Tender Notification for

SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF 11KV CABLE AND ACCESSORIES INCLUDING RMU ON SINGLE POINT RESPONSIBILITY FOR PROVIDING HT CONNECTION IN F/O TRANSPORT DEPTT. ADTT. HARI NAGAR OPP, DTC DEPOT

CMC/BR/22-23/RB/PR/KG/1019 DT 02.05.2022

Due Date for Submission: 23.05.2022 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**

Table of Contents

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	SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF 11KV CABLE AND ACCESSORIES INCLUDING RMU ON SINGLE POINT RESPONSIBILITY FOR PROVIDING HT CONNECTION IN F/O TRANSPORT DEPTT. ADTT. HARI NAGAR OPP, DTC DEPOT	1.15 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 "SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF 11KV CABLE AND ACCESSORIES INCLUDING RMU ON SINGLE POINT RESPONSIBILITY FOR PROVIDING HT CONNECTION IN F/O TRANSPORT DEPTT. ADTT. HARI NAGAR OPP, DTC DEPOT against NIT NO CMC/BR/22-23/RB/PR/KG/1019"

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 23/05/2022 1530 HRS at the address given at 3.01 below. Part A of the Bid shall be opened on 23/05/2022 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 2,30,000/-** 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:-**

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

- The bidder must be a manufacturer of 11KV or higher Voltage HT Power Cable of conductor size 300mm² and above having valid Type Test Reports carried out at CPRI/ERDA (Not More than 5 years Old from the NIT date) for the same.

- The bidder should have supplied at least 150 km. of similar Cross section (i.e 300mm²) or higher (Voltage level 11KV and Above) to any major utilities/SEB's in last 3 years from the NIT date out of which at least 50% should be in successful operation for the last 3 years.

- The bidder who is a manufacturer of 11KV or higher Voltage HT Power Cable of conductor size 300mm² and above can enter into Consortium /Joint Deed with the enlisted BRPL contractors who can jointly fulfill the Qualification Criteria.

- Bidder along with consortium, as mentioned above, should have at least two performance Certificates for the works executed in the last 3 years from reputed companies /utilities of successful laying, testing & commissioning of similar Cross section (i.e 300mm²)or higher (Voltage level 11KV and Above) cable. Out of these, one certificate should be more than 10 KMs of cable.

- The Bidder should have In –house raw material, routine and acceptance testing facilities as per relevant IS/IEC. Self-declaration & List of testing equipment to be submitted in support of this QR.

- In case of new vendor not registered with BRPL, factory inspection and evaluation shall be carried out to ascertain bidder's manufacturing capability and quality procedure. However, BRPL reserves right to carry out factory inspection and evaluation for any bidder prior to technical qualification evaluation

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

- Bidder should have Average Annual Sales Turnover of Rs 100 Crore or more in last three (3) financial years, duly certified CA certificate to be submitted. (FY 19-20, 18-19 & 17-18).

  Indian Subsidiaries of global companies having plant in India are also eligible to bid if the qualification requirements stated above are met independently or in combination with the parent company. Declaration from parent company needs to be submitted.

  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 **TERMS & CONDITIONS TO APPLY AS CONSORTIUM:**

i. Cable OEM may form a consortium with BRPL enlisted contractors and apply against this tender specification, provided they jointly qualify as per qualification criteria of the tender.

ii. Cable OEM shall be lead partner(Bidder) and this authorization shall be supported by submitting a power of attorney signed by legally authorized signatories of all the partners; Refer Annexure-I for Sample Format

iii. The Bidder (Lead partner) shall be authorized to incur liabilities and receive instructions for and on behalf of any and all partner of the Consortium and the entire execution of the contract including payment shall be done exclusively with the Bidder (lead partner). This authorization shall be evidenced by submitting by a Power of Attorney signed by legally authorized signatories of all partners.

iv. The Bidder (Lead partner) shall be solely liable for the execution of the contract in accordance with the contract terms and a copy of the agreement entered into by the consortium partners having such a provision shall be submitted with the Bid.

