery Charger Over Modbus TCP IP/Serial with RTU.

- Preparation of cable schedule, Wiring diagrams,Training documents with Step by Step Procedures and Interconnection as built drawings.
- Separate earthing bus bars to be provided for RTU panel and it will be directly connected to grid earthing.Earth BAR material should be Copper.
- Seprate earth pit with connections for Electronic cards,gateway,Switches,DCU.,etc.. earthing.
- All internal wiring between BCU and C&R Panel terminals, All Numerical relays,MFM (Multifunctional meters) and other grid equipment integration should be under SCADA vendor's scope.
- Hardware & software integration of RTU, Bay Control Units along with other equipments viz. Battery Chargers, Multi Function Meters, Fire Fighting System Signals, Transformer relays (for OTI, WTI, TPI, AVR, etc.),Smoke Detector Panels, Numerical Relays, 11&33&66KV Control and Relay panel signals etc. shall be in Vendor's scope.
- FAT and Training arrangements at factory/Work shop for BSES SCADA team (6 Persons for 5 days) – Travel ,Boarding, accommodation and local conveyance etc..shall be under SCADA Vendor's Scope.

2.1 Cables

The following types of cables / wirings will be required for extending signals and commands. Tagging is mandatory for all types of cables. Heat shrinking ferrule sleeves with printed ferrules to be used for identifying cables & Signals.

- 2.5 mm2, multi-stranded flexible copper wire, FRLS 1.1KV HRPVC for AC & DC Supply & 1.5 mm2 multi strand cables for other internal wiring for RTU.
- Red(P)and Black(N) color cable core to be used for AC and DC wiring.
- Fiber Optic Cables (GLASS&PLASTIC Types) with suitable connectors & Ethernet cables (CAT6) with conduit pipe for internal connections and GI Armored Cables for external connections.
- 2 C X 2.5 MM2 multi strained copper cable, ARM FRLS 1.1KV HRPVC for external AC / DC Power Supply.
- 16 C x 1.5 mm2,multi strained copper cable, ARM FRLS 1.1KV HRPVC ,Application: digital signal feed back.
- 3P X 1.5 mm2 for DO (Digital output)
- 2P X 0.5 mm2 Screened GI Armored RS485,Twisted pair, 22gauge Belden 8761 or equivalent for external (RTU to BCUs /MFM/BATT.CHG/Transformer Monitoring Devices) RS 485 connections.

The supplied cable shall be as a latest IS, also refer control cable specification.

❖ **Cable Gland**

Double Compression cable glands (Materials - Brass and Stainless Steel & Suitable for Industrial Grade) of different sizes for cable entry into the RTU,DCU,CRP & Other Panels

- **Cable Trays and NS cable Support**

  Perforated / ladder type (galvanized Iron) with cover for laying the cables.

2.2 Multifunction Meters (Accuracy – 0.2)

To extend the current / voltage / active and reactive power, power factor, etc. to RTU, MFMs, to be installed in C & R Panel individually for each feeder/ breakers and should be integrated with RTU.The outputs of these meters **(in groups of 5)** connections should be made using twisted pair screened cable (Typically 22gauge Belden 8761 or equivalent) & two wires (A and B) connections are daisy chained together and integrated with RTUs. All hardware's or protocol converters for having Modbus Protocol output, CT & PT wirings to MFMs and its Configuration should be in Vendor's scope.

For the protection of MFMs and RTU cards against Surges and electrical leakages, it is necessary to install Surge Protection Devices in b/w RTU & MFM serial loops. The typical diagram for this connection is mentioned in the System Architecture diagram**. MFM should be powered through Grid Battery Voltage (220 Volt or 50 Volts DC).**

The following parameters of MFM must be available for communication with RTU.

- Phase Voltages (L1-N, L2-N, L3-N)
- Line Voltages (L1-L2, L2-L3, L1-L3)
- Line Currents (IL1 , IL2, IL3)
- Active Power & Reactive Power
- Maximum Demand (KW) & Frequency
- Power factor
- Active Energy
- THD mean current & THD mean Voltage
- Neutral Current.
- Phase Angles

Approved Makes – RISH 3440 and Conzerv EM 6400NG

2.3 Numerical Relays or Bay Control Protection Units for all feeders (11,33,66KV)

Numerical Relays(BCPU) shall be integrated with Remote Terminal Units. All hardware's and protocol converters if required for compatibility with SCADA shall be in Vendor's scope.

The respective BCU,BCPU & Numerical Relays must have **dual redundancy communication ports** (Ethernet/Copper Ports) with **PRP & RSTP** protocols for SCADA connections & It will be connected to RTU via IEC 61850 protocol. (Dual Ports required to form **a Ring or PRP** Networks b/w relay to relay connections).

Hot Standby/Dual Power Supply Unit shall be supplied along with BCU.It will increase the BCU availability, if any one Power supply card fails the other one should keep the bay control unit continuous live.

Data Base File must be downloadable and Uploadable from BCU.

The following signals are to be taken from Numerical Relays to the BCUs through internal hard wiring. This list is indicative and signals should not be limited to this. Additional signals can be taken during review of actual drawings. – **Refer Para 2.8 for detail signals list with data format (DPI,DCO,SPI,SCO,Measured Values) types.**

- Online Currents / Voltage & Relay General trip signal
- All breaker,Isolators,Control & Relay Panel indications and commands
- Fault current and phase indication of faulty phase viz. R,Y,B, Earth, Unbalance(O/C & E/F Relay).
- Fault Differential and Bias current in Line and Transformer Differential Relay
- Fault voltage and phase indication of faulty phase viz. R,Y,B (Voltage Protection Relay).
- Post fault currents (R, Y, B phase separately) measured value & Relay Internal Fault
- Fault distance (in case of distance relays - R, Y, B Phase separately)
- Unbalance Current (in case of neutral displacement relay of capacitor feeders).

2.4 **Transformer Signal -** TMD (REGDA, A-EBERLE relays):

OTI, WTI, TPI, AVR and Transformer auxiliary protection signals should be integrated with RTU via IEC 61850 Protocol. TMD must have dual communication ports & have the option of RSTP and PRP Protocols for SCADA Connections.

All field installations of these sensors and its wiring/cabling and configuration along with hardware's or protocol converters, if any, should be in Contractor's scope. - **Refer Para 2.8 for detail signal's list with data types.**

2.5 **Battery Charger and Lithium Battery Integrations:**

All signals of Battery Chargers/Lithium Ion should have MODBUS Protocol output and integrated with an RTU through serial communication (RS 485) cables.

Laying communication cables through conduit pipe and battery charger signals (Soft & Hard Signals) integration with an RTU shall be in Vendor's Scope. - **Refer Para 2.8 for detail Battery Charger signal's list with data types.**

2.6 **Data Concentrator Unit/Gateway & Remote Terminal Units**

For extending the signals from the grid to the Master Control Centre & Backup Control Centre, BCUs and RTUs are to be installed. BCUs needs to be initially physically integrated with Numerical relays of respective breakers to enable soft signals and commands for breakers to be configured there and respectice BCU or BCPU integrated with Remote Terminal Units through IEC – 61850 protocol. However the options for IEC-60870-103 protocol along with the MODBUS protocol option is required for other devices integrations. BCUs can be of **ABB, Siemens,Schneider Electric, etc .,** make is depending on the type/ make of switch gears.**Remote Terminal Units need to be installed for interface between the BCUs and Control Centers (Main and Backup) through IEC – 60870 – 104 Protocol.** The

size of RTU will depend on the size of the substation, no. of the feeders/ number of signals and command outputs along with sufficient spares (20%) for future requirement.

All associated equipments and Supply of accessories including software &Operating tool / multiple user licenses for RTU & BCU, MCBs for DC and AC Supply, DC to DC Converter (in case station battery voltage level is 220 volts DC), etc. should be in Vendor's scope.

Hardware & software integration of RTUs, BCU along with other equipments viz. Battery Chargers, Multi Function Meters, Fire Fighting Systems, Signals, Transformer relays (for OTI, WTI, TPI, AVR, etc.), Numerical Relays, etc. should be in Vendor's scope.

In case of more than one BCPU,RTU,DATA Concentrator than these units must be able to communicate with other units on internal local IPs (Ex – 192.168.0.1) other than LAN IP(Ex-10.125.107.1) series.

Hot redundancy is required for Main Processor cards, rack/board and Gateway for MCC & BCC Communications.Each main processor must have two Ethernet ports dedicated for communication with SCADA servers over IEC 60870-104 protocol. First card will be live and 2nd card will be hot standby. Communication switchover between either cards in case of failure.

Main Processor cards along with Rack for MCC communication should be separate from the IO cards.

Data Base File must be downloadable and Uploadable from RTU,CPU and Gateway.

Approved RTU makes – ABB-RTU560,Schneider-SAITEL DP and Siemens (AK3). Bidders who are OEM of RTU and Numerical Relays are only acceptable.

Note : System shall be approved if they are agree to fulfill the following terms & Conditions,

- AMC period should be given 3 years along with this proposal.
- AMC period should be started after handovering the system to BSES.
- During AMC period all the issues pertaiting to RTU/Gateway/BCU should be handled by OEM at site(this included unlimited site visit)
- 5 Year replacement warranty is applicable for all OEM for Electronic cards & Gateway Units…If any hardware (or) Software fails during this period will be rectified by OEM.

RTU,Data Concentrator Unit Features & Performance capabilities

2.6.1 RTU,DCU Size and Expandability

20% Spare for RTU,DCU - Provision for 20 % (Basic IO Count +20% Spare) of the total DI / DO signals (hard/soft) as a spare should be made available for future requirement.

Spare Ports – 20% Spare ports **(Minimum – 3 to 4 No's Serial ports are essential)** for IEC 103/Mod Bus Protocol Connections

20% Spare for BCU,BCPU - Each Control and Relay panel BCU must have 20% (Basic + 20% Spare) of the particular bay DI/DO signals as a spare should be available.

Panel Size & Hardware Capacity - The RTU panel sizing should be capable of accommodating additional 50% of the basic I/O counts by way of addition of hardware such as modules, racks, panels, Terminal Blocks of basic I/O counts.

Software Capacity - The RTU software and database generation should be sized to accommodate for additional 50% of the basic I/O count without requiring software or database regeneration or License.

2.6.2 Remote database, downloading of RTU from master station/SCADA control center.

2.6.3 RTU shall have the capability of automatic start-up and initialization following restoration of power after an outage without the need for manual intervention. All restarts shall be reported to the connected master stations.

2.6.4 Act as a data concentrator on IEC60870-5-101/104/MODBUS/IEC 61850 protocols and Support for IEC 60870-5-103, IEC 60870-5-101, IEC 61850,MODBUS TCP IP and RS485 Modbus RTU protocols & ability to act as a gateway for Numerical relays.

2.6.5 **Cyber Security**

As the SCADA system will use public domain, such LAN/VSAT/GPRS/CDMA etc. therefore it is mandatory to guard the data/ equipment from intrusion/damage/breach of security & shall have SSL/VPN based security.

2.6.6 Internal battery backup to hold data in SOE buffer memory & also maintaining the time & date.

2.6.7 RTU must have the capability of time synchronization with a GPS receiver and the GPS at the control room will be used for this synchronization purpose. In case of failure of the GPS receiver, the RTUs time synchronization should be through the Master's SCADA clock.

2.6.8 **GPS for Time Synchronization** - The RTU must have inbuilt (or) external GPS with antenna & internal real time clock to synchronize the IEDs connected to it over their respective protocol. **GPS must have dual redundant LAN port for time synchronizations.**

2.6.9 **Main Processor(CPU in RTU & Gateway) HOT Retundancy for MCC & BCC communication**

Main processor (DCU) /RTU should have adequate capacity for data handling / processing and main processor/CPU must have required number of communication ports for simultaneous communication with Master Stations (MCC & BCC), /MFTs and RTU configuration & maintenance tool.**RTU main processor and Gateway must have HOT redundancy features for control center communications.**

2.6.10 **Hot Standby/Dual Power Supply Unit & Redundancy in power source for RTU and BCU/BCPU** - Possibility to increase the RTU,BCU main rack availability by having a second power supply card in case the first one fails **, if any one Power supply card fails the other one should keep the system continuous live.**

2.6.11 **CPU/RTU Soft Configuration Future (Communicate to multiple master stations simultaneously on IEC60870-5-104.)**

RTU/DAU must have multiple location (minimum 5 Locations) data transmission facility VAZ Master Control Centre, Backup Control Centre, etc.

2.6.12 **Protection Devices for RTU,BCPU –** All modules (**all Digital, Analog Input modules**) and ports (**Serial and Ethernet ports**) must have in-built or external surge protection devices and optical isolation

2.6.13 **Diagnostic Software & Multi user tool/License for RTU/(Numerical Relay) BCU** -

Diagnostic Software tool with licensed version shall be provided to continuously monitor the operation of the RTU and report RTU hardware errors to the connected master stations. The software shall check for memory, processor, and input/output ports errors and failures of other functional areas defined in the specification of the RTU**. If any system tries to connect to RTU for download/ Upload files,itshould be stored as a log in RTU.**

2.6.14 **RTU Panels**

At least 50% of the space inside each enclosure shall be unused (spare) space that shall be reserved for future use. The Contractor shall provide required panels conforming to IEC 529 for housing the RTU modules/racks, relays etc. and other required hardware. The panels shall meet the following requirements:

- Shall be free standing, floor mounted and height shall not exceed 2200 mm.
- RTU Panel should have air conditioner and should be mounted on side wall of RTU panel with temperature/humidity control facility. FAN with Filters shall be considered for for back up cooling.
- Seprate room / Cabinet with AC Provision to be considered for RTU and IT Equipments.
- All doors and removable panels shall be fitted with long life rubber beading.
- All non load bearing panels/doors ,top and bottom portion, rear cover shall be fabricated from minimum 2.0 mm thickness steel sheet and all load bearing panels, frames, top & bottom panels shall be fabricated from minimum 3.0 mm thickness steel sheet.
- Shall have maintenance access to the hardware and wiring through lockable full height doors.
- Shall have the provisions for bottom cable entry.
- All panels shall be supplied with 230V AC, 50 Hz, single-phase switch and 15/5A duplex socket arrangement for the maintenance.
- All panels shall be provided with an internal maintenance lamp, space heaters and gaskets.
- All panels shall be indoor, dust-proof with rodent protection, and meet IP54 class of Ingress protection.
- There shall be no sharp corners or edges. All edges shall be rounded to prevent injury.
- Document Holder shall be provided inside the cabinet to keep test report, drawing, maintenance register etc.
- All materials used in the enclosures including cable insulation or sheathing, wire troughs, terminal blocks, and enclosure trims shall be made of flame retardant material and shall not produce toxic gases under fire conditions.

2.6.15 **RTU Grounding**

The safety ground shall be isolated from the signal ground and shall be connected to the ground network. Safety ground shall be a copper bus bar. The contractor shall connect the panel's safety ground to the grid grounding network. Separate grounding is created for communication equipments and Signal ground shall be connected to the communication equipment signal ground.

2.7 Ethernet /Fiber Switch

The Ethernet/Fiber optic switches Should be a managed switch and are intended to be installed in the control room and shall be complaint to IEC-61850 electrical substation networks and IEEE 1613 standards. Provisions for additional feeders on the Ring Configuration should be provided on the same switch.

- Laying of Ethernet/Fiber cables for relay/BCU port to the RTU via switch through conduit pipe and integration with an RTU shall be in Vendor's Scope.
- Switch, Standard Features
- Switch design should withstand for power substation automation applications that operate in extremely harsh environments (High and medium voltage S/Stn environments) and it also withstands vibration, electrical surges, fast transients, electrostatic discharge, and extreme temperatures and humidity. Industrial managed Fast Ethernet Switch shall be supplied according to IEEE 802.3.
- Switch features and configuration should be easy to user interface and it must directly integrate with any other IEC-61850 devices. Shall be managed type,Layer-3 Switches and have KEMA certifications for IEC 61850.
- The FO switch shall support Multimode fiber and single mode fiber in 100Mbps ports on an SFP (simple form factor pluggable), for ease of functionality and maintenance.100Mbps ports for sub station level communications & 2 or 4 Gigabit Port for uplink communications.
- Retundancy Ring : Dual Ring to be consider between Ethernet switches for maintaining redundancy network.
- Hot Standby/Dual PSU & Redundancy in power source - Possibility to increase the switch availability by having a second power source in case the first one fails & should be available with 48VDC.Each PSU should be connected with a different power source, if any one power source or Power supply card fails then other one should keep the switch continuous operation.
- 20% Spare ports - Each switch must have 20% spare ports for future/back up requirements.
- Link Failure contact alarm - Failure contact alarm shall be achieved by hardware contact that is activated when a link problem occurs.
- Logs and alarms with Time Stamp - Statistics about link status alarms are to be stored with the accurate timestamp duly tracing all events.
- Security features - The FO switches shall support different user levels with different passwords, including the facility to work with different VLANs, following the 802.1Q

standard, port security based on MAC addresses, possibility to disable unused ports, authentication protocols shall be provided. The FO switches shall have advanced security features to be implemented to avoid unauthorized access to the system Such as RADIUS/TACACS & VPN gateway support with IP Sec & SSH.

- High Speed Implementation of RSTP protocol - The FO switches shall support STP and RSTP protocols, and shall facilitate for recovery and the fault recovery times shall be within 5 -10msec per switch, always fulfilling the RST protocol.
- Time Synchronization to RTU/Server and Connected IED/BCU - The FO switch shall have an internal clock and shall be synchronized from a network SNTP/NTP server, so all time stamped events shall be with a reliable time reference.
- Tools with License - Diagnostics tool, other necessary tools with a multi user license to be provided along with the switch.
- Mounting Options - Switch should be DIN Rail Mountable & also need to quote for Optional Wall/Rack Mountable kit.
- Local USB port for emergency boot is Mandatory.
- Network based distributed security by having a firewall on each port of the switch for all the standard Industrial protocol like IEC-61850 should be available.
- The FO switch shall have the facility of Port mirroring and the user shall configure one port to replicate traffic flows of different ports, so the system administrator can monitor the incoming, outgoing, or all kinds of traffic that is going through the ports under study.
- ITU-T G.8032 support for Ethernet Ring redundancy, ensuring fast failure detection is preferred.
- They FO switches shall sustain the stringent levels in temperature range and electromagnetic immunity defined in the 61850-3, but also the advanced functional requirements defined for operation with other IEC-61850 devices. The Switch should be certified on IEC-61850, functional & Environmental specifications by KEMA.

2.8 SIGNAL LIST (11/33/66KV)

List of Abbreviations
AI - Analog Input/Analog Values
MV - Measured Value
MFM - Multi Function Meter
DCO - Double Command Output
DPI - Double Point Indication
SCO - Single Command Output
SPI - Single Point Indication
RTU - Remote Terminal Units
BCU - Bay Control Units

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Signals - 11KV Out Going Feeders	Digital Input/AI soft through N.Relay/BCU	Digital Out Put soft through N.Relay/BCU	Digital Input Hard Wire to RTU	Additional signals Hard wire to RTU for backup	Signal Type	N.Relay Protocol
Breaker ON	√			√		IEC-61850 with Dual Communication Ports
Breaker OFF				√	DPI	
Trip Ckt Healthy -1 & 2	√				SPI	
Spring Charge	√				SPI	
Breaker in service	√				SPI	
Breaker in Test					SPI	
Auto Trip(86) Operated	√			√	SPI	
Panel DC Fail			√		SPI	
L/R Switch in Local	√				SPI	
L/R Switch in SCADA				√	SPI	
Relay Int Fault.			√		SPI	
Over Current Operated	√				SPI	
Earth Fault Operated	√				SPI	
BKR Close COMMAND		√		√		
BKR Open COMMAND					DCO	
AutoTrip(86) relay reset from Remote		√			SCO	
3Phase R,Y,B - Current & Voltage,Active Power,Reactive Power,Power Factor,Max.Demand,Neu.Current	√				AI/MV	
Fault current and phase indication of faulty phase viz. R,Y,B, Earth, Unbalance(O/C & E/F Relay).Disturbance Records, Fault Graphs for Remote diagnosis purpose	√				AI	
Total Signals - BCPU & RTU	13 DI + Analog , Measurand Values	3 DO	2DI	5DI + 2 DO		
Essential inbuilt Spare in BCPU,BCU	3 DI	2 DO				

Signals - 11KV Incomers	Digital Input/AI soft through N.Relay/BCU	Digital Out Put soft through N.Relay/BCU	Digital Input/Output Hard Wire to RTU	Additional signals Hard wire to RTU for backup	Signal Type	N.Relay Protocol
Breaker ON	√			√	DPI	IEC-61850 with dual Communication Ports
Breaker OFF				√		
Trip Ckt Healthy -1 & 2	√				SPI	
Spring Charge	√				SPI	
Breaker in service	√				SPI	
Breaker in Test					SPI	
Auto Trip(86) Operated	√			√	SPI	
VT fuse Blown - Metering.	√				SPI	
VT fuse Blown - Protection	√				SPI	

Panel DC Fail			√		SPI
L/R Switch in Local	√				SPI
L/R Switch in SCADA				√	SPI
Relay Int Fault.			√		SPI
Over Current Operated(All stages)	√				SPI
Earth Fault Operated (All stages)	√				SPI
Under Voltage Prot.Operated	√				SPI
Over Voltage Prot.Operated	√				SPI
REF Operated	√				SPI
BKR Close COMMAND		√		√	
BKR Open COMMAND				√	DCO
AutoTrip(86) relay reset from Remote		√			SCO
3Phase R,Y,B - Current & Voltage,Active Power,Reactive Power,Power Factor,Max.Demand,Neu.Current	√				AI/MV
Fault current and phase indication of faulty phase viz. R,Y,B, Earth, Unbalance(O/C & E/F Relay).Fault voltage and phase indication of faulty phase viz. R,Y,B (Voltage Protection Relay). Disturbance Records, Fault Graphs for Remote diagnosis purpose	√				AI
Total Signals - BCPU & RTU	17 DI + Analog , Measurand Values	3 DO	2DI	5DI + 2 DO	
Essential inbuilt Spare in BCPU,BCU	3 DI	2 DO			

Signals - 11KV Bus Coupler	Digital Input/AI soft through N.Relay/BCU	Digital Out Put soft through N.Relay/BCU	Digital Input/Output Hard Wire to RTU	Additional signals Hard wire to RTU for backup	Signal Type	N.Relay Protocol
Breaker ON	√			√		IEC-61850 with Dual Communication Ports
Breaker OFF				√	DPI	
Trip Ckt Healthy -1 & 2	√				SPI	
Spring Charge	√				SPI	
Breaker in service	√				SPI	
Breaker in Test					SPI	
Auto Trip(86) Operated	√			√	SPI	
Panel DC Fail			√		SPI	
L/R Switch in Local	√				SPI	
L/R Switch in SCADA				√	SPI	
Relay Int Fault.			√		SPI	
PT MCB - Metering operated	√				SPI	
PT MCB - Protection operated	√				SPI	

Over Current Operated	√				SPI	
Earth Fault Operated	√				SPI	
BKR Close COMMAND		√		√		
BKR Open COMMAND					DCO	
Fault current and phase indication of faulty phase viz. R,Y,B, Earth, Unbalance(O/C & E/F Relay).Disturbance Records, Fault Graphs for Remote diagnosis purpose	√				AI	
Total Signals - BCPU & RTU	14DI + Analog , Measurand Values	3 DO	2DI	5DI + 2 DO		
Essential inbuilt Spare in BCPU,BCU	3 DI	2 DO				

Signals - 11KV Capacitors	Digital Input/AI soft through N.Relay/BCU	Digital Out Put soft through N.Relay/BCU	Digital Input/Output Hard Wire to RTU	Additional signals Hard wire to RTU for backup	Signal Type	N.Relay Protocol
Breaker ON	√			√		IEC-61850 with Dual Communication Ports
Breaker OFF				√	DPI	
Bank ISO ON	√					
Bank ISO OFF					DPI	
Trip Ckt Healthy -1 & 2	√				SPI	
Spring Charge	√				SPI	
Breaker in service	√				SPI	
Breaker in Test					SPI	
Master Trip(86) Operated	√			√	SPI	
Bus PT fuse Blown - Metering.	√				SPI	
Bus PT fuse Blown - Protection	√				SPI	
Panel DC Fail			√		SPI	
L/R Switch in Local	√				SPI	
L/R Switch in SCADA	√			√	SPI	
Over Current Operated	√				SPI	
Earth Fault Operated	√				SPI	
Under Voltage Prot.Operated	√				SPI	
Over Voltage Prot.Operated	√				SPI	
Neg.Phase.sequence Operated	√				SPI	
Timer Relay operated/Normal	√				DPI	
Relay Int Fault.			√		SPI	
BKR Close COMMAND		√		√		
BKR Open COMMAND					DCO	
BANK ISO OPN		√				
BANK ISO CLS					DCO	
Master trip (86)reset from remote		√			SCO	
3Phase R,Y,B - Current&Voltage,Reactive Power,Neu.Current	√				AI/MV	

Fault current and phase indication of faulty phase viz. R,Y,B, Earth, Unbalance(O/C & E/F Relay).Fault voltage and phase indication of faulty phase viz. R,Y,B (Voltage Protection Relay). Disturbance Records, Fault Graphs for Remote diagnosis purpose	√				AI	
Total Signals - BCPU & RTU	19 DI + Analog , Measurand Values	5 DO	2DI	5DI + 2 DO		
Essential inbuilt Spare in BCPU,BCU	3 DI	2 DO				

Signals - 33 & 66KV Incomers/Out Going	Digital Input/AI soft through N.Relay/BCU	Digital Out Put soft through N.Relay/BCU	Digital Input/Output Hard Wire to RTU	Additional Spare signals (Hard wire to RTU for backup)	Signal Type	Protocol
Breaker ON	√			√	DPI	IEC-61850 with Dual Communication Ports
Breaker OFF				√		
Front Bus (89A) ISO ON(In-Case of O/D)	√				DPI	
Front Bus (89A) ISO OFF (In-Case of O/D)						
Rear Bus (89B) ISO ON (In-Case of O/D)	√				DPI	
Rear Bus (89B) ISO OFF (In-Case of O/D)						
LINE ISO (89L) ON (In-Case of O/D)	√				DPI	
LINE ISO (89L) OFF (In-Case of O/D)						
Earth Switch (89LE) -1 ON (In-Case of O/D)	√				DPI	
Earth Switch (89LE) -1 OFF (In-Case of O/D)						
Earth Switch (89LE) - 2 ON (In-Case of O/D)	√				DPI	
Earth Switch (89LE) - 2 OFF (In-Case of O/D)						
Breaker in service (In-case of I/D BKR)	√				SPI	
Breaker in Test (In-case of I/D BKR)	√				SPI	
Trip coil Ckt Healthy - 1 & 2	√				SPI	
Spring Charge	√				SPI	
Master trip(86) Operated	√			√	SPI	
SF6 Pressure Low & SF6 Lock Out	√				SPI	
VT fuse Fail	√				SPI	
Panel DC Fail			√		SPI	
L/R Switch in Local	√				DPI	
L/R Switch in Remote	√			√		
LBB Operated	√				SPI	
Relay Int Fault.			√		SPI	
Over Current Operated (All stages)	√				SPI	
Earth Fault Operated (All stages)	√				SPI	
DIFF.Prot Operated	√				SPI	
DIST.Ptot Operated	√				SPI	
BKR CLS COMMAND		√		√	DCO	
BKR OPN COMMAND				√		
Front Bus (89A) ISO OPNCOMMAND (In-Case of O/D)		√			DCO	

Front Bus (89A) ISO CLS COMMAND (In-Case of O/D)						
Rear Bus (89B) ISO CLS COMMAND (In-Case of O/D)		√			DCO	
Rear Bus (89B) ISO OPN COMMAND (In-Case of O/D)						
LINE ISO (89L) OPN COMMAND (In-Case of O/D)		√			DCO	
LINE ISO (89L) CLS COMMAND (In-Case of O/D)						
Master Trip(86) relay reset from Remote		√			SCO	
3Phase R,Y,B -Current&Voltage,Active&Reactive Power,PowerFactor,Max.Demand,Neu.Current etc	√				AI/MV	
Fault current and phase indication of faulty phase viz. R,Y,B, Earth, Unbalance(O/C & E/F Relay).Fault voltage and phase indication of faulty phase viz. R,Y,B (Voltage Protection Relay). Fault Differential and Bias current in Line and Transformer Differential Relay ,Fault distance (in Distance Relay) ,Disturbance Records, Fault Graphs for Remote diagnosis purpose	√				AI	
Total Signals - BCPU & RTU	29 DI + Analog , Measurand Values	9 DO	2DI	5DI + 2 DO		
Essential inbuilt Spare in BCPU,BCU	6 DI	3 DO				

Signals - 33 & 66KV Transformer	Digital Input/AI soft through N.Relay/BCU	Digital Out Put soft through N.Relay/BCU	Digital Input/Output Hard Wire to RTU	Additional signals Hard wire to RTU for backup	Signal Type	Protocol
Breaker ON	√			√	DPI	IEC-61850 with dual Communication Ports
Breaker OFF				√		
Front Bus (89A) ISO ON(In-Case of O/D)	√				DPI	
Front Bus (89A) ISO OFF (In-Case of O/D)						
Rear Bus (89B) ISO ON (In-Case of O/D)	√				DPI	
Rear Bus (89B) ISO OFF (In-Case of O/D)						
TRF ISO (89T) ON (In-Case of O/D)	√				DPI	
TRF ISO (89T) OFF (In-Case of O/D)						
Earth Switch (89LE) -1 ON (In-Case of O/D)	√				DPI	
Earth Switch (89LE) -1 OFF (In-Case of O/D)						
Earth Switch (89LE) - 2 ON (In-Case of O/D)	√				DPI	
Earth Switch (89LE) - 2 OFF (In-Case of O/D)						
Breaker in service (In-case of I/D BKR)	√				DPI	
Breaker in Test (In-case of I/D BKR)						
Trip coil Ckt Healthy - 1 & 2	√				SPI	
Spring Charge	√				SPI	
Auto Trip(86) Operated	√			√	SPI	
Differential Operated	√				SPI	
LBB Operated	√				SPI	

REF/SEF Prot Operated	√				SPI	
SF6 Pressure Low & SF6 Lock Out	√				SPI	
Panel DC Fail			√		SPI	
L/R Switch in Local	√				DPI	
L/R Switch in Remote	√			√		
Relay Int Fault.			√		SPI	
Over Current Operated	√				SPI	
Earth Fault Operated	√				SPI	
BKR CLS COMMAND		√		√	DCO	
BKR OPN COMMAND				√		
Front Bus (89A) ISO OPNCOMMAND (In-Case of O/D)		√			DCO	
Front Bus (89A) ISO CLS COMMAND (In-Case of O/D)						
Rear Bus (89B) ISO CLS COMMAND (In-Case of O/D)		√			DCO	
Rear Bus (89B) ISO OPN COMMAND (In-Case of O/D)						
Trf ISO (89T) OPN COMMAND (In-Case of O/D)		√			DCO	
Trf ISO (89T) CLS COMMAND (In-Case of O/D)						
Mastertrip (86) relay reset from Remote		√			SCO	
3Phase R,Y,B -Current&Voltage,Active&Reactive Power,PowerFactor,Max.Demand,Neu.Current	√				AI/MV	
Fault current and phase indication of faulty phase viz. R,Y,B, Earth, Unbalance(O/C & E/F Relay).Fault voltage and phase indication of faulty phase viz. R,Y,B (Voltage Protection Relay). Fault Differential and Bias current in Line and Transformer Differential Relay ,Fault distance (in Distance Relay) ,Disturbance Records, Fault Graphs for Remote diagnosis purpose	√				AI	
Total Signals - BCPU & RTU	28 DI + Analog , Measurand Values	9 DO	2DI	5DI + 2 DO		
Essential inbuilt Spare in BCPU,BCU	6 DI	3 DO				

Transformer - RTCC/A-Eberle Signals	Digital Input/AI soft through TMM	Digital Out Put soft through TMM	Digital Input/Output Hard Wire to RTU	Analog Input soft through TMM	Signal Type	Protocol
A-Eberle Unit Faulty/DC Fail			√		SPI	IEC-61850 with Dual Communication Ports
Oil Temp Alarm	√				SPI	
Oil Temp trip	√				SPI	
Winding Temp Alarm	√				SPI	
Winding Temp Trip	√				SPI	
Buchholz Alarm	√				SPI	
Buchholz Trip	√				SPI	
PRV TRIP	√				SPI	
OLTC OSR	√				SPI	

MOG/LOW Oil level Alarm	√				SPI	
SPR Trip	√				SPI	
OSR Main Tank	√				SPI	
L/R Switch in Local	√				DPI	
L/R Switch in Remote	√					
Auto Mode	√				DPI	
Manual Mode	√					
Fan Fail	√				SPI	
Tap Changer Fail	√				SPI	
OLTC Out of Step/Stuck Up/Motor trip	√				SPI	
Tap Rise/Tap Low Command		√			DCO/RCO	
Tap Rise/Tap Low Command		√				
Oil Temp				√	AI	
Winding Temp				√	AI	
Tap Position				√	AI	
Total Signals - BCPU & RTU	19 DI	2 Command	1 DI	3 Analog , Measurand Values		
Essential inbuilt Spare in BCPU,BCU	2 DI	1 DO				

Signals - 33 & 66KV BusCoupler	Digital Input/AI soft through N.Relay/BCU	Digital Out Put soft through N.Relay/BCU	Digital Input/Output Hard Wire to RTU	Additional signals Hard wire to RTU for backup	Signal Type	Protocol
Breaker ON	√			√	DPI	IEC-61850 with Dual Communication Ports
Breaker OFF				√		
Front Bus (89A) ISO ON(In-Case of O/D)	√				DPI	
Front Bus (89A) ISO OFF (In-Case of O/D)						
Rear Bus (89B) ISO ON (In-Case of O/D)	√				DPI	
Rear Bus (89B) ISO OFF (In-Case of O/D)						
Earth Switch (89AE-1) - ON (In-Case of O/D)	√				DPI	
Earth Switch (89AE-1) - OFF (In-Case of O/D)						
Earth Switch (89AE-2) - ON (In-Case of O/D)					DPI	
Earth Switch (89AE-2) - OFF (In-Case of O/D)						
Earth Switch(89BE-3) - ON (In-Case of O/D)	√				DPI	
Earth Switch(89BE-3) - OFF (In-Case of O/D)						
Earth Switch(89BE-4) - ON (In-Case of O/D)					DPI	
Earth Switch(89BE-4) - OFF (In-Case of O/D)						
Breaker in service (In-case of I/D BKR)	√				DPI	
Breaker in Test (In-case of I/D BKR)						
Trip coil Ckt Healthy - 1 & 2	√				SPI	
Spring Charge	√				SPI	
Auto Trip(86) Operated	√			√	SPI	
SF6 Pressure Low	√				SPI	
SF6 Lock Out	√				SPI	
VT fuse-1 Blown	√				SPI	
VT fuse-2 Blown	√				SPI	
Panel DC Fail			√		SPI	
L/R Switch in Local	√				DPI	
L/R Switch in Remote	√			√		
LBB Operated	√				SPI	

Relay Int Fault.			√		SPI	
Over Current Operated (All stages)	√				SPI	
Earth Fault Operated(All stages)	√				SPI	
BKR CLS COMMAND		√		√	DCO	
BKR OPN COMMAND				√		
Front Bus (89A) ISO OPNCOMMAND (In-Case of O/D)		√			DCO	
Front Bus (89A) ISO CLS COMMAND (In-Case of O/D)						
Rear Bus (89B) ISO CLS COMMAND (In-Case of O/D)		√			DCO	
Rear Bus (89B) ISO OPN COMMAND (In-Case of O/D)						
AutoTrip(86) relay reset from Remote		√			SCO	
3Phase R,Y,B - Current ,BUS PT-01 & BUS PT02 3Phase votages.	√				AI/MV	
Fault current and phase indication of faulty phase viz. R,Y,B, Earth, Unbalance(O/C & E/F Relay).Fault voltage and phase indication of faulty phase viz. R,Y,B (Voltage Protection Relay). Fault Differential and Bias current in Line and Transformer Differential Relay ,Fault distance (in Distance Relay) ,Disturbance Records, Fault Graphs for Remote diagnosis purpose	√				AI	
Total Signals - BCPU & RTU	31 DI + Analog , Measurand Values	9 DO	2DI	5DI + 2 DO		
Essential inbuilt Spare in BCPU,BCU	6 DI	3 DO				

Signals - 33 & 66KV CAP Bank	Digital Input/AI soft through N.Relay/BCU	Digital Out Put soft through N.Relay/BCU	Digital Input/Output Hard Wire to RTU	Additional signals Hard wire to RTU for backup	Signal Type	Protocol
Breaker ON	√			√	DPI	IEC-61850 With Dual Communication Ports
Breaker OFF				√		
Front Bus (89A) ISO ON(In-Case of O/D)	√				DPI	
Front Bus (89A) ISO OFF (In-Case of O/D)						
Rear Bus (89B) ISO ON (In-Case of O/D)	√				DPI	
Rear Bus (89B) ISO OFF (In-Case of O/D)						
CAP Bank ISO ON (In-Case of O/D)	√				DPI	
CAP Bank ISO OFF (In-Case of O/D)						
Earth Switch ON (In-Case of O/D)	√				DPI	
Earth Switch OFF (In-Case of O/D)						
Trip coil Ckt Healthy - 1 & 2	√				SPI	
Spring Charge	√				SPI	
Auto Trip(86) Operated	√			√	SPI	
SF6 Pressure Low & SF6 Lock Out of all chambers	√				SPI	
VT fuse Blown	√				SPI	
Cap Discharge Time	√				SPI	
Netural Displacement	√				SPI	

Panel DC Fail			√		SPI
L/R Switch in Local/Remote	√			√	DPI
LBB Operated	√				SPI
Relay Int Fault.			√		SPI
Over Current Operated	√				SPI
Earth Fault Operated	√				SPI
Under Voltage Prot.Operated	√				SPI
Over Voltage Prot.Operated	√				SPI
BKR CLS COMMAND		√		√	DCO
BKR OPN COMMAND				√	
Front Bus (89A) ISO OPNCOMMAND (In-Case of O/D)		√			DCO
Front Bus (89A) ISO CLS COMMAND (In-Case of O/D)					
Rear Bus (89B) ISO CLS COMMAND (In-Case of O/D)		√			DCO
Rear Bus (89B) ISO OPN COMMAND (In-Case of O/D)					
CAP Bank ISO OPN COMMAND (In-case of O/D)		√			DCO
CAP Bank ISO CLS COMMAND (In-case of O/D)					
3Phase R,Y,B - Current&Voltage,Reactive Power,Neu.Current	√				AI/MV
Fault current and phase indication of faulty phase viz. R,Y,B, Earth, Unbalance(O/C & E/F Relay).Fault voltage and phase indication of faulty phase viz. R,Y,B (Voltage Protection Relay). Fault Differential and Bias current in Line and Transformer Differential Relay ,Fault distance (in Distance Relay) ,Disturbance Records, Fault Graphs for Remote diagnosis purpose	√				AI
Total Signals - BCPU & RTU	26 DI + Analog , Measurand Values	9 DO	2DI	5DI + 2 DO	
Essential inbuilt Spare in BCPU,BCU	6 DI	3 DO			

Signals - BUS PT-1&2	**Digital Input/AI soft through N.Relay/BCU**	**Digital Out Put soft through N.Relay/BCU**	**Digital Input/Output Hard Wire to RTU**	**Additional signals Hard wire to RTU for backup**	**Signal Type**	**Protocol**
BUS A (89A) ON	√				DPI	IEC-61850 with Dual Communication Ports
BUS A (89A) OFF						
BUS B (89B) ON	√				DPI	
BUS B (89B) OFF						
Earth Switch (89LE) - 1 ON	√				DPI	
Earth Switch (89LE) - 1 OFF						
Earth Switch (89LE) - 2 ON	√				DPI	
Earth Switch (89LE) - 2 OFF						
BUS-A ISO OPN COMMAND		√			DCO	

BUS-A ISO CLS COMMAND						
BUS-B ISO OPN COMMAND		√			DCO	
BUS-B ISO CLS COMMAND						
Total Signals - BCPU & RTU	8 DI	4 DO				
Essential Spare in BCPU,BCU	2 DI	1 DO				

Signals - Smoke Detector - ALL Sensors,Manual Call Points Integration with RTU over MODBUS TCPIP Protocol.	**Soft Signals**	**Signal Type**	**Protocol**
All Sensors Alarm operated Signals (10 to 20 Sensors)	√	SPI	MODBUS TCP/IP Protocol with Dual Communication Ports
All Manual Call Points - MCP-1,MCP-2.etc…	√	SPI	

Signals - Battery Charger	**Digital Input/AI soft through RTU**	**AI from Transducer(4 to 20MA) /AI Hard wire signal to RTU**	**Signal Type**	**Protocol**
CHG A AC M/F CUM AC U/V	√		SPI	**Modbus Protocol with Dual ports**
CHG A AC OVER VOLTAGE	√		SPI	
CHG A RECTIFIER FUSE BLOWN	√		SPI	
CHG A FILTER FUSE BLOWN	√		SPI	
CHG A DC MCB TRIP/OFF	√		SPI	
CHG A DC UNDER VOLTAGE	√		SPI	
CHG A DC OVER VOLTAGE	√		SPI	
CHG A FLOAT	√		SPI	
CHG A BOOST	√		SPI	
CHG A DC FAIL	√		SPI	
CHG B AC M/F CUM AC U/V	√		SPI	
CHG B AC OVER VOLTAGE	√		SPI	
CHG B RECTIFIER FUSE BLOWN	√		SPI	
CHG B FILTER FUSE BLOWN	√		SPI	
CHG B DC MCB TRIP/OFF	√		SPI	
CHG B DC UNDER VOLTAGE	√		SPI	
CHG B DC OVER VOLTAGE	√		SPI	
CHG B FLOAT	√		SPI	
CHG B BOOST	√		SPI	
CHG B DC FAIL	√		SPI	
BATTERY MCCB TRIP/OFF	√		SPI	
DC system Earth	√		SPI	
Insulation fault	√		SPI	
Charger A AC INPUT CURRENT	√		AI	
Charger A AC INPUT VOLTAGE	√		AI	
Charger A DC OUTPUT CURRENT	√		AI	
Charger A DC OUTPUT VOLTAGE	√		AI	
Charger B AC INPUT CURRENT	√		AI	
Charger B AC INPUT VOLTAGE	√		AI	

Charger B DC OUTPUT CURRENT	√		AI	
Charger B DC OUTPUT VOLTAGE	√		AI	
Battery Current	√		AI	
Battery Load Voltage	√		AI	
Battery Voltage from Transducer		√	AI	**4 to 20 MA O/P**
Battery Current from Transducer		√	AI	

Signals - LT Board	**Digital Input Hard Wire to RTU**	**MFM data through Modbus protocol**	**Signal Type & Meter OP – Modbus with Dual Ports.**
LT AC Fail	√		SPI
R,Y,B Phase Current		√	AI

Signals - Fire Fighting(All Transformers)	**Digital Input Hard Wire to RTU**	**Signal Type**
SYSTEM OPERATED	√	SPI
SYSTEM OUT OF SERVICE	√	SPI
TCIV CLOSED	√	SPI
FIRE DETECTOR TRIP	√	SPI
N2 CYLINDER PRESSURE LOW	√	SPI
FIRE SYSTEM ALARM	√	SPI
DC SUPPLY FAIL	√	SPI

MFM - BUS PT -1 ,2 Signals (Front & Rear BUS)	**Data Type**	**Protocol**
R-Phase Current	MV/MFI	Modbus
Y-Phase Current	MV/MFI	
B-Phase Current	MV/MFI	
Neutral Current	MV/MFI	
R-Y Phase Voltage	MV/MFI	
Y-B Phase Voltage	MV/MFI	
B-R Phase Voltage	MV/MFI	

MFM - Signals - All Feeders (Including Bus Section/Coupler OF 11/33/66 KV)	**Data Type**	**Protocol**
R-Phase Current	MV/MFI	Modbus
Y-Phase Current	MV/MFI	
B-Phase Current	MV/MFI	
Neutral Current	MV/MFI	
R-Y Phase Voltage	MV/MFI	
Y-B Phase Voltage	MV/MFI	
B-R Phase Voltage	MV/MFI	
Active Power	MV/MFI	
Active Energy	MV/MFI	

Reactive Power	MV/MFI	
Power Factor	MV/MFI	
Maximum Demand	MV/MFI	
Phase angle 1	MV/MFI	
Phase angle 2	MV/MFI	
Phase angle 3	MV/MFI	
THD Mean Current	MV/MFI	
THD Mean Voltage	MV/MFI	

Note1 : Suitable Heavy Duty Relay /Contactor's with free Wheeling Diode to be placed in between RTU- DO card & Trip/Close Coil circuits of respective breakers for all breaker /Isolator open & Close circuits..It should be placed either at RTU (or) Breaker panel end.Its Potential free contact will be connected in the Closing/Tripping Coil Circuits.
Note 2: SF6 Low/Lockout of all chamber signal to be wired up to RTU.
Note 3: PQA & Lithium Ion Signal will be finalized at the time of drawing review.

2.8.1.Comments -

Analog signals (Fault Current levels,Disturbance records, Fault graphs for remote diagnosis, etc,) from Numerical relays needs to be confirmed by vendor before finalize the tender documents.

All the above mentioned signals(Refer Signal List -2.8) including Notifier /Smoke Detector Signal are compulsory and additional signal (10%) will be considered during detailed engineering.

Following indications data format should be configured as a DPS (Double point Status) in Relay(BCPU).

- All Feeders Circuit Breaker ON & Circuit Breaker OFF
- All Feeders BUS Isolators (89A,89B,89L,89T) - ON & OFF
- All Earth Switches ON & OFF

Following command data format should be configured as a DPC (Double point control) in Relay(BCPU).

- All Feeders Circuit Breaker - Open & Close
- All Feeders BUS Isolators (89A,89B,89L,89T) - Open & Close
- All Earth Switches – Open & Close.

3.0 Key Points -

1 All SCADA equipments viz DAU / DCU, MFM, Battery Charger, A-Eberle relays, etc. Should be powered through auxiliary supply of 48 V (or) 220 Volt DC.

2 Space for Energy Meter – Only Space (**Length - 185 mm & Height - 256 mm with CT, PT, Auxiliary Supply terminals & wiring**) without cut out is required to install energy meters.

3 Power Supply for Routers/ Gateway (IT Equipments) through an existing battery bank via DC to DC Converters (Input: 48 VDC/220 VDC, Output: 12 Volt DC) or as per the requirements of Routers.

Converter 01 Speifications : Input 220 Volt DC & Output 12 to 48 Volt DC

Converter 02 Specifications:Input 220 Volt DC (or) 48 Volt DC & OutPut 12 Volt DC

4 Any other wiring / cabling if required due to non availability of serial communication /MODBUS/IEC 61850 protocols (with justified reason) should be hardwired and that is in Contractor's scope.

5 Suitable transducers with an output of 4-20 mA have to be installed in the RTCC /Battery charger if required and the outputs of these transducers should be extended to terminal for further extension to the RTU.

6 STATION BUS : Topology

- Dual Homing (or) Redundant Ring with Ehernet/Copper Cable – From BCPU,BCU to Switch
- Redundant Ring with Fiber Optic Cable – From Switch to RTU/Gateway.
- Note : Dual Homing (or) Redunt Ring Network topology will be decided during the detail engineering stage.

7 The C & R ,RTCC,Battery Charger Panel should have additional spare contacts (potential free) for all SCADA signals – **Refer Signal List 2.8**

8 Data Base File must be downloadable and Uploadable from RTU,CPU,BCPU,BCU and Gateway.

9 Separate Room/Cabinet With AC for RTU and IT Equipments.

10 Warranty (5 Years) for SCADA products - All Supplied SCADA material should cover warranty for the duration of 5 years & Warranty period will start after successful commissioning of the SCADA equipments at site. If any SCADA materials found faulty during warranty period should be replaced within two weeks.

11 **Training** should be provided on configuration, installation, commissioning aspects of RTU,DCU,BCU and Numerical Relay - BCPU at your training/work center to the BSES SCADA team (4 to 5 persons) & Training Expenses (Air & Local Travel, boarding and Lodging for 4 to 5 persons) at factory/training center(4 days) comes under Vendor's scope.

Training documents to be submitted for approval & Documents should contain all the necessary installations,connections and Data Base development procedure & further trouble shooting procedure,etc..shall also be provided in the manual.

12 Antivirus/Cyber Security_solution for Gateway/RTU unit with 2 years validity need to be considered.

13 **Spares:** loose Spare Materials for following items with below mentioned quantity to be supplied for emergency back up/maintenance purpose.

- CPU (Main Processor) with Ethernet Interface Card/Memory in RTU – 1 No
- CPU(Main Processor Module in BCU) – 1 No
- Gateway – 1 No
- RTU Rack – 1 No
- BCU Rack – 1 No

- Communication Module for IEC-103 & Modbus Communications with Serial Interface Card/Memory in RTU – 1 No
- DO Contactots – 10% of supplied qty.
- DI/DO/AI/ Cards in RTU – 10% of the total IO signals
- DI/DO/AI/ Cards in BCU – 10% of the total IO signals
- PSU Cards in RTU – 1 No
- Ethernet Switches (9 ,16 & 24 Ports) – 1 No's
- Ethernet Switches (16 & 24 Ports) – 1 No's
- LIU Unit – 1 No
- Fiber Optic Patch Cards with Connectors - 20% of total installed cables.
- MFM – 5% of Supplied Qty.
- DC to DC converters if any for RTU Supply – 1 No.

14 **Protection devices for all SCADA Equipmentes –**

- Surge Protection devices installation between RTU & MFM Serial loops.
- SPD for Main DC Source.
- HDR/Inter Posing Relay for all Digital Output Signal's.
- All modules (All Digital, Analog Input modules in BCPU and RTU) and ports (Serial and Ethernet ports) must have in-built or external surge protection devices and optical isolation.

15 Local HMI shold be consider along with RTU :

- Human machine interface (HMI) with control software package, which shall contain an extensive range of system monitoring and data acquisition (SCADA) and control functions.
- Local control function shall have an access control for various level of authorities (for viewing, analyzing and operating). Logistics (Table & Chairs) shall be included in supply. HMI shall have 21" monitor & CPU with backup battery (UPS, APC make) system for 4 hours back up. All necessary accessories shall be a part of supply and installation work. HMI (KVM Type)shall be fixed inside RTU panel.
- Incase of failure of communication equipments then DR shall be extracted from HMI for further diagonosis purpose only.So,It will not be used as a Gateway for control center data process.