v. In the event of any default by any partner/partners of the Consortium, BRPL reserves the right to get the work executed from any other source at the Risk & Cost of the Bidder (Lead Partner). The Extra Expenditure so incurred shall be debited to the Bidder (Lead Partner)..

vi. Responsibilities in respect of execution of tendered work by the Bidder (lead partner) as well as of each Consortium member shall be clearly indicated in the agreement.

vii. The Consortium agreement shall not be cancelled or amended unilaterally without consent of the purchaser and a statement to this effect should appear in the consortium agreement.

viii. A firm can submit only one bid in the same bidding process, either individually as a bidder or as a partner of a Consortium. A bidder who submits or participates in more than one bid will cause all the bids in which the bidder has participated to be disqualified.

Original consortium agreement on Non judicial stamp paper duly registered with sub registrar office/Notarized of appropriate value satisfying the above conditions shall be submitted along with the bid indicating role and duties of each consortium member.

Note:

- **In case of non-furnishing the requisite documents along with the bid, the bid will be considered as non-responsive and bid may be summarily rejected.**
- **Purchase Order & Work Order shall be issued in favor of the Lead Partner/Bidder only**

4.00 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	03.05.2022
2	Pre-Bid meeting	12.05.2022 1430 HRS
3	Pre-Bid meeting ink	https://bsesbrpl.webex.com/meet/rakesh.bansal
4	Last date of Queries, if any	16.05.2022
5	Last date of receipt of bid documents	23.05.2022 1530HRS
6	Date & time of opening of tender – Part A	23.05.2022 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

5.00 Award Decision

5.01 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.

5.02 **Splitting of Tendered Scope of works in two or more bidders:** BSES reserve the right to split the tender scope amongst techno- commercially qualified bidders. The purchaser reserves all the rights to award the contract to one or more bidders to meet the timelines of the projects /scope of work or nullify the award decision without any reason.

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

5.04 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.

6.00 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.

7.00 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.

8.00 **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. Pankaj Goyal (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	amit.as.tomar@relianceada.com pronab.bairagi@ relianceada.com	pankaj.goyal@relianceada.com kumar.ga.gaurav@relianceada.com

SECTION – II: INSTRUCTION TO BIDDERS

1.00 GENERAL

BSES Rajdhani Power Ltd, hereinafter referred to as "The Company" is desirous of awarding work for "SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF 11KV CABLE AND ACCESSORIES INCLUDING RMU ON SINGLE POINT RESPONSIBILITY FOR PROVIDING HT CONNECTION IN F/O TRANSPORT DEPTT. ADTT. HARI NAGAR OPP, DTC DEPOT".

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 III
Technical Specifications - Annexure IV

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, 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. 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‘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 Splitting of Tendered Scope of works in two or more bidders**:** BRPL reserve the right to split the tender scope amongst techno- commercially qualified bidders. The purchaser reserves all the rights to award the contract to one or more bidders to meet the timelines of the projects /scope of work or nullify the award decision without any reason.

26.03 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/LOA 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**

Within 4 months from the date of issuance of LOI/Order

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 to owner after successful laying of HT Feed and installation, testing & commissioning etc as per BOQ ,with required accessories 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. Delivery of cable at site and all other equipments/accessories have to be aligned as per site requirements and progress.

1.5. 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.

1.6. 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.

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

1.8. Permission from road owning agencies & statutory clearance for road cutting shall be in the scope of bidder. However statutory fees will be borne by BRPL.

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

1.10. 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.

1.11. 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.

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

1.13. The Bidder should have all major tools and tackles for cable laying like Bench Machine, Rollers, Jack for lifting the Cable drum along with calibration certificates etc.

1.14. 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

1.15. 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.

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

1.17. 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.

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

1.19. 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.

1.20. 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.

1.21. 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.

1.22. **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.

For Cable, RMU & Joints: The defect liability period shall be 60 months from the date of commissioning or 66 months from the date of delivery 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

1.23. **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.

1.24. **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 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 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) 70% 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.

b) 15% pro-rata after installation/erection of equipment duly certified by BRPL Project-in-charge

c) 15% 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.

For Cable & Joints: The defect liability period shall be 60 months from the date of commissioning or 66 months from the date of delivery 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 forfeiture 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

Scheme	Name of the Scheme: BS-5858 Providing TF of New load of 115 KW on HT network, in F/O M/s Transport Deptt. Delhi , ADTT. Hari Nagar , Opp. DTC Depot , Mata Shanti Devi Marg , Hari Nagar (Pratap Nagar) , ND-64

MATERIAL SUPPLY

Sl no	Description	UOM	Qty	Basic (Rs)	Freight (Rs)	GST (Rs)	Unit Landed (Rs)	Total Landed Cost (Rs)
1	CBL,PWR,400MM2;3C;11KV;AL;XLPE, OFC Embedded	M	2710					
2	KIT,JOINTING,I/D;11KV;3CX150MM2;HS	EA	2					
3	KIT CBL TERN IND 11KV 3CX400MM2 HS XLPE, Including OFC kit	EA	9					
4	KIT STRT JNT -- 11KV 3CX400MM2 HS XLPE,Including OFC kit	EA	13					
5	RNG MAIN UNT,INDR,4WAYS,11KV, with FRTU	EA	1					
6	RNG MAIN UNT,OUTDR,4WAYS,11KV, with FRTU	EA	1					
7	Kit Chemical Earthing	EA	8					
8	EXTNGSR,FIRE,CO2;4.5Kg;CO2gas;17kg	EA	2					
9	MAT,INSLTNG:5M:1M:3MM:Elastomer	EA	2					
10	Ferrule cable reducer from 400 to 300 mm2	EA	9					
11	PNL,ELEC PWR,INDR OG FDR;11KV;800A	NOS	1					
12	CBL,CNTRL,ARM FRLS;1.1KV;1.5MM2;CU;16C	M	200					
13	GLND,CBL,1IN;SGL CMPRSN	NOS	2					
14	Single compression Metal Glands 1/2 inch Make : COMEX	NOS	6					
15	SW,ENET,6TX 2FX;8PORT;48VDC	NOS	1					
16	PNL,MET CUBICAL 15/5 amp;11KV	NOS	1					
17	Supply of HDPE 160 mm Pipe, PN6, PE 80	M	2600					

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. 70 % against R/A bills within 30 days against receipt of material at site b. 15% pro-rata after installation/erection of equipment c. 15% 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	4 months from date of LOI/Order	
5	Defect Liability period	24 months from the date of Handing over of entire Installation. For Cable, RMU & Joints: The defect liability period shall be 60 months from the date of commissioning or 66 months from the date of delivery whichever is later.	
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 undertake 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 Bidder 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 and handing over to owner after successful laying of Cable with required accessories and installation, testing & commissioning as per BOQ on single point responsibility basis. Schedule of work shall be as mentioned in the Bill of quantity attached herewith.

After completion of E/T/C work of the scheme, if required, contractor has to obtain the Electrical Inspectorate's Clearance from the Electrical Inspector of Delhi Govt.

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. HT Cable should be tested as per the specification only. Contractor shall test the complete cable; BRPL will also witness the same.

b. All cable laying tools and tackles and testing equipment shall be available with contractor in event of order.

c. Contractor shall submit copy of cable laying schedule to BRPL in event of order so that quality checks can be done on sample basis.

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

e. In case cable is damaged / fails during commissioning or during period of defect liability contractor shall bear all the repair and material cost.

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% prorata of total installation value shall be payable against R/A bills payable within 30 days after installation, testing & commissioning of material at site duly certified by Engineer in charge.

iii) 15% 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.