16 Syatem Architecture : System Architecture should be submitted at the time of tendering process.

17 Drawings/GTP shall be submitted to BRPL-3 Sets hardcopy for approval in the event of award of work.

18 As Built Drawings 3 Sets Hard copy and 2 Set in Pen drive shall be submitted at the time of Handover of project for Final billing.

19 DB back up along with Software in Pen drive shall be handover at the time of Handover of project for Final billing.

20 All the above features are indicative only and detailed engineering and deviation will be analyzed just before actual procurement and with discussion through a supplier/ vendor.

4.0 System Architecture Diagram

The Tentative System Architecture diagram is enclosed for reference. It will be revised during the approval stage of drawings..

5.0 PACKING AND SHIPMENT

Shall be packed such that protected against corrosion, dampness, heavy rains, breakage and vibration in GPS Enabled Vehicle and shipment status through GPS Device shall be sent to BRPL Project incharge Via SMS/Email.

6.0 QUALITY ASSURANCE

Factory Acceptance Test : BRPL executives shall be visiting the vendors factory for inspection of Supply material. Travel Ticket (return flight), local travel, boarding and lodging shall be in vendor's scope.

Field Quality Plan : Vendor shall submit a field quality paln for approval of buyer before taking up the execution work at site.

7.0 DEVIATIONS

Deviation from this specification, if any, shall be clearly brought out in the offer. Unless the owner explicitly accepts such deviations, it shall be considered that the offer fully complies with the specification.No deviations will be acceptable post order.

TECHNICAL SPECIFICATION

FOR

CABLE INSTALLATION & ACCESSORIES

Prepared by	**Javed Ahmed**		**Rev: 1**
Reviewed by	**Abhinav Srivastava**		**Date: 12th June 2018**
Approved by	**K.Sheshadri**		

Volume-I Technical Specification for Cable Installation and Accessories

1.0 INSTALLATION OF CABLES:

1.1 The cable shall be laid as per IS 1255. The Contractor shall prepare cable schedules for all the cable circuits associated with the equipment in the substation showing length, size and routing of each cable which shall be given suitable code numbers and submit the same for Owner's/Engineer's information/approval. Cable and Conduit laying shall be done strictly in accordance with the cable schedules.

1.2 The control and power cables shall be laid in conduits, concrete pipes, ducts, trays or cable trenches unless indicated otherwise. The power and control cables shall be laid in different trays. Cables shall be cleated to the cable tray after properly dressing.

1.3 Ducts shall be provided wherever cable trenches cross roads with provision of one spare duct for future use.

1.4 All civil works, viz, excavations, sand cover, providing brick cover on directly laid cables, construction of foundations, trenches with cable tray supports, cable ducts under roads, back filling, finishing associated with cabling work shall be duly completed.

1.5 The Contractor shall supply and install all the surface mounted/ embedded rigid and flexible conduits, their connections, and associated clamps, bushings, lock-nuts, caps etc required in the cabling work.

1.6 All conduits and their accessories shall be made of galvanized heavy gauge steel as per BIS Specification. The internal bore of all pipes shall be smooth and suitable for pulling PVC sheathed cables without damage.

1.7 The Contractor shall supply all fittings including ordinary tees and elbows, check nuts, male and female fittings pull boxes, junction boxes, conduit outlets, outlet boxes, splice boxes, terminal boxes, gaskets and box covers, saddles and all supporting steel work and all such arrangements which are required to complete the conduit installations.

1.8 Pre-fabricated junction boxes, conduit boxes and conduits shall be shop fabricated out of malleable iron or steel plates and shall be galvanized and provided with galvanized malleable iron or steel plate covers and rubber gaskets

1.9 All the apparatus, connections and cable work shall be designed and arranged to eliminate the risk of fire and minimize damage which might be caused in the event of fire. Wherever cables pass through floor or wall openings or other partitions, suitable bushes of approved type shall be supplied and put in position by the Contractor.

1.10 Standard cable grips, reels and rollers shall be utilized for cable pulling.

1.11 Each cable, whether power or control, shall be provided with a metallic or plastic tag of an approved type, bearing cable reference number indicated in the cable schedule prepared by the Contractor, at every 10 meter run and at both ends of the cable, adjacent to the

terminations as well as where cables enter or leave ducts. Cable routing shall be so done that cables are accessible for identification and maintenance easily, and are arranged neatly.

1.12 In no case the cables shall be bent sharply or kinked with the radius of bending falling below 15D where D is the overall diameter of the cable.

1.13 When power cables are laid in the proximity of communication cables, the minimum horizontal and vertical separation between power and communication cables shall be 600 mm. Wherever possible the power and communication cables shall be located as far from each other as possible. The power and communication cables shall cross each other at right angles.

1.14 Wherever cables cross roads, water, oil, sewage or steam-lines, special care shall be taken while designing the trenches/ducts for protection of the cables.

1.15 In each cable run, some extra length shall be provided at a suitable location to enable making of one or two straight-through joints for carrying out repairs if the cable develops fault at a later date.

1.16 Cable splices shall not be permitted except where called for as per the construction drawings, or where permitted by the Engineer. Straight-through joints in the run of cables wherever unavoidable shall be through joint-boxes.

1.17 The termination of cables at various equipments shall be carefully made in accordance with the manufacturer's instructions and detailed connection diagrams.

Termination materials for all cables shall match with the type of cable insulation and have thermal and electrical ratings and chemical properties similar to those of the associated cable.
All terminating materials except for those already supplied with the electrical equipment shall be provided by the Contractor.

1.18 Control cable terminations shall be made in accordance with the color code marked wiring diagrams of control circuits. Multi-conductor control cable jackets shall be removed as required to train and terminate the conductors. The cable jacket shall be left on the cable, to the extent possible. The insulated conductors from which the jacket is removed shall be neatly trained in bundles and terminated. The bundles shall be firmly, but not tightly, tied utilizing plastic or nylon ties or specially treated fungus-proof cord.

1.19 The connectors for control cables shall preferably terminate in Ross Courteny terminals and washers and be covered with transparent insulating sleeves so as to prevent accidental contact with ground or adjacent terminals. The insulating sleeves shall be fire resistant and shall be long enough to overlap the conductor insulation.

1.20 When control cables are to be fanned out and tied together with cord, the Contractor shall make connections to terminal blocks and test the equipment for proper operation before tying the cables together with cord.

1.21 Jointing of cables shall be made in accordance with the applicable Bureau of Indian Standards Code of practice, Owners approval and manufacturer's special instructions. The materials and tools required for cable jointing work shall be in the Contractor's scope.

1.22 The supply of joint boxes shall include all hardware fittings, compounds, tapes and other materials required for making the joints.

Special tools, clips and saddles, glands, seals, PVC sealing compound, locknut, etc, required for connection and termination of cables shall be in the Contractor's scope.

1.23 All cables shall be megger-tested before jointing. After jointing is completed all L.V cables shall be megger-tested.

Cable cores shall be tested for:

i. Continuity.
ii. Absence of cross phasing
iii. Insulation resistance to earth.
iv. Insulation resistance between conductors.

2.0 CABLE TRAYS, ACCESSORIES & TRAY SUPPORTS, CONDUITS, PIPES AND DUCTS

2.1 Cable trays shall be run either in concrete cable trench or overhead supported from building steel. The cable trays shall be ladder type for power cable and perforated type for Control cable. The trays shall be supplied with matching fittings and accessories.

2.2 Cable tray shall be fabricated out of rolled mild steel sheets free from flaws such as laminations, rolling marks, pitting etc. Minimum thickness of cable trays shall be 2.0mm.

2.3 Cables shall be clamped to the cable trays in the horizontal runs with 18 gauge GI wires. For vertical runs the cables shall be clamped with suitable site-fabricated clamps.

2.4 All cable trays including perforated sheet trays, weld mesh trays, vertical raceways shall be hot-dip galvanized and epoxy coated. The trays shall be of standard width of 150mm, 300mm, 450mm & 600mm and standard length of 2.5M. Trays upto 300mm shall be perforated type and above 300 mm shall be ladder type.

2.5 The conductors carrying AC and DC supplies shall not be bunched together in a conduit. Where single-core cables are individually drawn into separate pipes, HDPE pipes shall be used.

2.6 Flexible metallic conduits shall be used for termination of connections to equipment to be disconnected at periodic intervals and also for termination of connections to level switches, limit switches, pressure switches etc.

2.7 In order to minimize condensation or sweating inside the conduit, all outlets of the conduit system shall be properly drained and ventilated so to prevent entry of insects and water as far as possible.

2.8 The conduits or pipes shall be run along walls, floor and ceilings, on steel supports, embedded in soil, floor, wall or foundation, in accordance with the relevant layout drawings, approved by the Owner.

2.9 All fittings in the conduit systems having threaded connections shall be tightened with full thread engagement and with a minimum of wrench work in order to avoid wrench outs.

2.10 Embedded conduits running parallel to a masonry surface shall, wherever possible, have a cover of at least 38 mm.

2.11 The conduits shall be lead into terminal boxes through the entry points provided by the equipment manufacturers unless otherwise shown in the drawings or unless otherwise directed by the Engineer.

2.12 While installing asbestos pipe or other fiber conduit, cracked pieces shall not be used. The sections cracked or broken during or after placement shall be replaced.

2.13 For underground conduit runs the Contractor shall excavate and backfill as necessary.

2.14 Exposed conduit shall be adequately supported by racks and clamps or straps or by other approved means.

2.15 Where conduits are stubbed out of masonry for future extension outside the structure, they shall be specially protected against corrosion and shall be boxed in against possible physical damage.

2.16 Each conduit run shall be marked with its designation as indicated on the drawings - 'Identification'.

2.17 Where conduit and boxes in locations of severe exposure require, painting of galvanized surfaces with Alkyd Resin Zinc Dust paint following by a finish coat of Aluminum paint, shall be performed by the Contractor in a good and approved manner.

2.18 The Contractor shall bond of metal pipes or conduits in which cables have been installed to the main earthing system.

2.19 The conduits and accessories shall be adequately protected against mechanical damage as well as corrosion.

3.0 TERMINATION AND STRIGHT THROUGH JOINTS

3.1 Termination and jointing kits for 11KV and 33KV grade XLPE insulated Aluminum cables shall be proven design and make already been extensively used and type tested. Termination kit and jointing kits shall be pre moulded type, taped type or heat shrinkable. The joints and termination shall be tested as per IS 13573. The kit contents shall be of proven design and type tested. Kit contents shall be supplied from the same source as were used for type tested. The kit shall be complete with Aluminum solderless crimping cable lugs and ferrules as DIN standard

The termination kit make and specification shall be strictly as per approval of the Owner.

3.2 The straight through and termination kit shall be suitable to withstand the fault level for 11KV and 33KV system

4.0 CABLE GLANDS, LUGS & ACCESSORIES

4.1 The cable shall be terminated using double compression type cable glands. The cable glands shall confirm to BS 6121 and of robust construction capable of clamping the cables and armour firmly without injury to the insulation. The cable glands shall be made out of heavy duty brass machine finished and nickel chrome plated. The thickness of plating shall not be less than 10 micron. The rubber component shall be made out of neoprene and tested quality.

4.2 The trefoil clamps for single core cables shall be pressurized die cast Aluminum or fiber Glass or Nylon and shall include necessary fixing accessories such as GI bolts and nuts. Trefoil clamps shall have adequate mechanical strength to withstand the forces generated by short circuit current.

4.3 Cable End seal (Roxtec/MCT Brattberg) shall be provided for all Control Cable and Power Cable (including outgoing HT panels) at all the points wherever cable entries in the control room building or between room to room. 30% Spare modules shall be provided along with centre core has to be provided. System shall take up variation margin of +/-3mm in diameter of Cable. For details refer specs.

5.0 DEVIATIONS

Deviation from this specification, if any, shall be clearly brought out in the offer. Unless owner explicitly accepts such deviations, it shall be considered that the offer fully complies with the specification.

TECHNICAL SPECIFICATION

FOR

EXHAUST & VENTILATION SYSTEM INCLUDING AIRCONDITIONING

Prepared by					**Rev: 0**
Reviewed by					**Date:**
Approved by					

Volume-I Technical Specification Exhaust and Ventilation System

1.0 INTENT OF SPECIFICATION

1.1 This specification is intended to cover the design, manufacture, assembly, testing at manufacturer's works, supply & delivery, properly packed for transport for 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

1.2 In the event of any discrepancy with the listed documents, the stipulation this specification shall govern.

2.0 SCOPE OF SUPPLY

The following equipment shall be furnished with all accessories.

a) Air Handling system.
b) Air Conditioning
c) All necessary components for operation of the above equipment.
d) All wiring & accessories to complete the installation.
e) All relevant drawings, data & instruction manuals.
f) Mandatory spares.
g) Commissioning spares and recommended spare part list for three (3)

3.0 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.

3.3 In particular, the following standards and specifications are applicable.

3.4 Air conditioners suitable for 230V, 50 Hz single phase AC supply shall be capable of performing the functions as cooling, dehumidifying, air circulating and filtering. The air conditioners shall be complete with automatic temperature control and cut-in and cutout etc. for temperature range 16 to 25 degree C.

3.5 Outdoor unit of the air conditioners shall be fitted discharge cooled type rotary Compressor.

3.6 Air Conditioner shall be 5 Star rated

3.7 Air Conditioning shall maintain 22 Degree Celsius in summers and Winters, Environment condition shall be referred from General Design Criteria Chapter 1

3.8 Approved make of AC is Voltas/LG/Carrier.

3.9 The minimum thickness of the base in outdoor unit shall be 1.20 mm & sheet thickness for rest of the body shall be 0.70 mm (Min.) with galvanized coating thickness of 120 g/ sq. m and shall be provided with stiffeners for robust construction and shall have rounded corners.

3.10 The casing of the indoor units shall be made of ABS/HIPS/GS and shall be impact resistant. The control box of indoor unit shall withstand flame retardant.

3.11 Remote cordless control with LCD/LED Display for Air conditioner shall be provided with one On/Off timer, selecting fan speed (three speed) and setting up of temperature. Display shall be provided on indoor unit or on handset or on both.

3.12 Maximum power consumption of the split air conditioners shall be measured at capacity rating test conditions. Overall power factor of the unit shall be at least 0.85 at capacity rating test conditions

This specification shall be read and constructed in conjunction with the bid documents and annexure to determine the scope of work.

DESIGN CRITERIA

	Air Conditioning shall be supplied in Control Room and Switchgear Room including GIS Room, maintenance room and SCADA room. Exhaust system shall be supplied in following rooms -Toilet – one Pantry- One. All the Cable Celler
Number and details of wall mounted/Ceiling fan	Battery room – 1 No Control room – 3 No's Switchgear Room – 6 No's GIS Room-As per Calculation, 6 Nos(Minimum). **Note: Wall mounted fan shall be industrial type, domestic fans shall not be acceptable**
Power Point & socket	Each room shall be provided with at least 2 No's 15 Ampere Switch socket and 2 no's 5 ampere switch sockets. Two no's industrial 16 ampere points shall be provided in control room for installation of air conditioning system for future.

	All equipment, accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion.

4.0 DEVIATIONS

Deviation from this specification, if any, shall be clearly brought out in the offer. Unless owner explicitly accepts such deviations, it shall be considered that the offer fully complies with the specification.

TECHNICAL SPECIFICATION

FOR

FIRE EXTINGUISHER

Prepared by					**Rev: 0**
Reviewed by					**Date:**
Approved by					

Volume-I Technical Specification Fire Extinguisher

1.0 INTENT OF SPECIFICATION:

This specification is intended to cover the design, manufacture, assembly, testing at manufacturer's works, supply & delivery, properly packed for transport FOR site of Portable wall and trolley mounted Fire extinguisher and fire buckets for substation control room building complete with all materials and accessories for efficient and trouble free operation.

In the even of any discrepancy with the listed documents, the stipulation of this specification shall govern.

2.0 SCOPE OF WORK

2.1 Scope of Supply

The following equipment shall be furnished with all accessories:-

a) Wall mounted fire extinguisher-15 Nos. of 4.5kG (CO_2 Type)
b) Trolley mounted fire extinguisher- 5 Nos. of 22.5kg (CO_2 Type)
c) Sand buckets with stand- 4 Nos. bucket in each stand
d) All installation hardware.
e) All relevant drawings, data & instruction manuals.
f) Mandatory spares.
g) Commissioning spares and recommended spare part list for three (3) years of operation.
h) Rubber Mat for entire Indoor equipments (as per latest IS)

3.0 GENERAL REQUIREMENT

3.1 Codes and Standard

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.

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.

In particular, the following standards and specifications are applicable.

Indian Electricity Rules	Relevant safety regulation of CEA
Indian electricity act	
IS 2190	Selection, installation & maintenance of first aid, fire extinguisher.
	Tariff Advisory Committee Manual
IS 1646	Code for practice for fire safety of buildings
IS 940	Portable fire extinguisher, Water type - specification
IS 2878	Fire extinguisher CO2 type
IS 2171	Specification for fire extinguisher dry powder.
IS 10204	Specification for fire extinguisher Mechanical foam type.

This specification shall be read and constructed in conjunction with the bid documents and annexure to determine the scope of work.

4.0 DESIGN CRITERIA

General	The contractor shall supply the required type and quantities of fire extinguisher and Sand buckets. The quantity shall be as per TAC recommendations.
Location	Fire extinguisher and sand buckets shall be installed in Control room, battery room, switchgear room, ACDB & battery charger room, Cable cellar, Transformer yard, Outdoor switchyard and Capacitor bank.
Distribution	The fire extinguishers in various locations shall be as per the guidelines of TAC-India.
Tests	All equipment shall be completely assembled wired, adjusted and routine tested at the factory as per relevant standards.

5.0 DEVIATIONS

Deviation from this specification, if any, shall be clearly brought out in the offer. Unless owner explicitly accepts such deviations, it shall be considered that the offer fully complies with the specification.

TECHNICAL SPECIFICATION

FOR

VIDEO SURVEILLANCE SYSTEM

Prepared by	**Javed Ahmed**		**Rev: 1**
Reviewed by	**Abhinav Srivastava**		
Approved by	**K.Sheshadri**		**Date: 2rd Feb 2019**

1. SCOPE:

Design, Engineering, procurement of bought out items, manufacture, integration, inspection, factory testing and supply of complete CCTV System for the entire plant as per requisition consisting of following including necessary hardware, software and accessories as applicable.

2. STANDARDS:

In accordance with Latest Relevant IS/IEC.

3. SCOPE OF SUPPLY:

- CCTV cameras suitable for remote operation with all necessary accessories and installation hardware consisting of, but not limited to the following:

1. High speed zoom lens.
2. 360 Degree Cameras
3. Automatic Iris
4. Pan & tilt unit
5. Receiver unit
6. Weatherproof junction box
7. Weatherproof housing for unit camera.
8. Glass Dome with reflector shield on outside.
9. Night Vision.
10. One set of 360 camera shall be installed before start of work

- System cabinet consisting of following:-

1. Video encoder, network switches, etc.
2. Central control unit with all control functions like pan, tilt, focus and consisting of switching unit.
3. Video Motion Detection system
4. Video recorder to record video images

- 21'' FULL HD, LED Monitor with HDMI interface to CPU with Keyboard, Optical Mouse for monitoring at Main Control Room & Security Gate.

- Monitoring unit also including Programming unit consisting of programming Monitor LED 21", keyboard and optical mouse, independent of monitoring unit with all required hardware and software for CCTV functioning.

- All furniture required in the Control room and Security Gate, to mount the CCTV equipment like TV, PC, keyboard , DVR, etc.

- All types of Cables (Video, Control/data, Optic Fiber and Power Supply etc.), cable glands, plugs, connectors and accessories, for interconnection of all the equipments supplied by vendor.

- Junction boxes, Power distribution boxes, repeaters, cable glands, etc. as necessary.

- Mounting poles for mounting the camera along with a climbing ladder.

- The Ladder to be provided with wheels & brakes for easy movement on roads.

- HDPE pipe with required pipe fittings for laying optical fiber cables between CCTV Cameras and main control room, and between main control room and security control room (gate / security house).

- Cable trays for CCTV cables within control rooms with required accessories in case required at site. Cable trays outside control room (where main cable duct is not available). Buried cable trench for cabling along the boundary walls.

- All necessary supports for installation of all items supplied by vendor.

- All mounting accessories required to mount various items supplied by vendor.

- Earthing material required for earthing of CCTV equipment installed by Vendor.

- Necessary base frame support for mounting CCTV cabinets in main control room.

- Any other item necessary but not specifically listed for successful operation of CCTV system.

- Packing, forwarding, transportation and storage at site of complete CCTV system and accessories.

- Supply of special instrument or tools needed for testing, calibration and maintenance of offered CCTV system.

- Supply of consumables and commissioning spares as per requisition for CCTV system.

- Any other item or/and activity not listed/indicated specifically but necessary for successful operation of CCTV system.

- CCTV monitoring of the site & image capture in case of an intrusion

- Future hardware expansion facility.

- The CCTV system shall be support high resolution viewing & recording.

- The images shall be transferred to a central location or on Mobile using Internet connectivity.

- The System shall be CE & FCC certified

- Complete system shall be from the same manufacturer.

- System should be design to work on low bandwidth WAN with following considerations:

1) Camera stream : H.265
2) Camera resolution : 4CIF (704x480)
3) Video quality : Medium
4) Number of cameras : 01
5) Frame rate per camera at site :25FPS
6) Frame rate per camera at Centre :15FPS
7) Recording type : Continuous 24 Hours per day

8) Desired days of storage per camera : 30 Days

All cameras should support dual stream and configured in such a way that one stream should provide feed to central control centre and other stream should be capable to support edge recording (memory card on camera or NVR). System should be intelligent to monitor WAN and whenever there is outage or central control centre not reachable camera should start recording on memory card or NVR present on camera and capable to restore the data to the central system in the missing area.

4. SCOPE OF SERVICE :

- Installation, integration of complete CCTV system and associated accessories including calibration, cabling, junction boxes, power supply, distribution boxes, etc.
- Installation of CCTV Cameras. The Cameras to be mounted on top of Pole, so as no blind spot is created due to pole.
- Installation of CCTV monitors for monitors located in main control room and monitors located in security control room (gate / security house).
- Installation of monitor located in MCR and security control room.
- Installation of mounting poles wherever applicable.
- Installation of CCTV cabinets for various units.
- Installation of programming unit PC.
- Installation of various junction boxes (signal, power, control) supplied by vendor.
- Laying of co-axial / optical fiber cable between CCTV Camera & Control Console Cabinets.
- Laying of power cable between CCTV Cameras and CCTV Cabinet in MCR.
- Laying of CCTV Cables (video, control, data, power).
- Laying of CCTV fiber optic Cables between MCR and security control room.
- Termination, ferruling and glanding at both ends and interconnection of various cables (video, optical, control, power) supplied by vendor for complete CCTV system.
- Distribution of power supply and reduction to required levels to various CCTV equipment supplied by vendor.
- Integration of CCTV Camera with BRPL Network

The entire IP surveillance system to be designed to control and monitor the locations provided based on following considerations:

- Camera to be of 4 MP (all to be integrated in the VMS present and future)
- CCTV system should be design to work on WAN with at lower bandwidth as low as (256Kbps per camera). Objects or persons should be identified under low bandwidth Scenario

- Bandwidth should be configurable
- System should be design to work and record on 15fps and 1 MP centrally
- System should be design with event based and continuous recording as and when required

Four types of cameras shall be considered to monitor the movement of the people as follows:

1) Indoor
2) Outdoor
3) PTZ
4) 360 degrees outdoor

- All cameras shall be True Day/Night function IP camera
- Analytics to be in built at camera side like – Face capture, Trip Wire, Counter, Object removal, Motion detection.
- All accessories with the outdoor cameras like JBs, power supply, media converter etc. should be in water poof and dust proof housing
- All cabling including LAN network will be in scope of vendor in case of open through ISI mark PVC / GI pipes or concealed through ISI mark PVC / HDPE pipe
- L2 POE Cisco switches should be used to power-up the camera in case of 4 or more at a location else power adapter to be used to power up the cameras
- Servers should be either HP / IBM
- Servers should be planned in redundancy

5. TESTS.

All equipment with their terminal connectors, and other hardware etc., shall conform to type tests and shall be subjected to routine and acceptance tests in accordance with Latest Relevant IS .

6. COMPLETENESS OF EQUIPMENT:

Any fittings, accessories or apparatus which may not have been specifically mentioned in this specification but which are usually necessary for the satisfactory operation of the equipment, shall be deemed to have been included in this specification.

7. PACKINGS:

All material shall be suitably packed for transport, direct to site and Manufacturer shall be responsible for all damages/losses due to improper packing. All boxes shall be marked with signs indicating the up and down sides of the boxes along with the unpacking instructions, if considered necessary by the Manufacturers.

Note: All critical areas/rooms to be covered fully leaving no grey area. Placement of cameras shall be such that there should be no shadow portion.