For Cable, RMU & Joints: The defect liability period shall be 60 months from the date of commissioning or 66 months from the date of delivery 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 4 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. <u>WORKMAN COMPENSATION</u>:

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. <u>STAFF AND WORKMAN</u>

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

Scheme	Name of the Scheme: BS-5858 Providing TF of New load of 115 KW on HT network, in F/O M/s Transport Deptt. Delhi , ADTT. Hari Nagar , Opp. DTC Depot , Mata Shanti Devi Marg , Hari Nagar (Pratap Nagar) , ND-64

MATERIAL SERVICE

Sr. no.	Description	Unit	Quantity	Basic (Rs)	GST (Rs)	Unit Landed (Rs)	Total Landed Cost (Rs)
1	Trans/Hiring FullTruck8 Hr-Crane	TRP	18				
2	Hire 1/2Body Truck/Tempo,8 Hr	TRP	8				
3	High Pot Testing	EA	15				
4	Lay cable HT/LT>150to400 inpipe	M	2600				
5	Lay.cable HT/LT Ab150 in trench	M	110				
6	Route Survey for cable laying work	M	2600				
7	Inst. HT11KV 350MVA RMU-4Funct. with OEM supervation	EA	2				
8	Testing, Comm and intregration with SCADA, RMU 4Function, With OEM supervation	EA	2				
9	Supply MS Frame I/D 4-RMU<500MM	EA	2				
10	Trans empty steel cable drum	EA	9				
11	Dig Test Pit in Desns/CC/Asph	CUM	39				
12	Cleaning/Clearing malba	CUM	25				
13	Pro/lay CC 1:3:6	EA	29				
14	Inst.Testing &Comis.Chem.Earth Rocy Soil	EA	8				
15	Lay.GI Strp 500mm Depth Mesh Info	EA	30				
16	Make Civil Foudation RMU 4-Funct	EA	1				
17	Make End Termination, 11kV, 3CX400 sqmm with OFC	EA	9				
18	Make St Th.Box, 11kV, 3CX400 sqmm with OFC	EA	13				
19	Lay.cable HT/LT >70to150 in trh	M	12				
20	Make End Termination, 11kV 3CX150 sqmm	EA	2				
21	Paint Nomenclature,HT/LT Equip	EA	131				
22	Prov/Fix.Dng. Plate	EA	4				
23	DC-SUPPLY PRECAST RCC TRENCH COVER	SQMM	5				
24	Prov/Fix Exhaust Fan 12"	EA	2				
25	Prov Steel Barricading of 1.2 M	M	1200				
26	Cable laying and tagging (16 core, 1.5 mm2) & Termination with Petty Materials Such as connectors,Lugs,Jacks,White Sleeves,Ferrules,etc…	M	200				

27	Cable laying and tagging (2 core, 2.5 mm2) with Petty Materials Such as connectors,Lugs,Jacks,White Sleeves,Ferrules,etc…	M	20				
28	Laying and termination of Armored RS485 cable with proper tagging,Glanding and dressing upto RTU panel for MFM	M	20				
29	Connection of IED relay (Laying and termination of CAT-6 Cables with proper tagging ,Glanding and dressing upto RTU/Switch panel)	M	50				
30	Cable glanding and termination with Lugs and Ferrules in RTCC,C&R,charger panel,charger,DCDB,ACDB & RTU Marshalling panel. Note - Purchase of necessary Lugs & White Sleeve Ferrules Comes Under Vendor Scope	EA	8				
31	Cable tray laying with joint plates, MS angle support and nut bolts (size 400*50*2mm thick) Note - Purchase of required MS Angle Supports with Joint Plates & Nut Bolts for Cable trays(1 Set equivalent to 2 numbers of Joint Plates + 8 No's Nut & Bolts + 16 Washers)comes under vendor Scope.	M	20				
32	Installation of Switch	EA	1				
33	Material transportation from Store to Site	EA	1				
34	Cable Crimping - Supply of RJ45 Jack,White Sleeve Ferrule comes under vender Scope	EA	5				
35	Ferruling Work for all type of cables(16 Core & 2 Core) - Scope includes supply of suitable White Sleeves with Printed Ferrule from Machine & Lugs	EA	50				
36	Transp.by Truck I/C L/U Manually	TRP	1				
37	Transp.byTruck I/C L/U Tripod/Cran	TRP	1				
38	E/T/C of 11KV I/D O/G Panel	EA	1				
39	Laying of GI Strip 50x6 sqmm	M	30				
40	Supply and fixing of HT Sleeve	M	6				
41	Lay of Control Cable 10x2.5sqmm	M	50				
42	Lay of Control Cable 5 / 6x2.5sqmm	M	50				
43	Erec/Term D/Gland 10x2.5sqmm	EA	10				
44	Erec/Term D/Gland 5x2.5sqmm	EA	10				
45	Test.CTwth pri Inj method (11KVVCB)	EA	1				
46	Hire 1/2Body Truck/Tempo,8 Hr	TRP	2				
47	Inst. HT11KV Metering Panel	EA	1				
48	Inst.Testing &Comis.Chem.Earth Rocy Soil	EA	2				
49	Lay.GI Strp 500mm Depth Mesh Info, 50X6	EA	20				
50	Fab work,MS Steel,as Spec.	KG	30				
51	Prov MS Steel-angle/channel/Flat	KG	30				
52	Laying of HDPE 160 mm Pipe through Trenchless method.	M	2600				