TECHNICAL SPECIFICATION

FOR

FIRE DETECTION AND ALARM SYSTEM

Prepared by					**Rev: 0**
Reviewed by					**Date:**
Approved by					

Volume-I Technical Specification Fire Detection and Alarm System

1.0 INTENT OF SPECIFICATION:

This specification is intended to cover the design, manufacture, assembly, testing at manufacturer's works, supply & delivery, properly packed for transport FOR site of Fire and smoke Detection & Alarm System for substation control room building complete with all materials and accessories for efficient and trouble free operation.

In the even of any discrepancy with the listed documents, the stipulation of this specification shall govern.

2.0 SCOPE OF WORK

2.1 Scope of Supply

The following equipment shall be furnished with all accessories :-

a) Smoke and heat detectors and installation.
b) Manual call point for the substation building.
c) Fire detection alarm panels which shall be SCADA compatible along with its integration with SCADA.
d) All wiring & accessories to complete the installation.
e) All installation hardware.
f) All relevant drawings, data & instruction manuals.

3.0 GENERAL REQUIREMENT

3.1 Codes and Standard

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.

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.

In particular, the following standards and specifications are applicable.

Indian Electricity Rules	Relevant safety regulation of CEA
Indian electricity act	
CBIP manual	
IS 2189	Code of practice for selection, installation & maintenance of automatic fire alarm system.
IS 2190	Selection, installation & maintenance of first aid, fire extinguisher.
IS 1646	Tariff Advisory Committee Manual
	Code for practice for fire safety of buildings

This specification shall be read and constructed in conjunction with the bid documents and annexure to determine the scope of work.

4.0 DESIGN CRITERIA

General	1. The fire detection system shall consist of various types of fire detectors, control cabling, fire alarm panels, central monitoring station, annunciation/control panels, local panels. 2. The fire detection and alarm system shall be microprocessor based, analogue addressable system. 3. A central monitoring system shall be provided in the control room covering complete substation. 4. The control system shall be compatible to be interfaced with SCADA system through separate communication port.
Location	Fire detectors shall be provided for the entire substation building including control room, switchgear room, battery charger, corridors etc in the ground floor only. Fire detectors shall be located at strategic location in various rooms of the building.
Operation	The operation of any of the fire detectors / manual call point should result in the following : a) A visual signal exhibited in the alarm panel indicating the area where the fire is detected. b) An audible alarm (Hooter) sounded in the panel. c) An external alarm sounded in the building, location of which shall be decided during detailed engineering. d) An alarm should be signaled to the control room.
Detection & Alarm system	1. Each zone shall be provided with two zone cards in the panel so that system will remain healthy even if one the cards become defective which shall be indicated at SCADA . 2. The control panel shall be suitable for 230V AC and 220V DC as power supply.
Cabling	The detector cable and the other control cable shall be armoured, screened and twisted FRLS type in external areas and shall be of unarmoured FRLS type inside building (in conduits)
Tests	All equipment shall be completely assembled wired, adjusted and routine tested at the factory as per relevant standards.
	Following tests shall be performed on the system a) Response characteristics of fire detectors. b) Performance test on fire extinguisher as required in the code. c) A comprehensive visual and functional check for the fire alarm panel. d) Verification of wiring as per approved schematic. e) Testing of fire detection panel as per BS3116 Part IV.
Site Test	All the detectors installed shall be tested for actuation by bringing a suitable smoke source near the detector creating a stream smoke over the detector. After each test smoky

	atmosphere should be cleared so that the detector shall reset.
	Certify proper operation of all detectors and call points.
	One of each type of extinguisher shall be tested for its performance.

5.0 DEVIATIONS

Deviation from this specification, if any, shall be clearly brought out in the offer. Unless owner explicitly accepts such deviations, it shall be considered that the offer fully complies with the specification.

TECHNICAL SPECIFICATION

FOR

PACKING & TRANSPORTATION

Prepared by					**Rev: 0**
Reviewed by					**Date:**
Approved by					

1.0 PACKING AND TRANSPORTATION

1.1 Packing shall be sturdy and adequate to protect all assemblies, components and accessories from injury by corrosion, dampness, heavy rains, breakage and vibration encountered during transportation, handling and storage at the plant site. All accessories, which are likely to get damaged during transit if transported mounted on the equipment, shall be removed, adequately packed and shipped separately. All openings shall be sealed. Spare parts shall be packed separately and clearly marked. They shall be specially packed for long storage without injury.

1.2 The bidder shall after proper painting, pack and crate all plant equipment for sea shipment/air freight in a manner suitable for export to a tropical humid and saline air borne climate region as per Internationally accepted export practice in such a manner so as to protect it from damage and deterioration in transit by road, rail and/or sea and during storage at site till the time of erection. The bidder shall be held responsible for all damages due to improper packing.

1.3 The bidder shall give complete shipping information concerning the weight, size, contents of each package including any other information the Owner may require. The weight and size of the package shall be such that they can be easily transported from the maker's works to the plant site by ship/air, road ways and railways.

1.4 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 Owner 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 done and borne by the bidder.

1.5 The bidder shall prepare detailed packing list of all packages and containers, bundles and loose materials forming each and every consignment dispatched to 'site'. The bidder shall further be responsible, for making all necessary arrangements for loading, unloading and other handling right from his works; and from Indian port for equipment under the Off-shore Supply till the 'site' and also till the equipment is erected, tested and commissioned. The bidder shall be solely responsible for proper storage and safe custody of all equipment.

1.6 All packages must be marked consecutively from number one upwards covering all shipments until completion of the plant equipment execution without repeating the same number. Each box, crate, case bundle or each piece of lose material shall be painted with a combination of one white band and one yellow band of a least 4 cm wide each, round the body of the box, crates, etc as the case be for easy identification.

2.0 GPS instrument must be installed for proper tracking of material during transit of major equipment like Transformer, GIS Panel,11KV & 66 KV panels etc. of MAP my india make (asset tracking system)

3.0 DEVIATIONS

Deviation from this specification, if any, shall be clearly brought out in the offer. Unless owner explicitly accepts such deviations, it shall be considered that the offer fully complies with the specification.

TECHNICAL SPECIFICATION

FOR

MATERIALS WORKMANSHIP & TEST

Prepared by					**Rev: 0**
Reviewed by					**Date:**
Approved by					

1.0 MATERIAL, WORKMANSHIP & TESTS

1.1 General

All materials used in the manufacture of the offered plant equipment shall be of high grade, free from defects and imperfections, of recent manufacture and unused. Materials not specifically described elsewhere, shall as far as applicable and practicable conform to the latest specification of ISS where applicable and equivalent International Standards. Liberal factors of safety shall be used throughout the design for all parts of plant equipment when subjected to the most severe operating conditions. The working stress in all parts of the plant equipment shall be bestowed with ample margins for possible overstressing due to shock.

All work shall be performed and completed in accordance with the best modern shop practice in manufacture of high grade equipment.

Castings shall be free from blow-holes, flaws, cracks or other defects; and shall be smooth, close-grained and of true form and dimensions. No plugged or filled-up holes or other defects will be accepted. No casting shall be burned, plugged, patched or welded; and no repairs or defects will be accepted.

All materials, supplies, parts and assemblies supplied under this specification shall be tested as far as reasonably practical.

All welded joints shall be free from defects such as blow-holes, slag inclusions, lack of penetrations, under-cuts, cracks etc; and shall be made by qualified and tested welders. Slag shall be ground after joint completion; and well reinforced smooth welds shall be made.

1.2 Inspection, Testing program and Notification

Before manufacture commences, the contractor shall submit an outline of the proposed inspection and testing programmes (Quality Assurance Programme - QAP) for all major stages during manufacturing of major equipment. This inspection and testing programme shall include for the various items, the designation number, the kind of test, test standard and the extent of witness by the Owner/Engineer or third party.

The notification of the individual witness inspections made by the Owner/Engineer or the third party, shall be given by the contractor using facsimile or telex or e-mail in a format to be agreed upon. The contractor shall notify the Owner/Engineer within 21 days prior to the date on and the place at which item shall be ready for testing. If any postponement becomes necessary, the contractor shall provide written notification of same at least 72 hours prior to the originally scheduled date.

If the Owner/Engineer does not attend the test at the place and at the date which the contractor has stated in his notification, the contractor shall proceed with the test, which shall

be deemed to have been made in their presence and shall forthwith forward to them duly certified copies of the test readings.

Before erection commences, the contractor shall submit an outline of the proposed erection inspection and test programme during the erection of major systems. The individual testing procedure shall be submitted as progress of erection work of the equipment, systems and/or units, coordinated with relevant work of the complete plant.

Before commissioning commences, the contractor shall submit an outline of the proposed commissioning test procedure. The test programmes shall be maintained by the contractor during erection and commissioning.

1.3 Test : General

During manufacture, the Owner's representative shall have the right to expedite and/or inspect design, materials, workmanship and progress of manufacture of the contractor's and his sub-contractor's plant system equipment and may reject any defective materials considered unsuitable for the intended purpose or which does not comply with the intent of this specification. The contractor, upon any such rejection by the Owner or his representative, shall rectify or replace the defective or unsuitable material. The contractor shall provide every reasonable inspection facility to the Owner's inspector or representative at his own and his sub-contractor's works.

Material being furnished against this order shall only be shipped when factory inspection satisfactory to the Owner and/or his representative has been conducted. Such inspection and acceptance for shipment shall not however, relieve the contractor from entire responsibility for furnishing the plant system equipment conforming to the requirement of this specification nor shall prejudice any claim, right or privilege which the Owner may have, because of the use or supply of defective or unsatisfactory materials for the plant system equipment. Should the inspection be waived by the Owner, such waiver shall not also relieve the contractor in any way, from his entire obligations under this order.
The plant system equipment shall at factory or after installation be demonstrated capable of performing satisfactorily upto the contractor's guaranteed performance. All tests required by this specification, including retests and inspection, that may be necessary owing to failure to meet any tests specified, shall be made at the contractor's expense. Additional tests, as necessary, shall be made to locate any such failure and after determining the causes of failure and rectifying it, specified tests shall be repeated to establish that the rebuilt plant system equipment meets with the specification in every respect. Should the equipment ultimately fail to pass the tests specified, the Owner will have the option to reject the unit.

The bidder shall state in the proposal, the shop testing facilities available. Should full capacity testing equipment be not available, the bidder shall state the method proposed to be adopted with detailed computations and justification for adopting such a method to reliably ascertain the equipment characteristics corresponding to full capacity testing.

1.4 Test Certificate

In accordance with approved QCP, the results of the tests shall be certified by the Owner/Engineer or independent agency as applicable. As and when the item of the plant equipment has passed the tests, the Owner/Engineer shall furnish to the contractor a certificate in writing to that effect. The Quality Control Plan (QCP) shall be issued by the contractor within 1 months after NTP. Document files containing material certificates, test reports, etc shall be compiled for each QCP item of plant equipment; and shall be suitably identified (including equipment classification reference) and bound. Copies of compiled file shall be submitted as per distribution schedule

1.5 Tests at Manufacturers Works

The major equipment of the plant to be supplied under this contract shall be subjected to shop inspection and tests. After NTP, the contractor shall issue within 1 months a QCP indicating the kind and extent of inspection and tests to be carried out on the offered plant equipment components to prove whether the equipment fulfills the requirement of the contract in view of:

- Safety Conditions
- Consideration of the applied standards and regulations
- Execution of workmanship

SITE TESTS

Tests conducted at sites shall be indicated by bidder.

2.0 DEVIATIONS

Deviation from this specification, if any, shall be clearly brought out in the offer. Unless owner explicitly accepts such deviations, it shall be considered that the offer fully complies with the specification.

TECHNICAL SPECIFICATION

FOR

MISCELLANEOUS ACTIVITIES

Prepared by					**Rev: 0**
Reviewed by					**Date:**
Approved by					

1.0 SERVICE AFTER SALES

1.1 The bidder shall furnish in detail about his organization for rendering service after sales, covering deployment of personnel and supply of spares, for ensuring efficient operation and maintenance of the offered plant equipment. The details of spares and service facilities possessed by them should be elaborated.

1.2 The bidder shall guarantee furnishing of the following in respect of after sales services including spares:-

i) Providing services of his specialists on indent from the Owner for periodical or special maintenance of the plant; as well as for identifying sources of trouble, if any, reported and measures for immediate rectification.

ii) The bidder shall guarantee maintenance of adequate spares at his works to be supplied on indent from the Owner at short notice during the life of the plant.

2.0 BID DATA, DRAWINGS AND INFORMATION REQUIRED

2.1 Technical data sheets, drawings, schedules with supporting information incorporating the details in compliance to spec but not limited to the following shall be furnished along with the proposal:

2.2 Duly filled in 'Schedule of Guaranteed and other Technical Particulars Schedules ‘C’ except for data which cannot be finally furnished with the Bid. The Price and Delivery Schedule-B duly filled in.

2.3 Dimensioned outline drawings of the offered overall plant and separately for equipment including cross-sectional drawings showing dimensions, net weights, shipping weights and suggested arrangement layout of proposed plant & equipment with auxiliaries etc. Technical Literature/leaflets of the above plant equipment.

2.4 Manufacturers' catalogues showing the construction details of various equipments should be furnished indicating clearly the technical preference of the offered equipment over the specified equipment.

2.5 List of users of comparable plant equipment with the year in which the Diesel plant and other critical plant equipment was put actually into service. For technical acceptability of the bid, proven experience of the bidder in manufacture and satisfactory and trouble free performance of the critical plant equipment for at least three (3) years is essential for which the bidder shall furnish necessary documents in support of the above.

2.6 A bar chart of design, engineering, procurement, manufacture, testing, delivery, installation, commissioning and site testing including civil structural and architectural works of the proposed plant equipment.

2.7 Technical description of the proposed plant equipment and materials particularly outlining any additional list out features proposed for safety & reliability. List out items of work & services not included and which has to be provided by the Owner for satisfactory commissioning of the offered plant equipment supplied.

2.8 The bid shall not be considered if the bidder fails to submit all the details asked for. Proposal should be complete without ambiguity and should be clearly written against each item.

2.9 Bidder shall furnish Quality Assurance Programme for design, manufacture, assembly, erection, testing & commissioning including civil, structural and architectural works along with the proposal for all equipment covered under this specification whether manufactured by the bidder or procured from other sources.

2.10 Technical deviations from the specification, if any, shall be clearly listed in the Schedule-E. In absence of any deviation given in Schedule-E and accepted by Owner, it will be bidder's responsibility and his contractual obligation to supply the Plant equipment as per specification to Owner/Engineer's approval.

2.11 List of shop and site tests, the bidder proposes to carry out including those pertaining to their sub-suppliers works shall be clearly brought out in Schedule – G. In addition to above tests, the bidder shall conduct any other tests, to Owner/Engineer's approval, which are considered important for satisfactory operation of plant equipment.

2.12 Bidder shall furnish all required mandatory and startup commissioning spare parts as well as maintenance tools and tackles with unit prices for the offered plant equipment.

3.0 POST CONTRACT DATA AND DRAWINGS

3.1 The contractor shall submit within thirty (30) days from the date of the order and Notice to Proceed (NTP) certified dimensioned drawings and technical schedules giving every detail of the offered plant equipment particularly the following:

3.2 Completely filled in schedule of guaranteed particulars and other technical particulars.

3.3 Single line diagrams; logic diagrams, dimensioned general arrangement and equipment layout drawings showing front and side elevations, plan and sectional views of the offered equipment forming part of the contractor's supply; The drawings should also indicate structures & supporting details including foundation outline and loading data etc.

3.4 Final version of all drawings and data submitted along in the proposal mentioned above.

3.5 Structural, thermodynamic and pressure part calculations showing compliance with specifications and codes as and when required.

3.6 Any other drawings/details not specified herein and required by the Owner/Engineer to correctly coordinate the offered plant equipment with other contractor's work.

3.7 Civil design calculations.

3.8 Detailed specifications and data sheets of the plant equipment with auxiliaries.

3.9 Detail drawings of critical equipment units, assemblies, parts etc. as deemed necessary.

3.10 Design calculations of conductor sizing, cable sizing, main equipment sizing etc.

3.11 Schematic wiring diagrams along with write-ups for control, interlocks, instrumentation, protection, circuits. Terminal blocks and terminals arrangement drawings showing power & control cable connections.

3.12 Owner/Engineer will return to the contractor one (1) print of each drawing either.

(a) stamped approved or (b) marked up with the comments. In case of (a), no further submission of a drawing will be required. In case of (b), the contractor shall correct his original drawings to conform to comments made by the Owner/Engineer and resubmit within two (2) weeks of receipt of comments in the same manner as stated in the Distribution Schedule. The Owner/Engineer's approval shall not relieve the contractor from any of his obligation and responsibility to manufacture and supply equipment conforming to this specification, unless a written amendment to the specification is issued by the Owner.

3.13 After approval of the drawings, reproducible of each drawing shall be supplied. Final drawings shall be certified as Approved for Construction. Should any minor revision be made after approval the contractor shall re-distribute prints and reproducible as per the Distribution Schedule. Every revision shall be marked by a number, date and subject in a revision block provided in the drawing.

3.14 Reproducible shall be of quality to produce clear and legible prints and any inferior reproducible will be returned by the Owner for replacement with suitable reproducible. All reproducible shall be mailed rolled (not folded) on the outside of regular mailing tubes except for small sizes which can be mailed unfolded in envelope with a cardboard backing. The prints and reproducible shall be mailed in the most expeditious manner and shall be accompanied with a letter of transmittal.

4.0 INSTRUCTION MANUAL

4.1 At least one (1) month prior to the dispatch of the plant equipment, fifteen (15) copies of installation, testing and adjustments after installation, operation and maintenance manuals shall be furnished. These manuals shall be sturdily bound volumes and shall contain every drawings and information required for installation, testing, setting and adjustment of all components after installation, operation and maintenance of the equipment and all its components. Separate tabs shall be used for such instructions concerning each equipment control components, electrical and other accessories. The other data needed for servicing the components and ordering their spare parts.

4.2 Marked erection prints identifying the components parts of the equipment, as transported, with its assembly drawings.

4.3 Detailed dimensioned assembly and cross sectional drawings and description of all the plant system equipment with auxiliaries and drawings identifying all spare parts for re-order.

4.4 Documentation

Correspondence, drawings, progress reports, schedules, tests reports and instruction manuals shall be mailed in requisite copies in accordance with Distribution Schedule.

5.0 WORK SCHEDULE

5.1 Time being the essence of the proposal, preference will be given for the offers quoting earlier deliveries. The bidder shall include in his proposal his programme for furnishing and erecting the offered plant & equipment.

5.2 The programme shall be in the form of master network identifying the key phases in various areas of total plant work, such as design work, procurement of raw materials, manufacture of components & subassemblies; complete erection of equipment and all other field activities. The master network shall conform to completion of trial operation from the date of Letter of Award within a period of 4 months. The trial operations shall commence any day within 15 days prior to the date of completion indicated above.

5.3 This master network shall be discussed and agreed before the issue of letter of award. Engineering drawings as well as technical data sheets submission schedule shall also be discussed and finalized before the issue of letter of award. Provisions of the liquidated damages leviable for delays in completion of trial operation shall become effective after the above mentioned date.

5.4 After the contract award, the contractor shall plan the sequence of work of manufacture and erection including associated civil works to meet the Owner's power plant commissioning requirements; and shall ensure that all work/manufacture, shop testing, inspection & shipment of the equipment in accordance with the required construction/erection sequence.

5.5 Within seven (7) days of acceptance of the letter of award, the contractor shall submit, for review and approval, two copies (1 reproducible and 1 print) of Detailed Network schedules, based on the Master Network (mutually agreed by the Owner & contractor) to the Owner/Engineer showing the logic & duration of the activities in the following areas

i) Engineering, Procurement, Manufacturing & Supply Detailed engineering activities in regard to procurement of raw materials including bought out items, manufacture, dispatch/ shipment & receipt at site.

ii) Civil, Structural & Architectural Works:

Detailed engineering activities in regard to civil & structural works execution based on the offered equipment and approved drawings including detailed execution of execution activities covering the complete scope of work.

iii) Erection, Testing and Commissioning:

Detailed erection, testing and commissioning activities, covering the complete scope of work of the offered plant equipment coordinated with the civil and structural works executed.

5.6 Detailed Manufacturing Program

Detailed manufacturing PERT/PRIMAVERA programme for all the manufacturing activities of the offered plant equipment at contractor's/subcontractor's works shall be furnished within 7 days of letter of award.
The manufacturing network shall be supported by detailed procurement programme for critical bought out items/raw materials

Pre-erection Activity Programme

A) Manpower Deployment
B) Tools and plant mobilization plan
C) Detailed Site Mobilization Plan

5.7 Within a week of approval of the Network schedule, the contractor shall forward to the owner/Engineer copies of the Computer initial run data in an acceptable manner

5.8 The network shall be updated every month; or as frequency as possible to mutual agreement. Within seven (7) days following the monthly review, a progress meeting shall be held at the work (possible) wherein the major items of the plant or equipment are being produced. The meeting will be attended by the Owner/Engineer and responsible representatives of the contractor. The contractor shall be responsible for minuting the proceedings of the meeting, a report of which shall reach the Owner or the Owner/Engineer not later than 7 days following the meeting.

5.9 Access to the contractor's and/or sub-contractor's work shall be granted to the Owner/Engineer at all reasonable times for the purpose of ascertaining the progress

6.0 PROGRESS REPORTS

During execution of the contract either in manufacture or erection/commissioning, the contractor shall furnish monthly progress report to the Owner or the Owner/Engineer in a format as specified indicating the progress achieved during the month, and total progress upto the month as against scheduled and anticipated completion dates in respect of key phase of work or manufacture and shipment such as release of drawings for fabrication, procurement of raw materials, inspection and testing. If called for by the Owner/Engineer, the contractor shall also furnish to the Owner or the Owner/Engineer resources data in a specified format and time schedule. The contractor shall also furnish any other information necessary to ascertain progress if called for by the Owner/Engineer

Volume-I Technical Specification Misc Activities

7.0 DEVIATIONS

Deviation from this specification, if any, shall be clearly brought out in the offer. Unless owner explicitly accepts such deviations, it shall be considered that the offer fully complies with the specification.

TECHNICAL SPECIFICATION

EOT (ELECTRICAL OVERHEAD TRAVELLING) CRANE

Prepared by	**Javed Ahmed**		**Rev: 0**
Reviewed by	**Abhinav Srivastava**		**Date: 28.03.2017**
Approved by	**Vijay Panpalia**		

Volume-I Technical Specification for EOT (Electrical Overhead Travelling) Crane

Scope:

This specification applies to the design, engineering, manufacturing/fabrication, assembly, inspection, testing before dispatch, packing, forwarding, supply and delivery at destination by suitable transport, unloading at site, installation and commissioning of indoor EOT crane on Turnkey basis and as specified in the following sections of this document.

Reference Standards:

1	IS:325-1978	3-Phase induction motors (fourth revision
2	IS:807-2006	Code of practice for design, manufacture, erection and testing (structural portion) of cranes and hoists.
3	IS: 2062-1992	Specification for structural steel (fusion welding quality)
4	IS:2266-1989	Steel wire ropes for general engineering purposes
5	IS:3177- 1999	Code of practice for electric overhead travelling cranes and gantry cranes other than steel work cranes.
6	IS:l3947(Part-1)-1993	Low voltage switches and control gear PI-general rules
7	IS:l3947(Part-4, Section-1) -1993	Low voltage switchgear and control gear P-4 - contactors and indoor starters sec 1, electromechanical contactors and motor starters (superseding IS:2959 and IS:8544 – all parts)

Introduction:

The EOT cranes will consist of the following major components:

• Single girder.
• Trolley frame.
• Brakes.
• Wheels and rails.
• Hooks (main/auxiliary) and hoist rope.
• Operator’s cabin/radio control.
• Conductors.
• AC motor.
• Shrouded down shop leads (DSL) with maintenance cage.
• Control panel.

Volume-I Technical Specification for EOT (Electrical Overhead Travelling) Crane

Technical Details:

The girder will be of box type construction and will ensure that water/oil do not accumulate inside the box. The trolley frame will be fabricated from rolled sections/steel plates. The main hoist, auxiliary hoist, cross travel trolley, and long travel trolley of the crane will be motor driven. The structural portion of the EOT crane will be designed to meet the requirements of Class II of IS 807 (Indian Standard). The EOT crane will be designed (other than the structural steel portion) to meet the requirements of Class M5 of IS 3177.

Sideward approaches from the operating floor level to the rail level will be provided in both rows for access to the bridge. Safe means of access will be provided in the cabin and other areas of the crane where maintenance of any equipment or component is involved. A platform will extend the full length of the crane bridge on both sides of the bridge girder The EOT crane will have a permanent inscription in English and Hindi on each side, readily visible from the operating floor level, stating the safe working loads in metric tons for both the hooks, the year of manufacture, crane serial number, and manufacturer's name.

Features:

- The EOT crane will be of double girder, bridge type.
- Access to EOT Crane shall be provided with Ladder inside control room
- A permanent cage ladder with steel grating platform all along the length of the room between side wall and main beam which has power tapping DSL.
- Safety Railing on EOT Crane for maintenance
- The EOT crane shall be designed for lifting 25% more than the heaviest piece of equipment (detailed calculation shall be submitted by Vendor for approval), However minimum capacity shall not be less than 5 Ton.
- Steel will be of tested quality steel conforming to IS 2062 (Grade B).
- Handrails will be of galvanized steel pipe of flush welded construction, ground smooth using 32 mm.Nominal bore medium class pipe conforming to IS 1239 (Part II).
- The wheels and rails act as a guide for EOT cranes to provide smooth and linear motion.
- The crane panel will have two incoming supplies. The two isolators will have mechanical interlock(through Castell key) to prevent simultaneous closing of the two isolators.
- Electrical motors will be selected with an S4 duty, a 25 percent cycle duty factor, and 150 starts per hour.
- Speed of the hoist shall be 3-4 meter per min and the creep speed through DCEM clutch and pony geared motor shall be maximum 0.5 meter per min.
- The height of lift and length of long travel shall be in accordance to the GIS room.

- The end carriage & Trolley frame shall be fabricated with MS Rolled channels and MS plates, suitable stiffeners and diaphragms shall also be provided.

- Antiskid skid chequered plate with suitable maintenance platform for Hoist Block and long travel drive shall be provided. Sufficiently wide full length walk way with hand railing should be provided on the girder. Drawing &all other related document are to be approved from the user Dept.

- Totally enclosed helical splashed oil bath lubricated gear box shall be used for all motion. All gear & pinion shall be hardened and tempered alloy steel having metric module machine cut teeth. The housing shall be graded cast iron / cast steel or fabricated from steel plates. Fabricated housing shall be stress relieved before the machining. The gear box shall be oil tight and fitted with oil level indicator, breather plug, inspection cover and oil drain out plug. The internal surface of gearbox shall be painted with oil resistant type paint.
- Rope drum shall be fabricated form rolled steel plates or seamless tube. Fabricated rope drum shall be stress relieved before machining. The rope drum shall be designed for single layer of rope; the helical groove shall be smooth finished.
- Wire rope shall be regular right hand lay fiber core as per IS: 2266. The construction of wire rope shall be 6X36 constructions. The factor of safety shall be 6 minimum. Rope sheaves shall be graded cast iron. The rope sheaves shall be mounted on anti friction bearing.
- Lifting hook shall be single point with shank as per IS: 3815. The hook shall be mounted on anti friction thrust bearing which shall be enclosed by protective skirt for360° smooth swivelling of the load on the hook. The block sheaves · shall be fully encased in close fitting guards fabricated out of steel plate. Smooth opening shall be provided in the guard to allow free movement of rope. Hook block should be tested and certified with proof load from Govt. accredited testing authorities. Test certificates for lifting hook shall be furnished during the supply.
- All electrical motors shall be totally enclosed fan cooled, S4 Duty, Squirrel Cage Induction Motor. The starting motion of all travel shall be jerking free. Suitable starting arrangement shall be provided for all LT motor to reduce the starting current to achieve smooth starting and thereby jerk free operation in all motions of the crane. Motor shaft shall be connected to the gear box through gear type flexible coupling.
- Pendent push button shall be suspended from crane by link chain so that no undue stress can come on the cables. · The Push button station shall be independently movable. Separate cable track with cable trolley etc. shall be provided for the push button station. The unit shall comprise of push button marked as follows and 1no. Indication lamp for control of indication:
  (1)Start (2) Emergency stop (3) Up (hoist) (4) Down (lower) (5) Slow down (6) Slow UP (7) Left -CT (8) Right- CT (9) Forward - LT (10) Reverse –LT
- The unit shall comprise incoming ACB / MCCB with positive isolation contactor, line chock, three phase diode bridge rectifier acting as line converter and three phase inverter as load converter interconnected through DC link reactor and capacitor unit.

Inspection and Testing: The crane supplier shall put up the crane for inspection at his Works as well as at site and the following tests shall be carried out by him in the presence of the Purchaser or his authorised representatives

- All the dimensions of the crane shall be checked as per the approved general arrangement drawings. Diagonal measurement of the crane and trolley shall also be carried out in the fabrication shops before despatch to site.
- The deflection of the bridge girders shall not exceed 1/1000 of span with the fully loaded trolley stationed at mid-span with safe working load at rest. The measurement shall not be taken on the first application of the load. The datum line for measuring the deflection should be obtained by placing the unloaded trolley at the extreme end of the crane span
- The girders shall be tested for permanent set by applying 125% of the safe working load when the trolley is stationed at mid-span. At the end of the test there shall be no sign of permanent set of the girders
- Height of lift shall be checked by measuring the length of hook travel from its topmost position to the bottom-most position and this shall not be less than the lift specified
- All the motions of the crane shall be tested with rated load and the rated speeds shall be attained within the tolerance limits
- All the motions of the crane shall be tested with 25% overload in which case the rated speeds need not be attained but the crane shall show itself capable of dealing with the overload without difficulty.
- For checking the performance of the hoist motion the speed at each notch of the master controller with different loads both during hoisting and lowering shall be found out and the load/ speed characteristics shall tally with the speed/torques graph submitted.
- For the performance of long travel and cross travel motions, the crane shall be tested with rated load and the running time for a particular distance shall be as per the acceleration values specified.
- The hoist brakes shall be tested so as to enable to brake the movement under all conditions without any jerk on the load . The brakes shall also be tested with overload condition.
- The long and cross travel brakes shall be capable of arresting the motion within a distance in metres equal to 10% of the rated speed in metres/minute.
- Limit switches for all the motions shall be tested for their proper operation and shall be set right so as to obtain the required hook approaches and lifting height.
- Insulation and other tests as per applicable codes shall be carried out.
- Trolley frames shall be designed in accordance with applicable sections of IS 2062/IS 12075.

Volume-I Technical Specification for EOT (Electrical Overhead Travelling) Crane

- The main function of the trolley frames is to provide rigid support and strength to the EOT cranes to carry a load from one place to another.
- The trolley frame will be fabricated from rolled sections/steel plates. End carriages will be of welded Construction. Mountings will be designed to facilitate easy removal of the wheels, bearings, and journals for quick and easy maintenance. Wheel or wheel end carriage mountings will be complete with safety pads to prevent an accidental drop of more than 25 mm. Jack pads will also be provided on the trolley and bridge wheel mounting structural frames for the removal of wheels.

Drawing and Documents: Following drawings are to be submitted for scrutiny and approval

- The detailed general arrangement drawing containing all basic dimensions and vital particulars of the crane. These drawings should indicate the main specification, number and location of joints provided on the girder plates, CT rails etc. structural calculation, drawings of main load carrying members, if asked for by Purchaser
- General arrangement drawing of the trolley.
- Motor power &brake selection calculation.
- Cabin layout drawing showing location and mounting of all equipment.
- Control equipment supplier's schematic control circuit diagrams for individual drives along with speed-torque characteristics and explanatory notes.
- General arrangement drawing for control panel with sections.

Transportation of Equipment at Site:

The contractor shall be responsible for the loading, transport, handling and offloading of all equipment and materials from the place of manufacture or supply to site. The contractor shall be responsible to select and verify the route, mode of transportation and make all necessary arrangement with the appropriate authorities as well as determining any transport restrictions and regulations imposed by the government and other local authorities.

Packing , Storing and Unpacking:
All the equipment shall be carefully packed for transport in such a manner that it is protected against the climatic conditions and the variations in such conditions that will be encountered enroute from the manufacturer’s works to the site.

TECHNICAL SPECIFICATION

FOR

CABLE SEAL SOLUTION

Specification No- SP-GMS-01-R0

Prepared by	**Javed Ahmed**		**Rev: 0**
Reviewed by	**Abhinav Srivastava**		
Approved by	**Sheshadri Krishnapura**		**Date: 16th April 2018**

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1.0. SCOPE:

This specification covers design, engineering, manufacture, assembly, stage testing, inspection & testing before supply & delivery at site and installation testing and commissioning including handover the system to BRPL after successful execution of Cable Seal Solution
This Scope includes the following

a) Supply of Cable Seal System including its transportation to BRPL Site
b) Installation testing commissioning of Cable seal solutions with all the accessories including minor civil work if any.

2.0. Basic Features:

Following requirements shall be fulfilled and supported with valid test reports/certificates:

1. Minimum IP 65 Protection level Certificate for protection from Dust and Water.
2. Heat sink test report of Cable transit system.
3. Certificate/ Test Report for Protection from Rats and Rodents.
4. ATEX, PESO Approval for Explosive atmosphere.
5. NEMA Certificate as per UL 508A for the safety of Cabinets & Enclosures mandatory.
6. Material of Frame shall be of Aluminum (Grade EN AC 44300)/Stainless Steel.
7. System must have Bonding & grounding (Armour Earthing) feature as per IS 3043-1987 using a suitable Tin Plated Copper Braid to be used wherever required. It should be also tested for Impulse withstands as per IEC 62305-1 for minimum 50kA for 1 sec.
8. Manufacturer should have direct presence in India with all the after Sale & Service support from last 10 years.
9. Cable sealing system should have been tested for F- Rating Fire for 3 hrs as per UL 1479/ EN, Insulation and Integrity for 120 mins as mentioned in Indian National Building Code(EI 120) Certificate from BS 476 are mandatory.
10. Cable sealing system should have been tested for GAS tightness of 2.5 bar pressure.
11. EPDM modules in System must have Halogen content less than 200ppm with low smoke index-F1 Classification as per NF16-101 & NF16-102, Heat Radiation test in compliance with M2 classification, UV Ageing Test as per ISO-4892-2:2006 & ISO-815- 1:2008, Oxygen Index Test as per ASTM D 2863-00, Shock & Vibration Test as per NES 510.
12. System must have Bonding & grounding (ArmourEarthing) feature as per IS 3043-1987 using a suitable Tin Plated Copper Braid to be used wherever required. It should be also tested for Impulse withstand as per IEC 62305-1 for minimum 50kA for 1 sec.
13. Smoke Index shall be low. Type test reports for the same shall be provided by the supplier.
14. Shelf life of module - 25 Years
15. Solubility – Insoluble in water.

3.0. SERVICE CONDITIONS:

S.No	Particulars	Data
1	Design Ambient temperature	0°C to 50 °C
2	Seismic Condition	Zone IV as per IS 1893
3	Wind Pressure	195 kg/M² upto elevation of 30 M as per IS 875
4	Maximum Relative Humidity	100%
5	Maximum Altitude above Sea level	1000M
6	Rainfall	750mm (concentrated in 4 months)
7	Pollution level	Heavy/Dry
8	Average of no thunderstorm days	40 per annum

4.0. SYSTEM DESIGN

1. Modules with concentric peel able/removable layered multi-diameter cable sealing system consisting of frames, blocks and accessories shall be installed where the cables enter or leave any type of Electrical Panel/Cabinet/Transformer cable box.Each concentric module shall have a minimum of 10 mm range between smallest and largest adaptable diameter. System should be designed with minimum **+/-** 3 mm design margin. System should have provision for usable spares of 30**%** with no loose/ hanging / add layer / plug in type or to be stored components of modules / seals, each spare module should be concentric peelable/removable multi-diameter layered with complete range installed on Frame and solid Block are not acceptable..

2. It Shall cover following openings

For all Cable entry from outside to control room building and between room to room

5.0. MAINTENANCE

Bidder shall furnish a maintenance manual and support maintenance activity.

6.0. APPROVED MAKES

Roxtec, MCT Brattberg

7.0. APPROVED MAKES

8.1	Submissions along with the bid	
8.1.1	Duly filled GTP and	2 copies + 1 soft copy

	copy of specification	

8.0. SHIPPING

9.1	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.

9.0. HANDLING AND STORAGE

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

10.0. QUALITY

11.1	Vendor quality plan	To be submitted for purchaser approval
11.2	Inspection points	To be mutually identified & agreed in quality plan

11.0. DEVIATION

12.1	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.

12.0. TESTING AND INSPECTION

Shall be as per latest relevant standards

13.0. TRAINING

Training on installation, commissioning, operation and maintenance shall be included in the proposal.

- at factory/site- 1 Manday

TECHNICAL SPECIFICATION

SPARES MAINTENANCE TOOLS AND TACKLES

Prepared by	**Javed Ahmed**		**Rev: 1**
Reviewed by	**AS**		**Date: 11.07.2018**
Approved by	**KS**		

1.0 Spares Requirement: Following Spares shall be supply shall be in scope of Vendor for each package in addition to spares mentioned in individual equipment specifications

1. GIS Termination for Cables --4 Nos.
2. Spare SF6 Gas cylinder 20 Liter size-2 Nos
3. Spare Relay for GIS Panels
    a. O/C and E/F Relay- 1 Nos
    b. Trip Circuit Supervision relay- 2 No.
4. Communication cable and Probes one of each type
5. Spare Media Converters (Optical to Digital) -1 No
6. Indication lamp for GIS and CRP each colour- 20 Nos
7. TNC Switches- 2 Nos each type
8. Voltmeter- 2 Nos each type
9. Ammeter- 2 Nos Each type
10. Push buttons for GIS and CRP panels- 5 Nos for each type
11. MCB – 2 Nos for each type in loose.
12. Laptop – i7 1TB 8GB RAM of Dell/Lenovo- 1 No
13. Dummy Plugs for 66kV GIS Panels 4 Sets

Volume-I Technical Specification for Spares and maintenance tools and tackles

2.0 Maintenance tools and tackles: Following supply shall be in scope of Vendor for each package in addition to maintenance tools and tackles mentioned in individual equipment specifications, however in case of duplicacy/repetition only once shall be considered with quantity most stringent one quantity.

1. Cable Spiking tool (UV Make)---1 No
2. Torque Spanners---4 Nos

Note: Approval of Model no and make wherever not defined shall be done at the time of Bid evaluation

TECHNICAL SPECIFICATION OF IT DEVICES FOR GRID COMMUNICATION

DOCUMENT NO.: BRPL-IT-SCADA-0001

Rev.: 00

BSES Rajdhani Power Limited

BSES RAJDHANI POWER LIMITED
BSES Bhawan, Nehru Place,
New Delhi - 1100049

DOCUMENT CONTROL SHEET

DOCUMENT : TECHNICAL SPECIFICATION OF IT DEVICES FOR GRID COMMUNICATION

DOCUMENT NO. : BRPL-IT-SCADA-001

REV. NO. : 00

ENDORSEMENT

00	05.02.2019	First issue	Suman Kumar	Mrityunjay Kumar
Rev No.	Date	Description	GM - IT	HOD - IT
			Prepared by	Approved By
			BSES Rajdhani Power Limited	

Contents

POINTS TO BE CONSIDERED DURING DESIGNING OF NEW GRID

1.0 INTENT OF SPECIFICATION

1.1 Tender Specification is intended to cover design, engineering, manufacture, assembly, inspection, shop testing, supply, packing, forwarding to site, unloading, storage and preservation, handling at site, insurance, erection & supervision of erection, pre–commissioning, testing & commissioning, completion of facilities, conducting reliability run tests and performance guarantee tests and handing over the complete IT system to IT department of BSES Rajdhani power limited.

The scope shall also cover the following activities and services in respect of all the equipment and works specified in various sections of this specification.

a) Basic engineering of all equipment and equipment systems.

b) Detailed design of all the equipment and equipment system(s).

c) Providing engineering drawings, data, instruction manuals, as built drawings and other information for owner's review, approval and records.

d) Compliance with statutory requirements and obtaining clearances from statutory authorities, wherever required.

e) Complete manufacturing including shop testing.

f) Packing and transportation from the manufacturer's works to the site including customs clearance, port charges, if any.

g) Receipt, movement to proper storage, storage, preservation and conservation of equipment at the site, movement from storage area to interim/ final foundation location.

h) Supply of spares as per specified list.

i) All items and equipment though not specifically mentioned in the specification, but needed to complete the system to meet the intent of the specification shall be deemed to be included in the scope of the bidder.

It is not the intent to completely specify all details of design and construction, but only to lay down broad sizing and quality criteria for the major equipment and systems and it is expected that the equipments shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation up to the contractor's guarantee in a specified manner acceptable to the owner.

2.0 SCOPE OF SUPPLY AND SERVICES

The scope of supply and services shall be complete but not limited to the following:

2.1 IT RACK ROOM REQUIREMENT

2.1.1 Air conditioned room shall be provided for proper functioning of all IT devices. The temperature shall be maintained to 22^0 to 24^0 C

2.1.2 Room size shall be minimum as –

a) Length – 3.5 mtrs
b) Width – 2.5 mtrs.
c) Height – 3 mtrs.

2.1.3 Cable trench/ duct – 200mm wide cable trench/ duct shall be provided below the finished floor for proper routing of cables up to IT rack. 100mm size conduit shall be provided for cable entry from outside of the building to inside cable trench/ duct. The cable trench / duct shall be connected to nearest DCDB for proper power cable routing up to IT rack.

2.1.4 Room door width shall be minimum 4 ft. for ease of rack entry and height shall be as per standard norms. Door shall have locking arrangement.

2.1.5 Room's front side shall be provided with glass partition to have the clear view of IT rack from outside the room.

2.1.6 Towers (2nos.) for communication link shall be installed at the roof the building. The area required for base of the tower shall be 5 ft X 5 ft and the tower load shall be maximum 250 kg. Link shall be delivered by RCOM/ Airtel/ Sify ISPs. These links delivery shall be directly taken care by owner. Bidder to provide the suitable platform as motioned in the clause for tower erection.

2.2 POWER SUPPLY REQUIREMENTS

2.2.1 Required power supply for communication devices inside the IT rack shall be provided. Two numbers 48V DC power through suitable MCB shall be provided for owner's use in the IT rack this power supply shall be used for communication link's POE devices.

2.2.2 All internal wiring of rack for various ratings of power supply required by other devices i.e switch, routers, cooling fan, light etc shall be provided.

2.2.2 All communication equipments/ devices inside the IT rack shall be on DC supply .

2.3 EARTHING REQUIREMENTS

2.3.1 Dedicated electronic earthing shall be provided for IT rack and their devices. The earth pit resistance should be between 0.6 ohm to 1 ohm.

2.3.2 Electronic Earthing cable from earth pit to IT rack shall be of minimum 16 sq.mm multi stranded copper cable PVC insulated and internal devices shall be done with minimum of 06 sq.mm multi stranded copper cable PVC insulated.

2.4 IT RACK SPECIFICATION

2.4.1 The design of IT rack and layout of all equipment, terminal blocks etc. shall be based on human engineering considerations, fully keeping in view the convenience of operation and maintenance personnel and shall be subject to Owner's approval during detailed engineering.

2.4.2 Rack shall be free standing type and have bottom/ top entry for cables to be decided application wise during detailed engineering. The bottom of rack shall be sealed with bottom plate, double compression cable glands and fire proof sealing material to prevent ingress of dust and propagation of fire.

2.4.3 Rack size shall be 12U and made of CRCA sheet with 1.6 mm thickness. The rack shall be of front and back opening with 2 mm thick door frame. Front and back door shall have full length of 3 mm thick glass panel for clear view of inside equipments. Cable gland plate shall be detachable type and of 2mm thickness. Door hinges and locks shall be as per manufacturer standards. Special key type locks are not acceptable. Rack colour shade shall be powder coated RAL 7035.

2.4.4 Two nos. adjustable height tray shall be provided in the rack for routers and ISP devices.

2.4.5 Following are the minimum equipment/ accessories shall be provided in the rack however same shall be decided during detail engineering –

1. DC Power supply converter -

   i) Input source – 48V DC – 1 no.

   ii) Output – 12V DC - 4 nos., 5VDC – 2 nos.

   iii) Input and output connection shall be of terminal type.

   iv) Input terminals - suitable for 4 sq.mm cable

   v) Output terminals - suitable for 2.5 sq.mm cable

2. AC power supply extension board -

   i) Input source – 230V AC – 1 no.

   ii) Output sockets with individual switch – 230V AC – 5 nos.

3. Rack Fan and filter – size 6"

4. MCB and Terminal blocks – MCB DP type and terminals shall be mounted on DIN rail. Minimum four nos. MCB shall be provided in the rack. One no. for 48 V DC (20A), one no.

for 230V AC (10A) and one no. of each rating shall be kept as spare. Terminal blocks shall be fused type and suitable to respective voltage rating and intended cable size mentioned elsewhere in the specification.

2.4.6 All inter panel wiring shall be with FRLS type wires with proper routing inside the cable alley. Cross ferruling shall be provided for easy identification of wires. Cable shall have proper cable tagging.

2.4.7 Panel name plate shall be provided at top portion of front and back doors. It shall be engraved type and made of acrylic plate.

2.5 IT devices

2.5.1 Router – Router shall have minimum 2 nos. WAN ports and 8 nos. LAN port. Router shall also support the 3G/ 4G dongle connectivity.

2.5.2 Switch – Switch shall have minimum 12 LAN ports. Switch shall be provided with all mounting accessories.

3.0 Terminal Points

3.1 Power supply – From PDB to IT rack including cable supply, erection and termination at both end (PDB and IT rack). PDB details shall be part of Electrical section of technical specification

3.2 LAN cabling – From RTU to IT rack router/ switch including CAT 6 cable (armour type) supply, erection and termination at both end (RTU and IT rack).

3.3 Communication link – Shall be provided by respective ISP upto router WAN ports.

4.0 Exclusions –

4.1 Communication tower and link.

5.0 Bill of Quantity and vendor list of each item per rack for each grid –

Sr. No.	Item Description	Make / Model No.	Quantity (in nos.)
1	Rack – 12U	Rittal / Pyrotech	01
2	Router	Fortigate / CISCO	01
3	Switch	CISCO	01
4	Power Supply converter	Meanwell/ Phoenix	01
5	MCB	Havells / Legrand	04
6	Terminal blocks	Wago/ phoenix	1 lot

7	AC extension board	Havells / Anchor	1
8	Wires for Internal wiring	RR cable, Finolex, Havells	1 lot
9	Spare Terminal blocks with fuses (mounted in the rack)	Wago/ phoenix	20%
10	Terminal fuses of each rating (loose supply)		20%

Technical Specification of Three Phase Four Wire CT operated Static Tri-vector ABT Meter

Document number: BR/18-19/M/ABT_V2

January 2019

Prepared By	Reviewed by	Approved By
Md. Akhtar Ansari 07.01.19	07/01/19	
Md. Akhtar Ansari	Rishi Goyal	Sheshadri Krishnapura

VERSION CONTOL

SN	Date	Previous Version No.	Current Version No.	Author
1	28.05.18	NA	BR/18-19/M/ABT_V1	Md. Akhtar Ansari, Rishi Goyal
2	07.01.19	BR/18-19/M/ABT_V1	BR/18-19/M/ABT_V2	Md. Akhtar Ansari, Rishi Goyal

CHANGE MANAGEMENT

SN	Date	Version No.	Major Changes
1	07.01.19	BR/18-19/M/ABT_V2	- Display parameters (SN 7) - Load Survey parameters (SN 16) - Other Salient Features added (SN 20)

CONTENTS

1. SCOPE

This specification shall cover design, engineering, manufacture, assembly, inspection, testing at manufacturers works before dispatch, supply and delivery to BRPL, Class 0.2s accuracy class static 3 phase–4 wire CT operated three-vector energy meter. The meter shall be suitable for measurement of energy and power, demand requirement in an AC balanced/unbalanced system over a power factor range of zero lag to unity. These meters should have communication port to interface for remote meter reading.

2. STANDARDS

The meter shall be ISI marked (vendor shall be BIS certified) and conform to CEA Metering (Installation and Operation of Meters) Regulation 2006 and latest amendments, Indian Electricity Acts and Indian Electricity Rules.

The CT operated energy meter shall be of accuracy Class 0.2 for active/ reactive / apparent energy and conform to relevant clauses of following standards or report: -

IS 14697: 1999	Specification for A.C Static Transformer operated Watt Hour & VAR – Hour meters, class 0.2s
CBIP Technical Report No. 304 with	Specification for A.C. Static Electrical Energy Meters.
IS 15959 (Companion specification)	DLMS Indian Companion Standard – Category 'B' for Ring fencing/Boundary/ABT Metering

Unless otherwise specified elsewhere in this specification the static meters shall conform to the latest version available of the standard as specified above.

3. TECHNICAL SPECIFICATION

SN	Parameters	Technical Requirements
1	Rated Secondary Voltage	63.5 V (Phase to Neutral)
2	Rated secondary Current (I Basic)	1A or 5 A
3	Maximum Current	200% of Ib
4	Rated Frequency	50 Hz.
5	Accuracy class	• 0.2s (the meter should meet the same class of accuracy for reactive energy also) • The reactive accuracy class of the meter shall be same as the active accuracy class
6	Power Factor	Unity to Zero (all power factor lag / or lead)
7	Temperature	The standard reference temperature for performance shall be 27 °C. The mean temperature co-efficient shall not exceed 0.03%.

The meter shall start and continue to register on application of 0.1% of basic current at Unity P.F., as per relevant standards and shall work satisfactorily up to maximum continuous current of 2 times rated basic current with the following supply system variation:

Voltage: Vref ± 30%
Frequency: 50 Hz ±5%

4. CONSTRUCTIONAL SPECIFICATION

The case, winding, voltage circuit, sealing arrangements, registers, terminal block, terminal cover & name plate etc, shall be in accordance with the relevant standards. The meter should be compact & reliable in design, easy to transport & immune to vibration & shock involved in the transportation & handling. The construction of the meter should ensure consistence performance under all conditions especially during storms/heavy rains/very hot weathers. The insulating materials used in the meter should be non-hygroscopic, non-ageing & have tested quality. The meter should be sealed in such a way that the internal parts of the meter become inaccessible.