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% prorata of total installation value shall be payable against R/A bills payable within 30 days after installation, testing & commissioning of material at site duly certified by Engineer in charge. c) 15% 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	4 months from date of LOI/Order	
5	Defect Liability period	24 months from the date of Handing over of entire Installation. For Cable, RMU & Joints: The defect liability period shall be 60 months from the date of commissioning or 66 months from the date of delivery whichever is earlier.	
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	SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF 11KV CABLE AND ACCESSORIES INCLUDING RMU ON SINGLE POINT RESPONSIBILITY FOR PROVIDING HT CONNECTION IN F/O TRANSPORT DEPTT. ADTT. HARI NAGAR OPP, DTC DEPOT			
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

SAMPLE FORM OF POWER OF ATTORNEY FOR CONSORTIUM

(On Non –Judicial Stamp Paper of Appropriate value to be purchased in the Name of Lead Member)

KNOW ALL MEN BY THESE PRESENTS THAT WE, the Members whose details are given hereunder…….. have formed a Consortium and having our Registered Office (s)/Head Office (s) at ……(hereinafter called the 'Consortium' which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators and assigns) do hereby constitute, nominate and appoint M/s……. a company incorporated under the laws of ……..and having its Registered/Head Office at …….as our duly constituted lawful Attorney hereinafter called "Attorney" (hereinafter called Bidder) to exercise all or any of the powers for and on behalf of the Consortium in regard to Tender Notice No…….. for "Supply, Installation, Testing & Commissioning of 11 kV feeders including RMU, Cable and accessories on single point responsibility basis in connection with providing new load of 1345 kw on HT system for NICF, Ghitroni " under jurisdiction of BRPL (hereinafter called the "**Owner**") for which bids have been invited by the Owner, to undertake the following acts :

(i) To submit proposal, participate and negotiate in respect of the aforesaid Bid – Specification of the Owner on behalf of the "Consortium".

(ii) To negotiate with Owner the terms and conditions for award of the contract pursuant to the aforesaid Bid and to sign the contract with the Owner for and on behalf of the "Consortium".

(iii) To do any other act or submit any document related to the above.

(iv) To receive, accept and execute the contract for and on behalf of the "Consortium".

(v) To submit the Contract performance security in the form of an unconditional irrecoverable Bank Guarantee in the prescribed format and as per terms of the contract.

It is clearly understood that the Bidder/Lead Partner shall ensure performance of the contracts(s) and if one or more Member fail to perform their respective portion of the contracts(s), the same shall be deemed to be a default by all the Partners.

It is expressly understood that this power of Attorney shall remain valid, binding and irrevocable till expiry of contract period or any extension thereof.

The Consortium hereby agrees and undertakes to ratify and confirm all the whatsoever the said Lead Partner quotes in the bid, negotiates and signs the Contract with the Owner and / or proposes to act on behalf of the Consortium by virtue of this Power of Attorney and the same shall bind the Joint Consortium as if done by itself.

IN WITNESS THEREOF the Members Constituting the Consortium as aforesaid have executed these presents on this …… day of …….. under the Common Seal (s) of their Companies.

For and on behalf of the members of Consortium

……

……

……

The Seal of the above Partners of the Consortium:

The Seal has been affixed there unto in the presence of:

WITNESS

1. Signature ……
Name ……
Designation ……
Occupation ……

2. Signature ……...
Name …….
Designation ……
Occupation ……

ANNEXURE –II

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-III

SCOPE DEMARACATION AND ROUTE MAP

TECHNICAL SPECIFICATION

FOR

SUPPLY, ERECTION, TESTING & COMMISSIONING

OF

11KV CABLE LAYING WORK

BSES RAJDHANI POWER LTD			
Prepared By	Gautam Deka		Rev: 00
	Pronab Bairagi		
Reviewed by	Amit Tomar		Page 1 of 10
Approved By	Gopal Nariya		06.05.2022
Registered office: BSES Bhawan , Nehru Place , New Delhi- 19			

Index

1.00.00 GLOSSARY LIST

S. No.	Abbreviation	Description
1	F.O. R.	Freight On Road
2	CT	Current Transformer
3	PT	Potential Transformer
4	kV	Kilo Volts
5	MVAR	Mega Volt Amperes Reactive
6	MVA	Mega Volt Amperes
7	kVA	Kilo Volt Amperes
8	O&M	Operation and Maintenance
9	LOA	Letter of Award
10	FO	Fiber Optic
11	MCD	Municipal Corporation of Delhi
12	DDA	Delhi Development Authority
13	PWD	Public Works Department
14	U/G	Underground
15	HT	High Tension
16	ACSR	Aluminum Conductor Steel Reinforced
17	BOQ	Bill of Quantity
18	GA	General Arrangement
19	RCC	Reinforced Cement Concrete
20	CPRI	Central Power Research Institute
21	ERDA	Electrical Research and Development Association
22	CRP	Control &Relay Panel
23	T&P	Tools & Plant
24	IR	Insulation Resistance
25	OFC	Optical Fiber Cable
26	GAIL	Gas Authority of India Limited
27	IGL	Indraprastha Gas Limited
28	IOCL	Indian Oil Corporation Limited
29	DMRC	Delhi Metro Rail Corporation
30	PPE	Personal Protective Equipment
31	FRLS	Fire Retardant Low Smoke
32	GI	Galvanized Iron
33	GPR	Ground Penetration Radar
34	P/L	Providing and laying
35	P/F	Providing and fixing
36	TAC	Tariff Advisory Committee
37	IS	Indian Standard
38	IEC	International Electro technical Commission

2.00.00 GENERAL DESIGN CRITERIA

2.01.00 General Service condition

a) Maximum ambient temperature (Degree C): 50
b) Minimum ambient temperature (Degree C): 0
c) Relative Humidity (%): 100
d) Maximum annual rainfall (mm): 750
e) Maximum wind pressure (Kg/Sq.m): 150
f) Maximum Altitude above mean sea level (Meters): 1000
g) Seismic level Zone IV as per IS 1893
h) Pollution Level: Heavy/Dry

2.02.00 Code and Standards

Contractor shall follow latest Indian Standards or International Standards. Refer respective equipments specification for applicable standards.

2.03.00 Scope and Services

S.No.	Head	BRPL Scope	Contractor's Scope	Remarks
1	Road Cutting Permission	X	√	Statutory fees will be borne by BRPL
2	Supply, Laying, testing and commissioning of 11kV Cable including Cable Jointing , Cable termination	X	√	NA
3	Supply, Laying, testing and commissioning of 11kV Ring Main Unit (Indoor and Outdoor)	X	√	
4	Permissions from relevant External and Internal Agencies regarding Cable Laying and Commissioning (Traffic Police, GAIL, IGL, IOCL, PWD, CPWD, Pollution Control Board, DMRC etc.)	X	√	Statutory fees will be borne by BRPL
5	GPR/Scanning of the whole route shall be done and the same shall be submitted to BRPL. The report shall be submitted within 15 days after the issue of LOI	X	√	This work shall be done by vendor before execution of job.
6	Drawing Submissions	X	√	NA
7	Engineering Approvals	√	X	NA
8	Testing Equipments	X	√	NA
9	Lighting Arrangement	X	√	NA