The meter should employ latest technology such as Application Specific Integrated Circuit (ASIC) to ensure reliable performance. The mounting of the components on the PCB should be Surface Mounted Technology (SMT) type except some power supply related component. The electronic components used in the meter should be of high quality.

4.1 GENERAL MECHANICAL REQUIREMENT

The construction of the meter shall be rigid & suitable to withstand shock & vibration involved in transportation & handling, as specified in IS14697. Meter shall be designed and constructed in such a way as to avoid introducing any danger in normal use and under normal conditions, so as to ensure especially personal safety against electric shook, safety against effect of excessive temperature, protection against spread of fire, protection against penetration of solid objects, dust and water. The design of meter shall conform to IP51 class degree of protection against dust and moisture as per relevant standards.

4.2 TROPICAL TREATMENT

All parts, which are subject to corrosion under normal working conditions, shall be protected effectively. Any protective coating shall not be liable to damage by ordinary handling or damage due to exposure to air, under normal working conditions. Meters shall withstand solar radiation. The meters shall be suitably designed and treated for normal life & satisfactory operation under the hot and hazardous tropical climatic conditions as specified in clause no. 2. The meter shall work from -10°C to +55°C and RH 95% non-condensing type.

4.3 METER CASE

The housing of the meter shall be safe high-grade Engineering plastic or any other high quality insulating material and shall be very compact in design. All the insulation materials used in the construction of meter shall be non-hygroscopic, non ageing & of tested quality, capable of withstanding resistant to heat & fire. The construction of the meter offered shall be such that it can be sealed independently and the cover cannot be removed with the use of a

tool, without breaking the seal. The case of offered meters shall be so constructed that any non-permanent deformation shall not prevent the satisfactory operation of the meter.

4.4 TERMINALS -TERMINAL BLOCK

a. The base of the meter shall have a terminal block at the bottom made out of high grade engineering plastic so as to facilitate bottom connection and houses solid nickel plated brass terminals having capability to carry maximum value of current.

b. The material of the terminal block shall be capable of passing the tests given in IS14697: 1999.

c. The terminal holes in the insulating material shall be of sufficient size to accommodate the insulation of the conductors. The diameter of the terminal hole for current terminals shall not be less than 5.0 mm & shall be of adequate length in order to have proper grip of conductors / crimping pins with the help of two screws.

d. The terminal block shall satisfy all the conditions such as clearance & creepage distance between terminals & surrounding part of the meter as specified in relevant clause of IS 14697: 1999.

e. The manner of fixing the conductors to the terminals shall ensure adequate and durable contact such that there shall have no risk of loosening or undue heating. Screw connections transmitting contact force and screw fixing which may be loosened and tightened several times during the life of the meter shall be such that the risk of corrosion resulting from contact with any other metal part is minimized. Electrical connections shall be so designed that contact pressure shall not be transmitted through insulating material.

4.5 TERMINAL BLOCK COVER

The terminals block cover for the energy meters shall be extended transparent type, which can be sealed independently of the meter cover. The ETBC shall have a clear space of min 40±5mm, thus allowing sufficient clearance space for inserting cables. The terminals, their fixing screws and the insulated compartment housing them shall be enclosed by extended terminal cover in such a way that no part of meter or accessories at terminal block shall be accessible from the front of the meter. There shall be provision of fixing of seals so that screws cannot be loosened without breaking the seals.
The terminals shall not be accessible without removing the seal(s) of terminal cover when energy meter is mounted on the meter board.

4.6 WINDOW

The energy meter cover shall be made of high-grade engineering plastic with one window. The window shall be of transparent material ultrasonically welded with the meter cover such that it cannot be removed undamaged without breaking the meter cover seals.

4.7 QUALITY

Overall the quality of the meter should be good and the service life of the meter shall be more than the guarantee period. The material, components used for manufacturing the meter shall be of premium quality. The LCD display shall not fade with time and the display annunciators should be visible. Functionality of the meter shall not be affected by the harsh environmental conditions. Quality meters shall be given preference and the performance of previous installed meters shall be analyzed before awarding the tender. Aesthetically, the meter shall be of premium quality.

5. COMMUNICATION PORT

5.1 LOCAL COMMUNICATION PORT

The energy meter shall have a galvanically isolated optical communication port located in front of the meter for data transfer to or from a hand held Data Collection Device. The sealing provision should be available for optical port.

5.2 REMOTE COMMUNICATION PORT

Meter shall have an additional communication port (RS 232) in the form of RJ11 port to interface external modem for remote data collection. RS232 port should have sealing provision. It should facilitate to read meter remotely via GSM/GPRS/3G/4G modem.

6. DATA DOWNLOADING CAPABILITY

Meter shall support a minimum baud rate of 9600 on optical port as well as RS 232 remote communication port. It shall be possible to read selective data from the meter using base computer software.

7. DISPLAY OF MEASURED VALUE

The measured value(s) shall be displayed on seven segments, six digit Liquid Crystal Display (LCD) display unit/register, having minimum character height of 10 mm.

The data should be stored in non-volatile memory. The non-volatile memory should retain data for a period of not less than 10 years under unpowered condition. Battery back-up memory will not be considered as NVM.

It should be possible to easily identify the single or multiple displayed parameters through symbols/legend on the meter display itself or through display annunciators.

The register shall be able to record and display starting from zero, for a minimum of 1500 hours, the energy corresponding to rated maximum current at reference voltage and unity power factor. The register should not roll over in between this duration.

The principle unit for the measured values shall be Wh/kWh for active energy, VArh/kVArh for reactive energy & VAh/kVAh for apparent energy based on secondary current. Bidder shall mention the scale in which the meter displays the energy values.

Following parameters should be made available on display:

1. Real Time
2. Date
3. Line currents
4. Phase to Neutral Voltages
5. Phase wise Power Factor
6. Frequency
7. Active, Reactive and Apparent Power
8. Cumulative tamper count
9. Cumulative MD reset Count
10. Cumulative active import energy
11. Cumulative active export energy
12. Cumulative reactive lag While active import
13. Cumulative reactive lead While active import
14. Cumulative reactive lag While active Export
15. Cumulative reactive lead While active Export
16. Cumulative apparent import energy
17. Cumulative apparent export energy
18. Active net energy(Imp – exp)
19. Reactive net energy(Imp – exp)
20. Reactive high energy(V>103 percent)
21. Reactive low energy (V<97 percent)
22. THD in % for Voltage R Phase
23. THD in % for Voltage Y Phase
24. THD in % for Voltage B Phase
25. THD in % for Current R Phase
26. THD in % for Current Y Phase
27. THD in % for Current B Phase
28. THD in % for Power R Phase
29. THD in % for Power Y Phase
30. THD in % for Power B Phase
31. Present PT status
32. Present CT status
33. High resolution active import energy
34. High resolution active export energy
35. High resolution reactive lag While active import
36. High resolution reactive lead while active import
37. High resolution reactive lag While active Export
38. High resolution reactive lead While active Export
39. High resolution apparent forwarded energy
40. High resolution apparent import energy
41. High resolution apparent export energy

The meter should have visual quadrant representation on the LCD for energy measurement. Relevant quadrant in which metering is taking place should be in on state for ease of understanding.

8. ELECTROMAGNETIC COMPATIBILITY

The static energy meters shall conform to requirements listed in relevant standards and shall also be protected against radiated interference from either magnetic or radio-frequency source.

8.1 IMMUNITY TO ELECTROMAGNETIC DISTURBANCE

The meter shall be designed in such a way that conducted or radiated electromagnetic disturbance as well as electrostatic discharge do not damage or substantially influence the meter and meter shall work satisfactorily under these conditions as per relevant standards

NOTE: the disturbances to be considered are: -

(a) Harmonics
(b) Voltage dips and short interruptions
(c) Conducted transients
(d) D.C. and A.C. magnetic fields
(e) Electromagnetic fields
(f) Electrostatic discharges

8.2 RADIO INTERFERENCE SUPPRESSIONS

The meter shall not generate noise, which could interfere with other equipment, and meter shall work satisfactorily as per relevant standards

8.3 INFLUENCE OF HIGH MAGNETIC FIELD

The meters shall be provided appropriate magnetic shielding so that any external magnetic field (AC/DC electromagnet) as per CBIP Technical Report no. 304 applied on meter would not affect the proper functioning of the meter and meter shall work satisfactorily as per relevant standards.

9. STARTING CURRENT

The meter shall start and continue to register at the current 0.1% of Ib.

10. RUNNING WITH NO LOAD

When the 115% of rated voltage is applied with no current flowing in the current circuit, the meters shall not register any energy and test output of the meter shall not be more than one pulse/count on "no load".

11. POWER CONSUMPTION

11.1 The active and apparent power consumption in each voltage circuit of the CT Operated meters at reference voltage; temperature and frequency shall not exceed 1.0 W and 4 VA per phase respectively.

11.2 The apparent power consumption in each current circuit for the CT Operated meters at basic current, reference frequency and reference temperature shall not exceed 1.0 VA per phase.

12. CALIBRATION & TEST OUTPUT

All the meters shall be tested, calibrated and sealed at works before dispatch. Further, no modification of calibration shall be possible at site by any means.

However, it shall be possible to check the accuracy of kWh and kVArh energy measurement of the meter in the field by means of LED/LCD output on meter for accuracy. Resolution of the test output shall be sufficient to enable the starting current test in less than 10 minutes

13. CONNECTION DIAGRAM

The connection diagram of the meter shall be clearly shown for 3 phase 4 wire system, on the terminal cover. The meter terminals shall also be marked and this marking should appear in the above diagram.

14. QUANTITIES TO BE MEASURED

The meter shall be able to provide the following data:

a. Instantaneous Parameters (Phase wise THD in % for Voltage and Phase wise THD in % for Current).
b. Block Profile / Load Survey data
c. Daily load profile/Mid night data
d. Abstract quantities
   - Name Plate Details
   - Programmable parameters
e. Event Conditions.(Parameter snapshot of Phase wise THD% in Current and Voltage along with other parameters & kWh (total & fundamental), kVAh, Phase wise Current and Voltage for 3^{rd}, 5^{th}, 7^{th} and 9^{th} Harmonics).

Meter should store previous 12 month billing data into meter memory.

15. ABNORMALITY EVENTS DETECTION

The meter should have features to detect the occurrence and restoration of, at least, the following common abnormal events:

a. **Missing Potential:** The meter shall be capable of detecting and recording occurrence and restoration with date and time the cases of Potential failure (one phase or two phases). All potential missing cases shall be considered as power failure.
b. **Current imbalance**: The meter shall be capable of detecting and recording occurrence and restoration with date and time of Current unbalance (for more than a defined persistence time).
c. **Current Reversal:** The meter shall be capable of detecting and recording occurrence and restoration with date and time if the current is flowing in reverse direction in one or more phases.
d. **Power on/off**: The meter shall be capable to record power on /off events in the meter memory. All potential failure should record as power off event.

e. **Voltage unbalance** – Meter shall detect voltage unbalance if there is unbalance in voltages.
f. **Over Current** – When load condition at any phase i.e. Line current at any phase goes more than defined limit , this will be detected as Over current condition.
g. **CT Open** – The meter should detect phase wise current circuit open when the circuit is opened from meter side.
h. **CT Bypass** – The condition should be detected whenever the current terminal is bypassed in the meter
i. **High and Low Voltage**: The meter should detect under and over voltage events respectively if voltage falls / rise from defined limits.
j. Phase wise voltage THD% more than 5% for 5 min
k. Phase wise current THD% more than 8% for 5 min.

The meter shall keep records for the minimum last 250 events (occurrence + restoration) for above abnormal conditions. Each event shall be logged with date and time of occurrence/restoration. It shall be possible to retrieve the abnormal event data locally using a hand held unit (HHU) through the meter's optical port & same can be viewed / analyzed at base computer end in simple and easily understandable format.

16. LOAD SURVEY

Following parameters shall be made available for last 60 days with integration period of 15 min.

i. Frequency
ii. Three Phase Average Voltage
iii. R Phase Voltage
iv. Y Phase Voltage
v. B phase Voltage
vi. Phase R Current
vii. Phase Y Current
viii. Phase B Current
ix. Energy Active Import (with & without harmonics)
x. Energy Active Export (with & without harmonics)
xi. Energy Apparent Import (with & without harmonics)
xii. Energy Apparent Export(with & without harmonics)
xiii. Energy Reactive Import with voltage as per ABT requirement
xiv. Energy Reactive Export with voltage as per ABT requirement
xv. Energy Net Active Energy
xvi. THD for phase wise voltage, current, power
xvii. Average and phase wise power factor

These load survey and history data can be retrieved with the help of Meter Reading Instrument on local interrogation or remotely using the remote communication interface.

17. MID NIGHT ENERGY PARAMETER

The parameters shall be logged at midnight (00:00 hrs).The meter should store these parameters for 35 days.

i. Real time clock , date and time
ii. Cumulative Energy , kWh Import
iii. Cumulative Energy , kWh Import
iv. Reactive energy high (V>103 percent)
v. Reactive energy low (V<97 percent)

18. MD RESET

The meter shall have provision to store two Maximum Demand occurred during the integration period selected for kW / kVA parameters during a month. The meter shall monitor the demand during the period set and record for each of the TOD zones the maximum registered values during the particular month. Default demand integration period shall be 15 min.

The meter shall have any of the following MD resetting options:

a. Automatic reset at the end of a certain predefined period (say, end of the month)
b. Manual resetting arrangement (MD reset button) with sealing facility.
c. MD reset through authenticated transaction

19. SELF DIAGNOSTIC FEATURE

The meter shall be capable of performing complete self-diagnostic check to monitor the circuits for any malfunctioning to ensure integrity of data memory location at all time. The meter shall have indication for unsatisfactory/non-functioning/malfunctioning of the following:

a. Time and date on meter display
b. All display segments on meter display
c. Self diagnostic (RTC, NVM information) on display

20. OTHER SALIENT FEATURES OF METER

a. It should be possible to check the healthiness of phase voltages by phase indicator available on meter display.
b. The meter shall have provision for TOD tariff as per latest DERC regulations. The following features.
- Programmable upto 8 energy and 2 Demand registers.
- Programmable upto 4 seasons per year.

c. The meter should work accurately irrespective of phase sequence of the supply.
d. The meter shall compute the reactive power on 3-phase, 4-wire principle, with an accuracy as per relevant IS/ IEC standards, and integrate the reactive energy algebraically into two separate reactive energy registers, one for the period for which the average RMS voltage is greater than 103% (Reactive High), and the other for the period for which the average RMS voltage is below 97.0% (Reactive Low). When lagging reactive power is being sent out from substations bus bars, reactive registers shall move forward. When reactive power flow is in the reverse direction, reactive registers shall move backwards.
e. The meter shall continuously compute the average of the RMS values of the three line-to-neutral VT secondary voltages as a percentage of 63.51 V, and display the same on demand.

21. TEST AND TEST CONDITIONS

a. Acceptance test: All acceptance tests as per relevant standards shall be carried out in the presence of utility representatives.

b. Routine Test: All the routine tests as per – IS 14697 shall be carried out and routine tests certificates shall be submitted for approval of purchaser.

--End of Doc--

TECHNICAL SPECIFICATION

APPROVED MAKES & VENDERS

Prepared by	**Abhinav Srivastava**		**Rev: 1**
Reviewed by	**k.Sheshadri**		**Date: 22.07.2018**
Approved by	**k.Sheshadri**		

1.0 APPROVED MAKES & VENDORS

S NO.	Vendors
1.0	**Power Transformer**
1.1	BHARAT BIJLEE LIMITED
1.2	ABB LIMITED
1.3	SCHNEIDER ELECTRIC LIMITED.
1.4	BHEL
1.5	CGL
2.0	**Station Transformers**
2.1	SCHNEIDER ELECTRIC LIMITED.
2.2	TOSHIBA
2.3	DANISH
2.4	CGPISL
3.0	**LT Control, Communication and special cables**
3.1	POLYCAB
3.2	PARAMOUNT COMMUNICATIONS LIMITED
3.3	TARUNA METALS PVT. LIMITED.
3.4	ALPHA COMMUNICATION
3.5	KEI INDUSTRIES LIMITED.
4.0	**LT(1.1 KV grade) XLPE Insulated Power Cables**
4.1	PARAMOUNT COMMUNICATIONS LIMITED
4.2	KEI INDUSTRIES LIMITED.
4.3	HINDUSTAN VIDYUT PRODUCTS LIMITED
4.4	GEMSCAB INDUSTRIES LIMITED
4.5	KRISHNA ELECTRICAL INDUSTRIES LIMITED
4.6	POLYCAB WIRES PRIVATE LIMITED
4.8	KEC INTERNATIONAL LIMITED (RPG CABLES LIMITED)
4.9	HAVELLS
5.0	**11KV 500MVA Indoor Switchboard**
5.1	SIEMENS LIMITED
5.2	ABB LIMITED
5.3	SCHNEIDER ELECTRIC LIMITED.
6.0	**66KV Outdoor Circuit Breakers**
6.1	ABB LIMITED
6.2	SIEMENS LIMITED
6.3	GE
6.4	CGPISL
7.0	**66KV & 11KV Outdoor CT/PT**
7.1	CROMPTON GREAVES LIMITED
7.2	KAPCO ELECTRIC PVT. LIMITED.

7.3	GE
7.4	MEHRU ELECTRICAL & MECHANICAL ENGINEERS P LIMITED.
7.5	ABB LIMITED
7.6	BHEL
8.0	**CVT**
8.1	CROMPTON GREAVES LIMITED
8.2	ABB LIMITED
8.3	MEHRU
8.4	GE
8.0	**33&66KV Lightening Arrestor**
8.1	ALSTOM
8.2	OBLUM ELECTRICAL INDUSTRIES PVT. LIMITED.
8.3	LAMCO INDUSTRIES PVT. LIMITED.
8.4	ABB LIMITED
8.5	CROMPTON GREAVES LIMITED.
8.6	ELECTROLYTE
8.7	RAYCHEM
9.0	**66KV Isolators**
9.1	ABB LIMITED.
9.2	SIEMENS LIMITED.
9.3	CROMPTON GREAVES LIMITED.
10.0	**66KV Control & Relay Panel**
10.1	ABB LIMITED.
10.2	SCHNEIDER ECLECTRIC LIMITED.
10.3	SIEMENS LIMITED.
11.0	**11KV Capacitor Bank**
11.1	UNIVERSAL CABLES LIMITED.
11.2	SHREEM ELECTRIC LIMITED
11.3	ABB LIMITED
11.4	LARSEN & TOUBRO LIMITED
11.5	EPCOS INDIA PVT. LIMITED
12.0	**ACDB &BMK**
12.1	NEPTUNE
12.2	CMKL
12.3	NEC
12.4	EATHUN
12.5	POPULAR SWITCHGEAR
12.6	SHIVALIC
13.0	**St. through jointing and Termination Kits – 1.1KV,11KV**

13.1	RAYCHEM RPG LIMITED
13.2	3M ELECTRO & COMM. INDIA (P) LIMITED.
13.3	DENSON
14.0	**St. through jointing and Termination Kits – 66KV**
14.1	RAYCHEM RPG LIMITED
14.2	3M ELECTRO & COMM. INDIA (P) LIMITED.
15.0	**LED/HPSV/Fluorescent Lamps, Ballasts, Starters / Igniters, Fittings, Lamp Holder**
15.1	PHILIPS ELECTRONICS INDIA LIMITED
15.2	CROMPTON GREAVES LIMITED
15.3	BAJAJ ELECTRICALS LIMITED
15.4	SURYA ROSHNI LIMITED
16.0	**Transformer oil**
16.1	APAR INDUSTRIES LIMITED
16.2	SAVITA OIL TECHNOLOGIES LIMITED
16.3	RAJ PETRO SPECIALITIES PVT. LIMITED.
17.0	**Protective Relays (Refer Technical specification for details)**
17.1	SIEMENS LIMITED
17.2	A-EBERLE
17.4	ABB LIMITED
17.5	SCHNEIDER ELECTRIC
17.6	GE
18.0	**Overhead Line accessories e.g. Clamps, Connectors, Line Hardware fitting**
18.1	RAYCHEM RPG PVT.LIMITED
18.2	RASHTRA UDHYOG LIMITED.
18.3	KLEMMEN ENGINEERING
18.4	LEGION
18.5	BURMA
19.0	**Disc and Pin Insulators**
19.1	ADITYA BIRLA INSULATORS
19.2	MORDEN INSULATORS LIMITED.
19.3	BHEL
19.4	IEC
19.5	W.S. INDUSTRIES
20.0	**STEEL TUBULAR POLES**
20.1	FABRICO (INDIA) PVT. LIMITED.
20.2	ADVANCE STEEL TUBES LIMITED.
20.3	GOOD LUCK STEEL TUBES LIMITED.
20.4	RAMA STEEL TUBES LIMITED.

21.0	**ACSR Conductors**
21.1	HINDUSTAN VIDYUT PRODUCTS LIMITED
21.2	GUPTA POWER
21.3	LUMINO INDUSTRIES LIMITED
21.5	POLYCAB WIRES PRIVATE LIMITED
22.0	**Battery Bank**
22.1	Panasonic
22.2	Samsung
23.0	**Battery Charger cum DC DB**
23.1	MASS-TECH CONTROLS PRIVATE LIMITED
23.2	CALDYNE AUTOMATICS LIMITED.
23.3	CHABI ELECTRICALS
24.0	**PAINTS & CHEMICALS**
24.1	BERGER PAINTS INDIA LIMITED BRITISH PAINTS DIVISION
24.2	SHALIMAR PAINTS LIMITED.
24.3	NEROLAC PAINTS LIMITED.
24.4	ASIAN PAINTS LIMITED.
25.0	**CEMENT**
25.1	ACC
25.2	ULTRA TECH
26.0	**STEEL**
26.1	TATA
26.2	SAIL
27	NIFPS
27.1	CTR
28	High Mast
28.1	Bajaj Electricals Ltd
29	Cable Seal
29.1	Roxtec
29.2	MCT Brattberg
30	EOT Crane
30.1	REVA
30.2	DEMAG
31	**GIS Gas Handling kit(Gas filling, filter and evacuation kit)**
31.1	DILO

VOLUME – II

SCHEDULE AND ANNEXURE

SCHEDULE – A

GENERAL PARTICULARS

(This shall from part of Technical Bid)

1.0 Bidder

1.1	Name	:	
1.2	Postal Address	:	
1.3	Telegraphic Address	:	
1.4	Telex number / Answer back code	:	
1.5	Phone(s)	:	
1.6	Name and Designation of the person who should be contacted in case of clarifications / details etc. not received expeditiously form the officer mentioned in item 1.6 above	:	
1.7	Brief write-up giving details of the organization, years of establishment and and commercial production activities, manufacturing, fabrication, shop testing, erection, testing, commissioning and after-sales service facilities, key personnel with their qualifications and experience, collaboration agreements, if any number of employees in various categories and last three (3) years turn over	:	
2.0	Bid Validity	:	
3.0	All the Schedules filled-in	:	Yes
4.0	All the Deviations brought out in Schedule – E1and E2	:	Yes
5.0	All the drawings, write-ups, literature, leaflets, calculations, details, etc as called for in the specification attached	:	Yes
6.0	Is the Bidder agreeable to undertake this contract, if deviations stipulated by him are not acceptable to the Purchaser	:	Yes/No

Chapter 6c Schedules & Annexure **Schedule A**

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Seal of Company Date : _____

SCHEDULE – C2

66 kV CONTROL & RELAY PANEL

	Parameter	Technical Particulars	
1.00.00	**CONTROL PANEL BOARD**		
1.01.00	Make		
1.02.00	Type		
1.03.00	Reference Standard		
1.04.00	Construction		
1.04.01	Degree of protection		
1.04.02	Sheet metal thickness mm		
1.04.03	Floor channel sills, vibration damping pads and kick plate furnished?		
1.05.00	Equipment Mounting		
1.05.01	All relays, meters and switches are flush mounted?		
1.05.02	Relays furnished in draw out cases with built in test facilitate?		
1.06.00	Name plate		
1.06.01	Material		
1.06.02	Thickness		
1.06.03	Size for:-		
	Equipment		
	Panels		
1.07.00	Mimic		
1.07.01	Material		
1.07.02	Width		
1.08.00	Internal Illumination		
1.08.01	Volt		
1.08.02	Watt		
1.08.03	Door switched controlled		
1.09.00	Space Heater		
1.09.01	Volt		
1.09.02	Watt		
1.09.03	Thermostat Controlled?		
1.10.00	Plug Socket		
1.10.01	Type		
1.10.02	Rating		
1.11.00	Panel Illumination, space heater & plug socket circuits provided with individual switch fuse units?		
1.12.00	AC/DC Supply - Type & rating of isolating switch fuse units for		
1.12.01	Incoming AC Supply		
1.12.02	Incoming DC Supply		
1.13.00	Internal Wiring		
1.13.01	Wire Type		
1.13.02	Voltage Grade		

1.13.03	Conductor Material		
1.13.04	Conductor Size for		
	i) Current / control circuit		
	ii) Voltage Circuit		
1.13.05	Wires identified at both ends with ferrules?		
1.14.00	Terminal block		
1.14.01	Make		
1.14.02	Type / Catalogue No		
1.14.03	20% spare terminals furnished?		
1.15.00	Ground Bus		
1.15.01	Materials		
1.15.02	Size (mm)		
1.16.00	Painting		
1.16.01	Type of finish		
1.16.02	Colour Shade - Inside/Outside		
1.16.03	Details of Painting procedure finished?		
2.00.00	**BREAKER CONTROL SWITCH**		
2.01.00	Make		
2.02.00	Type		
2.03.00	Reference Standard		
2.04.00	Contact Rating	220V DC	240V AC
2.04.01	Make & Continuous (A)		
2.04.02	Break (inductive) (A)		
3.00.00	**ISOLATING CONTROL SWITCH**		
3.01.00	Make		
3.02.00	Type		
3.03.00	Reference Standard		
3.04.00	Contact Rating	220V DC	240V AC
3.04.01	Make & Continuous (A)		
3.04.02	Break (inductive) (A)		
4.00.00	**METER SELECTOR SWITCH**		
4.01.00	Make		
4.02.00	Type		
4.03.00	Reference Standard		
4.04.00	Contact Rating	220V DC	240V AC
4.04.01	Make & Continuous (A)		
4.04.02	Break (inductive) (A)		
5.00.00	**PUSH BUTTON**		
5.01.00	Make		
5.02.00	Type		
5.03.00	Reference Standard		
5.04.00	Contact Rating		
5.04.01	Make & Continuous (A)		
5.04.02	Break (inductive) (A)		
5.05.00	NO & type of Contacts provided per button		
6.00.00	**LAMPS**		
6.01.00	Make		
6.02.00	Type		
6.03.00	Reference Standard		
6.04.00	Rating:		

6.04.01	Volt		
6.04.02	Watt		
6.04.03	Series Resistance		
6.05.00	10 % Extra lamps furnished?		
6.06.00	Size of lens		
7.00.00	**SEMAPHORE INDICATORS**		
7.01.00	Make		
7.02.00	Type		
7.03.00	Diameter of the Disc		
7.04.00	Operating voltage		
7.05.00	Burden (Watt DC)		
7.06.00	Whether latch in type or supply Failure type		
8.00.00	**INDICATING INSTRUMENT**	**Ammeter**	**Voltmeter**
8.01.00	Make		
8.02.00	Type		
8.03.00	Reference Standard		
8.04.00	Type of Movement		
8.05.00	Accuracy Class		
8.06.00	Scale in Degrees		
8.07.00	VA Burden		
9.00.00	**MULTIFUNCTION METER**		
9.01.00	Make		
9.02.00	Type		
9.03.00	Reference Standard		
9.04.00	Furnished in Draw out Case or not		
9.05.00	Type of Register		
9.06.00	Accuracy Class		
9.07.00	VA Burden		
9.07.01	Current Coil		
9.07.02	Voltage Coil		
10.00.00	**ANNUNCIATOR**		
10.01.00	Make		
10.02.00	Type		
10..03.00	Reference Standard		
10.04.00	No. of Annunciator groups furnished?		
10.05.00	No. of Windows per group		
10.06.00	Overall Dimension of a group (mm)		
10.07.00	Detailed Write-up on Scheme furnished?		
11.00.00	**TRANCDUCERS**		
11.01.00	Whether provided as per specification		
11.02.00	Make		
11.03.00	Type		
11.04.00	Output		
11.05.00	Accuracy		
11.06.00	Response Time		
11.07.00	Power Supply		
11.08.00	Isolation		
11.09.00	Catalogue furnished		

12.00.00	RELAYS	Make	Type
12.01.00	Relays furnished in draw out cases with built in test facilitates?		
12.02.00	Line Protection Panel		
12.03.00	Transformer Panel		
12.04.00	Bus coupler Panel		
12.05.00	Miscellaneous Auxiliary Relays		
12.06.00	Auxiliary Relay, Voltage Operated with		
	4 pair of contacts		
	8 pair of contacts		
12.07.00	Auxiliary Relay, Current Operated with		
	4 pair of contacts		
12.08.00	Catalogue of all relays submitted with bid		

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Seal of Company Date : _____

SCHEDULE – C3

BATTERY CHARGER

Sr. No.	Description	Data to be filled by manufacturer
1	Manufacturer equipment type	
2	Conformance to design standards as per specification Yes / No	
3	Conformance to design features as per specification Yes / No	
4	Submitted to deviation sheet for each specification clause no - Yes / No	
5	Panel dimension in mm (length x depth x height)	
6	Panel weight in kg	
7	Panel enclosure protection offered	
8	Voltage regulation as per specification (value to be specified)	
9	Boost charging DC current adjustment range (Value to be specified)	
10	Amount of Ripple in DC in % - output with battery - without battery	
11	Charger efficiency offered	
12	Max temperature rise above ambient	
13	Power factor at rated load	
14	Rectifier bridge as per specification	
15	Heat generated by the panel in Kw	
16	AC MCCB - Make , rating	
17	DC MCCB - Make , rating	
18	Rectifier transformer - Make , rating	
19	Semiconductor rectifier - Make , rating	
20	DC conductor - Make , rating	
21.1	DCDB integral part of charger or separate?	
21.2	MCB for DC distribution boards - Make, rating	
22	Conformance to metering & indication as per specification	
23	Conformance to make of component as per specification	
24	Conformance to mimic diagram, labels & finish as per specification	
25	Submission of component catalogue - Yes / No	
26	DC charger nominal output current - (battery trickle charge + DC load)	
27	DC charger boost charge current	

28	DC battery	
29	DC battery duty cycle	

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Seal of Company Date : _____

SCHEDULE – C4

Li Ion BATTERY

S.NO.	Description	BRPL Requirement	Data to be filled by Manufacturer
1	Battery (as per scope of supply) – Yes / No	Yes	
2	Manufacturing battery type	Li-Ion	
3	Conformance to design standards as per specification clause no. 2.0 – Yes / No	Yes	
4	Conformance to design feature as per specification clause no. 5&6 – Yes / No	Yes	
5	Submitted of deviation sheet for each specification clause no - Yes / No	Furnish each deviation if yes	
6	Battery GA drawing submitted - Yes / No	Required	
6.1	Battery selection / sizing calculation submitted – Yes / No	Required	
7	Battery rating offered in Ahr	Refer specs	
7.1	Rating at temperature 45 deg C	Refer specs	
8	Battery bank dimensions in mm (length x depth x height)	As required	
9	Battery Module weight in kg	As required	
10	Battery nominal voltage	220V for 220VDC	
11	Total battery bank CC-CV charging required in volts	As per clause no 6.1	
12	Heat generated by battery at rated full load (in Kw)	Less than 0.025kW/module	
13	Manufacturer of Li-Ion Battery Cells and Modules	Yes	
14	Manufacturer of Battery management system (BMS)	Yes	
15	Availability of Service team in India	Yes	
16	Built In Battery Management System	Yes	

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Seal of Company Date : _____

SCHEDULE – C7

LT POWER CABLES

For each size / rating separate GTP need to be furnished.			
S.No.	**Description**	**Buyer's requirement**	**Seller's Data**
1	Make	……	
2	Type (AS PER IS)	A2XFY (Multicore)	
3	Voltage Grade (KV)	1.1	
4	Maximum conductor temperature		
A	Continuous (^{0} C)	90 ^{0}C	
B	Short time (^{0} C)	250 ^{0}C	
5	Conductor		
A	Size (mm^2)	4CX300,4CX50, 4CX25, 4CX10 & 2CX10 Sqmm	
B	No. of wire in each conductors Nos.	As per Manufacturer standard	
C	Dia of wires in each conductors before compaction (mm)	As per Manufacturer standard	
D	Shape of conductor	As per specification	
E	Diameter over conductor (mm)	……	
F	Maximum conductor resistance at 20^0 C (ohm / km)	As per table 2 of IS -7098 Part -1	
6	Insulation		
A	Nominal thickness (mm)	As per table 3 of IS -7098 Part -1	
B	Minimum thickness (mm)	……	
C	Diameter over insulation (mm) Approx	……	
7	Inner Sheath		
A	Minimum thickness	As per table 5 of IS -7098 Part -1	
B	Approx dia over sheath (mm) Approx	……	
8	Galvanized steel Armour	As per table 6 of IS -7098 Part -1	
A	Number of strips	As per manufacturer Std.	
B	Size (Thickness X width) in mm	0.8 x 4	
C	Dia of wire for 2CX10sqmm	1.4mm Min	
D	Dia over Armour -Approx	……	
9	Outer Sheath	As per table 8 of IS -7098 Part -1	
A	Thickness (Minimum)		
B	Colour	Yellow	
C	Weather proof paint (applicable for 2c x 10 sqmm and 4c x 10 sqmm only)	……	
10	Approx. overall dia (mm)	……	
11	End Cap	Required	
12	Continuous current rating for standard I.S. condition laid Direct		

	a. In ground 30 ^{0}C Amps	……	
	a. In duct 30 ^{0}C Amps	……	
	a. In air 40 ^{0}C Amps	……	
13	Short circuit current for 1 sec of conductor (KAmp)	……	
14	Electrical Parameters at Maximum operating temperature		
A	Resistance (Ohm / Km) (AC Resistance)	……	
B	Resistance AT 50 C/s (Ohm / Km)	……	
C	Impedance (Ohm / Km)	…….	
D	Capacitance (Micro farad /Km)	……	
15	Recommended minimum bending radius	…….. X O/D	
16	De-rating factor for following Ambient Temperature in	Ground /Air	
	a. At 30 ^{O}C		
	a. At 35 ^{O}C		
	a. At 40 ^{O}C		
	a. At 45 ^{O}C		
	a. At 50 ^{O}C		
17	Group factor for following Nos. of cables laid	Touching Trefoil	
A	3 Nos.		
B	4 Nos.		
C	5 Nos.		
D	6 Nos.		
18	Process of cross linking of polyethylene	Dry cure	

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Seal of Company Date : _____

SCHEDULE – C8

CONTROL CABLES

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	Continuous (° 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	Color of all the cores shall be different	
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	Galvanized Steel Armour	As per Cl 2.1.5 of specification	
A	Number of armour wire	As per Manufacturer Std.	
B	hal 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 (FRLS)	As per Table 2 of IS:5831 – 1984	
A	Thickness (Minimum)	As per Table 7 of IS 1554(Part-1)	
B	Color	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	
19.0	FRLS Properties		
	i) Oxygen Index		
	ii) Temperature Index		
	iii) Max Acid Gas Generation		
	iv) Light Transmission / Smoke Density		

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Seal of Company Date : _____

SCHEDULE – C9

ILLUMINATION SYSTEM

1	**General**			
+1.01	Make			
*1.02	Applicable Standards			
*1.03	Degree of protection			
2	**Lighting Panel /Feeder Pillarm Box (LP/ELP/DLP/FPB/EPB/LDB/ELDB/ Construction Features)**			
2.01	Make			
2.02	Rated Value (V)			
*2.03	Busbar continuous current rating (A)			
*2.04	Busbar material and cross section	1	2	3
3	**Minimum current breakers :**			
+3.01	Service			
3.02	Make			
+3.03	Type			
*3.04	No. of poles			
*3.05	Rated continuous current (A)			
*3.06	Short time current rating (Ka)			
*3.07	Related Voltage (V)			
*3.08	Breaking Current (Ka)			
4	**Load Breaking Switches**			
4.01	Service			
+4.02	Make			
+4.03	Type			
*4.04	No. of poles			
*4.05	Related Voltage (V)			
*4.06	Rated continuous current (A)			
*4.07	Rated making current (Ka peak)			
*4.08	Rated breaking current (Ka)			
*4.09	Rated short time one (1) second current (Ka)			
*4.10	Rated dynamic current (kApeak)			
5	**Fuses**			
5.01	Service			
+5.02	Make			
*5.03	Type			
*5.04	Standard applicable			
*5.05	Related Voltage (V)			
*5.06	Rated current (A)			
*5.07	Fusing factor			

*5.08	Category of duty			
*5.09	Rupturing capacity (prospective current) (Ka)			
6	**Earth Leakage current Breaker**			
+6.01	Make			
+6.02	Type			
*6.03	No. of poles			
*6.04	Rated continuous current (A)			
6.05	Short time current rating (Ka)			
6.06	Rated Tripping current			
7	**Lighting Fixtures**	Type A	B	C
+7.01	Manufacturer			
+7.02	Type			
7.03	Description of different types			
*7.04	Type and wattage of lamp			
*7.05	Rated life of the lamp			
*7.06	Applicable standards			
	Note:- In case luminaries other than the ones specified in specification are offered, all the deviations shall be listed out otherwise these shall be considered as being fully in line with luminaries specified.			
8	**Receptacles with Switches**	1	2	3
+8.01	Make			
+8.02	Type			
+8.03	Related Voltage (V)			
*8.04	Rated current (A)			
8.05	Technical brochures (Attach brochures and state brochure Nos.)			
9	**Cables / Wire**	1	2	3
9.01	Service			
+9.02	Make			
+9.03	Type			
*9.04	Voltage Grade (V)			
*9.05	Conductor Material			
*9.06	Size of conductors (mm^2)			
*9.07	Current rating of conductors (A)			
9.08	Applicable Standards			
10	**Conduits and Accessories**			
10.01	Make			
10.02	Type			
10.03	Material			
10.04	Applicable Standards			
11	**Lamp and Luminaries**	Incandescent Lamps	Fluorescent Tubes	HPSV Lamps
11.01	Make			

11.02	Type			
*11.03	Lumen output throughout life (Lumen)			
*11.04	Derating factor due to temperature			
*11.05	Derating factor due to aging			
12	**Lighting Poles / Towers**			
12.01	Manufacturer			
12.02	Applicable Standards			
12.03	Material and Painting			
12.04	Height			

Notes :

1. Single asterisk (*) marked particulars are guaranteed.
2. Other particulars are bonafide and may vary slightly upon completion of detailed design.
3. Particulars against items marked * and + shall be furnished with the Bid.

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Seal of Company Date : _____

SCHEDULE – C10

AC DISTRIBUTION BOARDS

S.No	Description	Buyers Requirement	Sellers Data
1	**Panel Construction**		
1.1	Enclosure Type	Free standing, indoor, Fully compartmentalized, Metal clad, Vermin Proof	
1.2	Enclosure degree of protection	IP 5X	
1.3	Enclosure Material	CRCA steel	
1.4	Load bearing members	Minimum 2.5 mm thick	
1.5	Doors and covers	Minimum 2.0 mm thick	
1.6	Gland Plate (detachable type)	3.0mm MS detachable type or Aluminum 5.0mm for single core cables	
1.7	Separate compartment for	Bus bar, circuit breaker, incoming cable, outgoing cable PT, LV instruments.	
1.8	Breaker compartment door	Separate with lockable handle	
1.9	Fixing arrangement i. Doors ii. Covers iii. Gasket	 Concealed hinged Bolted with SS bolts Neoprene	
1.10	Panel Base Frame	Steel base frame as per manufacturer's standard.	
1.11	Handle	Removable bolted covers for cable chamber and busbar chamber shall be provided with "C" type handles	
1.12	Space Heater	Required	
1.13	Panel extension possibility	Required	
2	**MCCB**		
2.1	Mounting	Flush Mounted	
2.2	Rated Operational Voltage(V)	415 volt	
2.3	Ultimate breaking Capacity		
2.3.1	630A MCCB	As per requirement	
2.3.2	100A MCCB	As per requirement	
2.4	Rated Service breaking capacity at rated voltage Ics	Ics =100% Icu	
2.5	Rotary handle	Required	
2.6	Interlocking arrangement	Between Incomer MCCBs	
2.7	Trip time	As per requirement	
2.8	Test Certificates	Should have test certificates for breaking capacities from independent test authorities	

		CPRI / ERDA or equivalent	
3	**MCB**		
3.1	Rated Operational Voltage(V)	415 VAC 50 Hz	
3.2	Protection relay/Release	Magnetic thermal release for over current and short circuit protection	
3.3	Breaking capacity	Shall not be less than 10 KA at 415 VAC	
3.4	Mounting	Din mounted	
3.5	MCB classification	As required	
3.6	ISI Marked	The complete range shall be ISI marked	

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Seal of Company Date : _____

SCHEDULE – C12

GROUNDING & LIGHTNING PROTECTION SYSTEM

S.No.	Description	Unit	Data by vendor
1	**Earth mat**		
a	Material		
b	Size of conductor		
c	Fault withstand current & duration		
2	**Equipment Earthing**		
a	Material		
b	Size of conductor		
3	**Earth Electrode**		
a	Material		
b	Size		
c	Length		
4	**Lightning Protection System**		
a	Material and size of horizontal air termination		
b	Material and size of vertical air termination		
c	Material and size of down conductor		
d	Size of test link		
e	Material of enclosure for test link		
f	Material and size of earth electrode		

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Seal of Company Date : _____

SCHEDULE – C13

CABLE ACCESSORIES

1	Cable Accessories	
1.01	Makes	
1.02	Termination kits	
1.03	Straight through joint kits	
1.04	Cable glands	
1.05	Cable lugs	
1.06	Termination blocks	
1.07	Types	
1.08	Termination kits	
1.09	Straight through joints	
1.1	Cable glands	
1.11	Cable lugs	
1.12	Terminal blocks	

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Seal of Company Date : _____

SCHEDULE – C14

CABLE TRAYS, ACCESSORIES AND TRAY SUPPORT, CONDUITS, PIPES AND DUCTS

1	**General**	
a	Name of the Contractor	
b	Name of sub contractors, if any	
c	Applicable standards	
2	**Cable Trays and Fittings**	
a	Cable Trays and Fittings	
i.	Make	
ii.	Type	
iii.	Material	
	1. Thickness (mm)	
	2. Thickness of galvanization (microns)	
	3. Zinc coating per sq meter (gms)	
3	**Conduits , Fitting and Accessories**	
a	Pipes with fitting	
i.	Make	
ii.	Type	
iii.	Material	
	1. Thickness (mm)	
	2. Thickness of galvanization (microns)	
b	Flexible conduits with fittings and accessories	
i.	Make	
ii.	Type	
iii.	Material	
	1. Thickness (mm)	
	2. Thickness of galvanization (microns)	

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Seal of Company Date : _____

SCHEDULE – C15

GAS INSULATED SWITCHGEAR

Proposed Technical data 66 k V Gas insulated switchgear

Sr. No.	Description		Proposed Data
1.0	Manufacturer		
2.0	Country of origin		
3.0	Type designation		
4.0	Indoor or outdoor		
5.0	Applied standard, publication number and year		
6.0	Segregated-phase type or common enclosure type		
7.0	Rate voltage	kV rms	
8.0	Number of phase		
9.0	Rated lightning impulse withstand voltage	kV peak	
9.1	phase to earth		
9.2	phase to phase		
9.3	across open contact		
10.0	Rated 1 min power-frequency withstand voltage	kV rms	
11.0	Auxiliary circuit 50HZ, 1 min withstand voltage		
12.0	Rated frequency	Hz	
13.0	Rated short time withstand current	kA	
14.0	Rated peak withstand current	kA	
15.0	Degree of protection for auxiliary and control circuit		
16.0	Rated supply voltage of closing and opening device	Vdc	
17.0	Permissible ambient temperature	**0C**	

18.0	Maximum temperature rise at.....A		
19.0	Material of enclosure	Al/alloy/steel	
20.0	Average Thickness	mm	
21.0	Guarantee SF6 gas losses per compartment per year	%	
22.0	Design Maintenance period		
23.0	Rated SF6 gas pressure at 20 **0C**		
24.0	Minimum safe gas pressure at 20**0C** required for safe operation		
25.0	Setting of pressure relief device (20 **0C**)		
26.0	Emergency operation at rated voltage and	yes/no	
27.0	No. of Gas Compartment		
27.1	Bus Bar		
27.2	**Feeder**		
28.0	Heat losses per feeder at rated power	KW	
29.0	Bay width	mm	
30.0	Volume of gas contained in each compartment	M3	
31.0	Burn through time of enclosure for internal fault of 31.5KA	Sec	
32.0	Weight per bay (ready for operation)	Sec	
33.0	Heaviest part	Kg	
34.0	Net total weight	Kg	
35.0	Packing detailed drawing number (to be attached)	Kg	
CIRCUIT BREAKER			
1.0	Manufacturer		

2.0	Country of manufacture		
3.0	Type designation, number of pole		
4.0	Indoor or outdoor		
5.0	Applied standard, publication number and year		
6.0	Catalog number (to be attached)		
7.0	Outline drawing number (to be attached)		
8.0	Rated voltage	kV	
9.0	Rated lightning impulse withstand voltage	kV peak	
10.0	Rated 1 min power-frequency withstand voltage	kV rms	
11.0	Rated frequency	Hz	
12.0	Rated normal current	A	
13.0	Rated short-circuit breaking current	kA	
14.0	Rated short-circuit making current	kA	
15.0	Rated duration of short-circuit	s	
16.0	Rated operating sequence		
17.0	Short-time withstand current, 3 sec	kA	
18.0	Total break time	ms	
19.0	Rated capacitive breaking current	A	
20.0	Rated small inductive breaking current	A	
21.0	Rated out-of-phase breaking current	A	
22.0	Switching over current factor	pu	
23.0	Rated characteristics of short line faults		

23.1	TRV of supply circuit		
23.2	TRV peak value uc		
23.3	time delay td		
24.0	Opening time		
24.1	Maximum		
25.0	Maximum closing time		
26.0	Maximum make time		
27.0	Minimum dead time		
28.0	Gas operating pressure		
28.1	Rated pressure at..... **0C**	Kg/cm	
28.2	Alarm pressure at..... **0C**	Kg/cm	
28.3	Lock out pressure at..... **0C**	Kg/cm	
29.0	Contacts		
29.1	Type of contact		
29.2	Material		
29.3	Surface treatment		
29.4	Maximum temperature rise at.....A	**0C**	
30.0	Guaranteed contact life in terms of number of operation		
31.0	Operating mechanism		
31.1	Type		
31.2	Method of operation (hydraulic, pneumatic or motor operated spring charging)		
31.3	Mechanical life in terms of number of operation		

31.4	Method of interlocking			
31.5	Number of auxiliary contacts, NO/NC			
31.6	Rated voltage of tripping, closing and			
31.7	interlocking coil	vdc		
31.8	Method of interlocking			
32.0	Motor			
32.1	Rated voltage			
32.2	Voltage range in % of rated			
32.3	Number of phase			
32.4	Frequency			
32.5	Power			
33.0	Number of operations within one maintenance period			
33.1	At rated normal current	Recommended		
33.2		Maximum		
33.3	At Rated Breaking capacity	Recommended		
33.4		Maximum		
33.5	Accumulated current per one set	KA		
33.6	Static weight complete set	Kg		
33.7	Dynamic weight complete set	Kg		
33.8	Detailed complete set of drawing to be attached			

CONDUCTOR

S.No.	**Description**		**Proposed Data**	
			Line & Bus coupler	**Transformer Bays**

			Bays	
1.0	Manufacturer			
2.0	Country of manufacture		k V	
3.0	Type designation, number of pole		K V peak	
4.0	Indoor or outdoor		kV rms	
5.0	Applied standard, publication number and year		Hz	
6.0	Catalog number (to be attached)		A	
7.0	Outline drawing number (to be attached)			
8.0	Material			
9.0	Rated voltage			
10.0	Rated lightning impulse withstand voltage			
11.0	Rated 1 min power-frequency withstand voltage			
12.0	Voltage			
13.0	Rated normal current			
14.0	Rated short time withstand current, 1sec.	kA		
15.0	Rated Peak withstand current	Amp		
16.0	Rated capacitive current	Amp		
17.0	Gas operating pressure			
18.0	Rated pressure at..... **0C**	kg/cm		
19.0	First stage alarm pressure at..... **0C**			
20.0	Second stage alarm pressure at..... **0C**			
21.0	Material (Copper or aluminum)			
22.0	Packing detailed drawing number(to be attached)			

DISCONNECTOR				
S.NO.	Description		Proposed Data	
			Bus	Other
			Disconnect or	Disconnector
1.0	Manufacturer			
2.0	Country of manufacturer			
3.0	Type designation, number of poles, indoor or outdoor			
4.0	Applied standard, publication number and year			
5.0	Catalog number (to be attached)			
6.0	Outline drawing number (to be attached)			
7.0	Rated voltage	kV		
8.0	Rated lightning impulse withstand voltage			
8.1	To earth and betweenpole	kV peak		
8.2	Across isolating distance	kV peak		
9.0	Rated power frequency withstand voltage, 1 min			
9.1	To earth and between pole	kV rms		
9.2	Across isolating distance	kV rms		
10.0	Rated frequency			
11.0	Rated normal current			
12.0	Rated short time withstand current , 3 sec.	kA		
13.0	Rated duration of short circuit	s		
14.0	Rated peak withstand current	kA peak		

15.0	Rated capacitive breaking current and recovery voltage	A, kV	
16.0	Rated inductive breaking current and recovery voltage	A, kV	
17.0	Closed loop current switching	A, V	
18.0	Gas operating pressure	kA	
18.1	Rated pressure at..... **0C**	kg/cm	
18.2	First stage alarm pressure at..... **0C**	kg/cm	
18.3	Second stage alarm pressure at..... **0C**	kg/cm	
19.0	Contact		
19.1	Type		
19.2	Material		
19.3	Surface treatment		
19.4	Temperature rise at..... **0C**		
20.0	Operating mechanism		
20.1	Type		
20.2	Method of operation		
20.3	Method of interlocking		
20.4	Operating time, close/open	s	
20.5	Number of auxiliary contact, NO/NC		
20.6	Power requirement	W	
20.7	Rated supply voltage	Vac/phase	
	Rated supply frequency	Hz	
	Recommended maintenance period	Year	
	Packing detailed drawing number(to be attached)		
Earthing Switch			
S.No.	**Description**		**Proposed Data**

			High Speed	Slow Acting
1.0	Operating speed			
2.0	Manufacturer			
3.0	Country of manufacturer			
4.0	Type designation, number of poles, indoor or outdoor			
5.0	Applied standard, publication number and year			
6.0	Catalog number(to be attached)			
7.0	Outline drawing number(to be attached)			
8.0	Rated voltage	k V		
9.0	Rated lightning impulse withstand voltage	k Vpeak		
10.0	Rated power frequency withstand voltage, 1 min.	k Vrms		
11.0	Rated frequency	Hz		
12.0	Rated short- circuit making current	A		
13.0	Guranteed number of short-circuit making operation			
14.0	Rated short-time withstand current			
15.0	Rated duration of short circuit			
16.0	Rated peak withstand current			
17.0	Gas operating pressure			
17.1	Rated pressure at..... **0C**			
17.2	First stage alarm pressure at..... **0C**			
17.3	Second stage alarm pressure at..... **0C**			
18.0	Contact			
18.1	Type			
18.2	Material			

18.3	Surface treatment			
18.4	Temperature rise at.....A			
19.0	Operating mechanism			
19.1	Type			
19.2	Method of operation			
19.3	Method of interlocking			
19.4	Operating time, close/open			
19.5	Number of auxiliary contact, NO/NC			
19.6	Power requirement	W		
20.0		Vac /Phase		
20.1	Rated supply voltage	Vdc		
20.2	Rated supply frequency	Hz		
21.0	Interrupting capability			
21.1	Inductive current			
21.2	Interrupting current			
21.3	Recovery voltage			
22.0	Capacitive current			
22.1	Interrupting current			
22.2	Recovery voltage			
22.3	Recommended maintenance period			
23.0	Packing detailed drawing number (to be attached)			
24.0	Interrupting capability			

VOLTAGE TRANSFORMER

S.NO.	Description		Proposed Data	
1.0	Manufacturer			
2.0	Country			
3.0	Type designation, number of phases			

4.0	Applied standard, publication number and year				
5.0	Catalog number (to be attached)				
6.0	Outline drawing number (to be attached)				
7.0	Rated voltage	k V			
8.0	Rated Lightning impulse withstand voltage	k V peak			
9.0	Rated power frequency withstand voltage, 1 min	kV rms			
10.0	Rated frequency	Hz			
11.0	Rated burden	VA			
12.0	Rated second voltage	V			
13.0	Metering core				
13.1	Rated output and accuracy class				
13.2	Rated transformation ratio				
13.3	Rated voltage factor				
14.0	Protective core				
14.1	Rated output and accuracy class				
14.2	Rated transformation ratio				
14.3	Rated voltage factor				
15.0	Class of insulation and material	**0C**			
16.0	Maximum temperature rise at.....A	kg			
17.0	Net weight				
18.0	Packing detailed drawing (to be attached)				
Current Transformer					
S.No.	**Description**		**Proposed Data**		
			Line	**Bus Coupler**	**Transformer**

			Bay	Bay	Bay
1.0	Manufacturer				
2.0	Country of manufacturer				
3.0	Type designation, number of phases				
4.0	Applied standard, publication number and year				
5.0	Catalog number (to be attached)				
6.0	Outline drawing number (to be attached)				
7.0	Mounted inside GIS enclosure or on power cables				
8.0	Ring type or bushing type				
9.0	Rated voltage	kV			
10.0	Rated lightning impulse withstand voltage	kV peak			
11.0	Rated power frequency withstand voltage, 1 min	kV rms			
12.0	Rated frequency	Hz			
13.0	Rated primary current	A			
14.0	Rated short time thermal current(3s)	kA			
15.0	Rated dynamic current	kA peak			
16.0	Rated continuous thermal current in percentage of rated primary current	%			
17.0	Class of insulation & material				
18.0	Maximum temperature rise at.....A				
19.0	Metering core				
19.1	Rated transformation ratio				
19.2	Rated output and				

	accuracy class				
19.3	Instrument security factor				
20.0	Protection core				
20.1	Rated transformation ratio				
20.2	Rated output and accuracy class				
20.3	Accuracy limit factor				
21.0	Net weight				
22.0	Packing detailed drawing number (to be attached)				

Sealing End

S.No.	**Description**		**Proposed Data**
1.0	Manufacturer		
2.0	Standards		
3.0	Material		
4.0	Rated power frequency voltage	Yes / no	
4.1	(1 min/20 C)	k V	
5.0	Breakdown dielectric stress	k V /mm	
6.0	Maximum working dielectric stress	k V /mm	
7.0	Impulse withstand voltage	k V	
8.0	Creepage distance (minimum)	mm	
9.0	Expansion devices	Yes / no	
10.0	Splicing method of conductor		
11.0	Compound for internal insulation		
12.0	Nominal weight	Kg /pc	

Bay Board

S.No	Description		Proposed Data
1.0	Manufacturer		
2.0	Type		
3.0	Applied standard, publication number and year		
4.0	Confirm to be supplied according to specification	Yes /no	
5.0	Material		
5.1	Steel thickness (minimum)		
5.2	- door	Mm	
5.3	- side/top/near panels	Mm	
6.0	Surface finish	k V /mm	
6.1	Total Paint thickness(Minimum)		
7.0	Dimension		
7.1	Length		
7.2	Width		
7.3	Height		
8.0	Total net weight		
9.0	Packing detailed drawing number(to be attached)		
Type test certification			
Type test made on identical design of equipment to those offered			Proposed Data
a	Circuit breakers		
	Terminal faults: (Test duties 1,2,3,4 and 5		
	to IEC 56) (with a first phase to clear factor of 1.5)		
	Making current		
	Short-time current		

	Dielectric		
	Temperature rise		
	Mechanical endurance		
	Short-line faults (60%, 75%, 90%)		
	Out-of-Phase tests		
	Capacitance switching		
	Low inductive switching		
	Special tests : Parallel switching		
	Partial discharges		
b)	Disconnectors		
	Short-time current	One second	
		Three second	
	Peak current		
	Dielectric withstand		
	Temperature endurance		
	Capacitance switching		
	Peak current		
c)	Busbars and Connections		
	Short-time current	One second	
		Three second	
d)	**Earthing switches**		
	Short-time current	One second	
		Three second	
	Peak current		
	Making current capability Dielectric withstand		
	Dielectric withstand		
	Mechanical endurance		
	Type Tests Made on Identical Designs of		

	Equipment to Those Offered		
	Interrupting capability for line coupling currents :		
	- capacitive currents		
	- inductive currents		
	Peak current		
	Making current capability Dielectric withstand		

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Seal of Company Date : _____

SCHEDULE – E1

TECHNICAL DEVIATIONS FROM THE SPECIFICATION

(This shall form part of Technical Bid)

All the technical deviation from the tender specification shall be listed out by the Bidder, para by para in this schedule. Deviation taken in covering letter, standard terms and/or body of the Bid but not listed herein will make the Bid liable for rejection as 'Irresponsive'

S.No.	Section/Sub-Section	Part	Para	Deviation	Justification
1	2	3	4	5	6

Certified that above are the only technical deviations from the tender Specification

Name of Firm : _____

Signature of Bidder : _____

Designation : _____

Date : _____

Seal of Company

SCHEDULE – E2

COMMERCIAL DEVIATIONS FROM THE SPECIFICATION

(This shall form part of Technical Bid)

All the commercial deviation from the tender specification shall be listed out by the Bidder, para by para in this schedule. Deviation taken in covering letter, standard terms and/or body of the Bid but not listed herein will make the Bid liable for rejection as 'Irresponsive'.

S.No.	Section/Sub-Section	Part	Para	Deviation	Justification
1	2	3	4	5	6

Certified that above are the only technical deviations from the tender Specification

Name of Firm : _____

Signature of Bidder : _____

Designation : _____

Date : _____

Seal of Company

SCHEDULE – F

LIST OF DRAWINGS ENCLOSED WITH BID

(This shall form part of Technical Bid)

S.No.	Drawing No	Title
1	2	3

Name of Firm : _____

Signature of Bidder : _____

Designation : _____

Date : _____

Seal of Company

SCHEDULE – G

SCHEDULE OF TEST

(This shall form part of Technical Bid)

Tests as per the relevant Indian Standard except as modified and/or as additionally called for in the tender specification shall be performed. Detailed list of the type test certificates enclosed for the various equipments offered shall be listed in the schedule.

S.No.	Type of test	Equipment	Description
1	2	3	4

1.0 TYPE TESTS

2.0 TESTS
– DURING MANUFACTURE

3.0 ROUTINE TESTS
– ON COMPLETION OF MANUFACTURE

Name of Firm : _____

Signature of Bidder : _____

Designation : _____

Date : _____

Seal of Company

SCHEDULE – H

LIST OF INSTRUMENTS, TESTING EQUIPMENTS, TOOLS AND TACKLES FOR ERECTION AND MAINTANANCE

(This shall form part of Technical Bid)

S.No.	Description	Capacity	Quantity	Delivery
(1)	(2)	(3)	(4)	(5)

1.0 INSTRUMENTS, TESTING EQUIPMENT, TOLLS & TACKLES FOR ERECTION
(To be taken back by the Bidder after completion of job)

2.0 INSTRUMENTS, TESTING EQUIPMENT, TOOLS & TACKLES FOR MAINTENANCE
(To be taken back by the Bidder after completion of job)

3.0 SPECIAL INSTRUMENTS, TSTING EQUIPMENT, TOOLS & TACKLES FOR ERECTION
(To be taken back by the Bidder after completion of job)

4.0 SPECIAL INSTRUMENTS, TSTING EQUIPMENT, TOOLS & TACKLES FOR MAINTENANCE
(To be taken back by the Bidder after completion of job)

Name of Firm : _____

Signature of Bidder : _____

Designation : _____

Date : _____

Seal of Company

SCHEDULE – I
LIST OF INSTALLATIONS

S.No.	Purchaser	Project	PF Ref.	Brief Description	Value	Target Commissioning	Commissioned	Performance	Person to whom reference may be made	Remarks
1	2	3	4	5	6	7	8	9	10	11

Bidders Name : _____

Signature : _____

Name : _____

Seal of Company

Designation : _____

Date : _____

SCHEDULE – J

DELIVERY TERMS AND CONDITIONS

1	Quoted for all the items & in the manner as called for in Specification	*Yes/No
1.1	If not, furnish details of deviations	
2	Price FOR site delivery basis	
2.1	Freight:	
	1 Applicable rate	* Not included/included
2.2	Transit Insurance including forty five(45) days storage	
	1 Applicable rate	* Not included/included
2.3	Excise duty	
	1 Applicable rate	* Not included/included
2.4	Sales tax	
	1 Applicable rate	* Not included/included
2.5	Are quoted price firm	*Yes/No
3	Delivery from LOI	
3.1	Supply	
3.2	Erection	
3.3	Testing & commissioning	
3.4	Whether penalty clause acceptable	*Yes/No
4	Validity	
5	Terms of payment	
5.1	As per tender specification	*Yes/No
5.2	If not, give details	
6	Guarantee period	
6.1	Is it as per the tender specification	*Yes/No
6.2	If not, state alternative guarantee period acceptable	
7	Earnest money furnished	*Yes/No
8	Agreeable to furnish security deposit as per the tender specification	*Yes/No
8.1		*Yes/No
9	Agreeable to furnish performance Bank as per the tender specification	*Yes/No
10	Correspondence, drawings, test certificates, instruction manuals, BAR/PERT charts progress reports etc. shall be furnished in number of copies as per distribution schedule attached to the tender specification	*Yes
11	Agreeable to approval of above documents in our (4) weeks from date of receipt as per tender specification	Yes
12	Agreeable to commercial as well as technical terms & conditions of the tender specification, unless listed deviations are accepted	Yes
13	Commencing & completion of submission of drawings from LOI	

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Seal of Company Date : _____

SCHEDULE – K

SCHEDULE OF RECOMMENDED SPARES

Bidder shall offer the prices for spares for destination, rate of taxes & duties to be considered shall be indicated.

S.No.	Description	Quantity	Unit Price	Total Price
1	2	3	4	5

Bidders Name : _____

Signature : _____

Name : _____

Designation : _____

Seal of Company Date : _____

SCHEDULE – L

DECLARATION

(This shall form part of Technical Bid)

I, _____ certify that all the typed data & information pertaining to the subject tender specification are correct & are true representation of the equipment covered by our formal Bid No_____dated_____.

I hereby, certify that I am duly authorized representative of the Bidder whose name appears above my signature.

Bidders Name : _____

Authorized Representative Signature : _____

Authorized Representative Name (Typed) : _____

Authorized Representative Designation : _____

Seal of Company

Date : _____

Bidder's Intent : The bidder hereby agrees to fully comply with the requirements & intents of the subject tender specification for the price(s) indicated

Authorized Representative Signature : _____

Annexure-O

Technical specification for New Grids 24x7 O&M support

Scope:

24x7 (8 Hours per shift) O&M support for equipment supplied by bidder inclusive of GIS and Terminations after Handing over of Grid by Vendor to BRPL

O&M Shall cover following

Operation:

- Handling equipment with training (on job) to BRPL staff.
- Knowledge of sequence of operation (bidder to provide flow chart for the same in laminated form so that the same may be pasted on grid notice board).
- Competency level in electrical as well as mechanical operations.

Breakdown:

- Attending any breakdown in equipment supplied and replacement of faulty parts (within 10-12 hrs).
- Presence in experienced engineer during entire restoration sequence till equipment get energized.

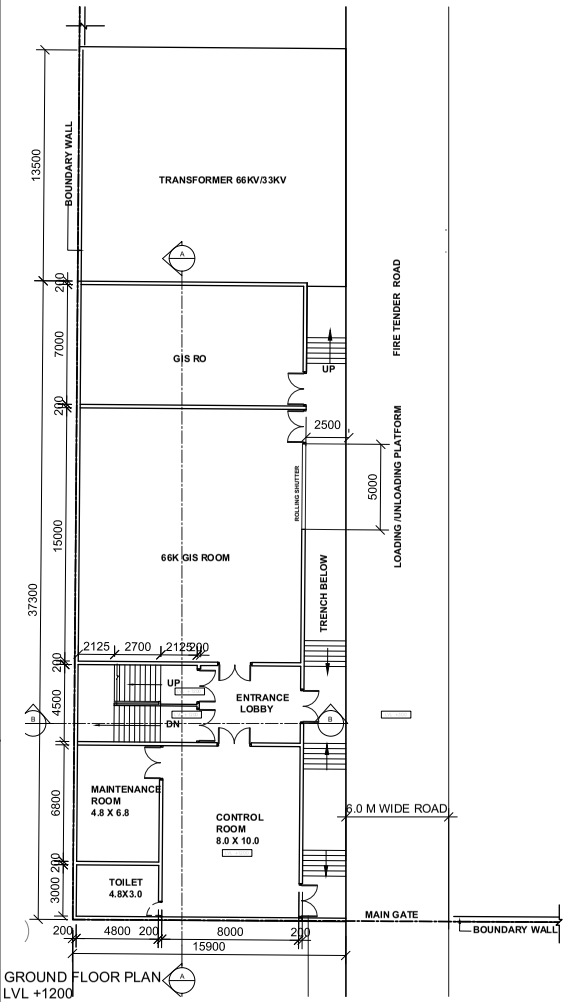
General Guidance:

- Work force required to attend the outages – built a QRT (quick response team to attend breakdown during that tenure).
- Tools tackles and spares necessary for attending outage.- 1 set of special tools to be incorporated in tech doc to be handed over to user during HOTO.
- Skill level suitable to carry out the operation for 66kV/33kV.

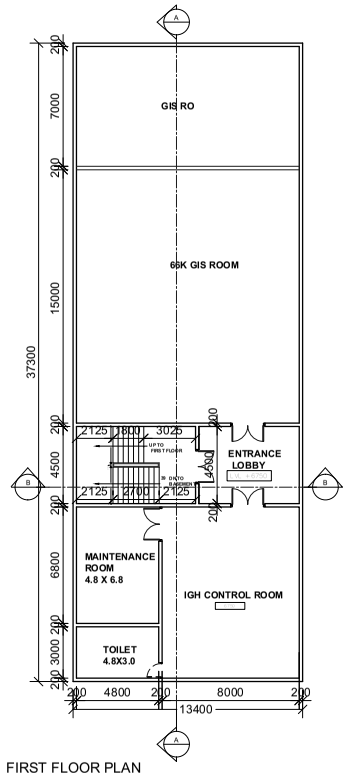
Manpower Requirement:

- One Operator (Minimum ITI qualified), one Skilled worker and one reliever shall be assigned per shift.

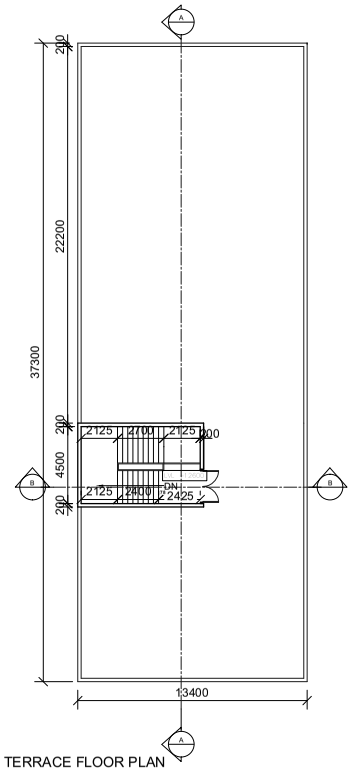
- Qualification documents of Manpower assigned shall be submitted to BRPL for approval.



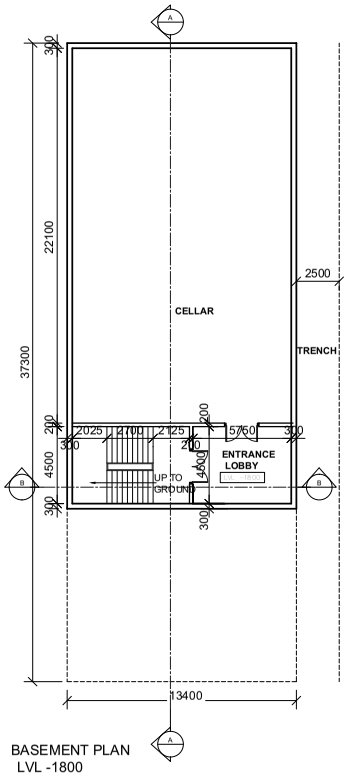
GROUND FLOOR PLAN
LVL +1200



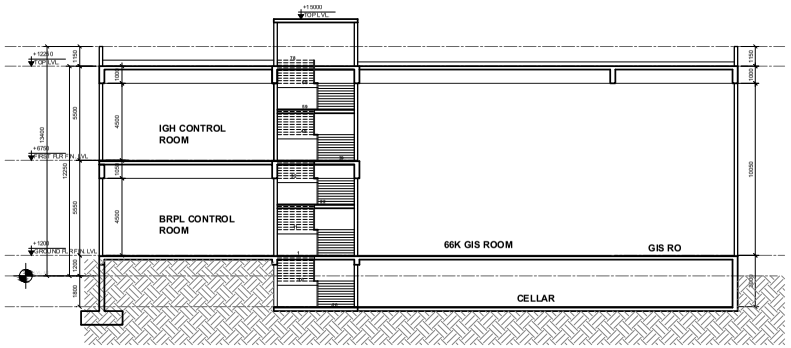
FIRST FLOOR PLAN
LVL +6750



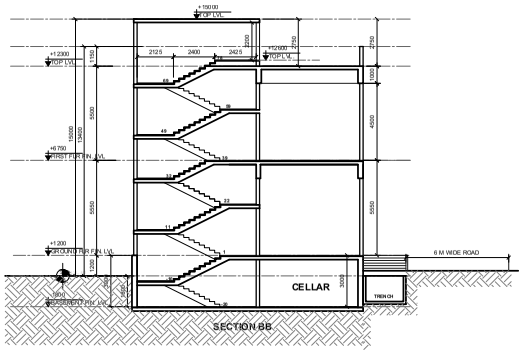
TERRACE FLOOR PLAN
LVL +12600



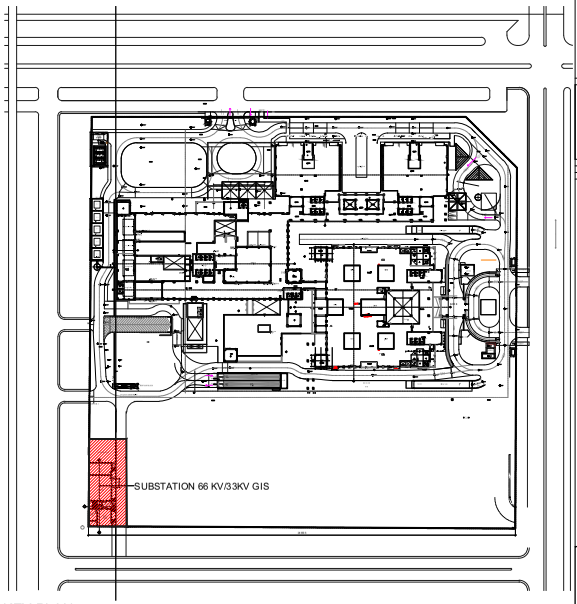
BASEMENT PLAN
LVL -1800



SECTION AA



SECTION BB



KEY PLAN

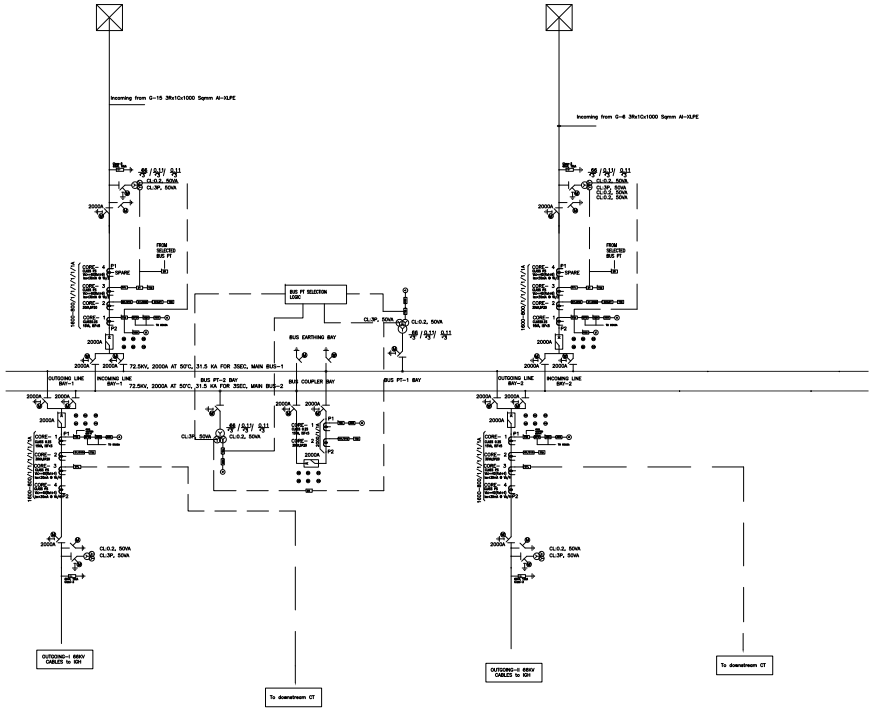
NOTES

ARCHITECT

JSA
JASBIR SAWHNEY & ASSOCIATES
ARCHITECTS
D-I
176, M.I.RD.
SHAHEED JEET SINGH MARG
NEW DELHI-110016
DRAWN: AM
SCALE: 1:200
DATE: 23 JUNE 2016

SUBSTATIN 66 KV/33 KV GIS
PLANS & SECTIONS
INDIRA GANDHI HOSPITAL
SECTOR 9, DWARKA, NEW DELHI

A
ES-101



LEGEND

- POWER CIRCUIT
- BUSBAR
- LIGHTNING ARRESTOR
- 3 POSITION MOTORISED ISOLATOR WITH EARTH
- POTENTIAL TRANSFORMER
- MOTORISED EARTH SWITCH
- SF6 CIRCUIT BREAKER
- POWER TRANSFORMER
- FUSE
- CURRENT TRANSFORMER
- BUSHING CURRENT TRANSFORMER

NOTES:

THIS DRAWING IS TENTATIVE AND WILL BE FINALISED DURING DETAILED ENGINEERING.

REV. No.	DESCRIPTION	DATE	PRPD. BY	CHKD. BY	APPR. BY
00	FIRST DRAWING BASED ON MOM DT 04.05.17	10.01.18	BG	US / AS	AS

BSES Rajdhani Power Limited
BSES BHAWAN
Nehru Place, New Delhi - 110017

DRAWN	SUMIT	TITLE:- SLD OF 66KV SUBSTATION INDIRA GANDHI HOSPITAL	
CHECKED	AS		
APPD.	VP		
DATE	10.01.18	DWG No.:- BRPL-DMI-DEE-B-0001	SHEET 1 OF 1
SCALE	NTS		REV. 00 / VER. 00