S.No.	Head	BRPL Scope	Contractor's Scope	Remarks
10	Construction Power and Construction Water	X	√	NA
11	Safety , Security and insurance of Manpower(Labour, Engineers, Supervisors etc)	X	√	Labour should be provided with every safety gear like safety jacket, helmet etc.
12	Various Tools and Tackles related to Job	X	√	NA
13	Transportation of Material and any other tender related work	X	√	NA
14	Cleanliness around project site	X	√	NA
15	Security and Safety of material until handing over the project to BRPL	X	√	NA
16	Providing of Various Machines e.g Crane, Hydra, JCB, Hammer , Cutting Machine etc to complete the project	X	√	NA
17	Providing of Trenchless Machine	X	√	NA
18	Loading and Unloading of material at site including scrap returning to BRPL site	X	√	NA
19	Electrical Inspector Clearance	X	√	Statutory fees will be borne by BRPL
20	Providing of Continuous Steel Barricading with Mobile no of project supervisor, sufficient traffic marshal, becon light, Fluorescent tape, PPE etc. (Mobile no shall be clearly visible on the barricading)	X	√	as per drawing enclosed with specification.
21	Permit to work requesting Agency in BRPL premises	X	√	Permit Should be applied to Engineer Incharge prior to work through proper procedure
22	Permit to work issuing agency inside BRPL Premises	√	X	NA
23	Temporary office and Material Store near work premises	X	√	NA
24	Storage of all kind of Material required for project	X	√	BRPL premises will not provide for any kind of material storage

S.No.	Head	BRPL Scope	Contractor's Scope	Remarks
				and issuance
25	Dismantling of material at project site, , Dismantled material loading, Unloading and transportation and deposit to BRPL store	X	√	Store location will be within BRPL premises
26	Preparation, updation and submission of PERT chart fortnightly to track activities	X	√	NA
27	Submission of final drawing showing layout of cable in Google map alongwith of cable joint location with GPS Coordinates	X	√	Approval will be done by BRPL Representative
28	Removal and renaming of existing signboard of other utilities (if any) including painting as per their actual route	X	√	Painting colour and material should be in line with the existing ones for aesthetic look
29	Surface levelling, removal and disposal of excess earth (malwa) after back filling of trench. During execution excavated earth shall be covered with green mat to prevent dust pollution. Also regular Water Sprinkling is to be required at site.	X	√	NA
30	Sheath Integrity test before Charging of Cable	X	√	Mandatory
31	All cable drum shall be returnable basis so immediate after laying of cable, empty cable drum shall be removed away from site at their risk and cost by respective bidder from time to time in line with project progress.	X	√	
32	Compliance of instructions/ orders issued by National Green Tribunal/ Central Pollution Control Board/ any other agency related to pollution.	X	√	Any kind of penalty shall be borne by the vendor
33	De-watering of pits	X	√	Scope shall be covered as per execution team requirement.
34	Petty/Miscellaneous items related to job	X	√	

Special requirement

1. Delivery of cable at site and all other associate equipments/accessories have to be aligned as per site requirement and progress.
2. All kind of structural steel shall be GI unless otherwise specified.
3. Make of all kind of materials shall be as per BRPL approved make list, no deviation shall be allowed from make list.
4. The 11kV 3 Cx400 sqmm cable is required with OFC embedded inside (OFC cable is of 48 fibre with 36 single mode and 12 multi mode). For OFC cable details please refer attached specification.

3.00.00 PACKAGE

3.01.00 BS-5858 Providing TF of New load of 115 KW on HT network, in F/O M/s Transport Deptt. Delhi , ADTT. Hari Nagar , Opp. DTC Depot , Mata Shanti Devi Marg , Hari Nagar (Pratap Nagar) , ND-64.

3.02.00 Route map and Single Line diagram (attached below)

4.00.00 TECHNICAL SPECIFICATION

Please refer individual Technical Specification

5.00.00 SCHEDULES

SCHEDULE -I
TECHNICAL DEVIATION FROM THE SPECIFICATION
(This shall be part of Technical bid)

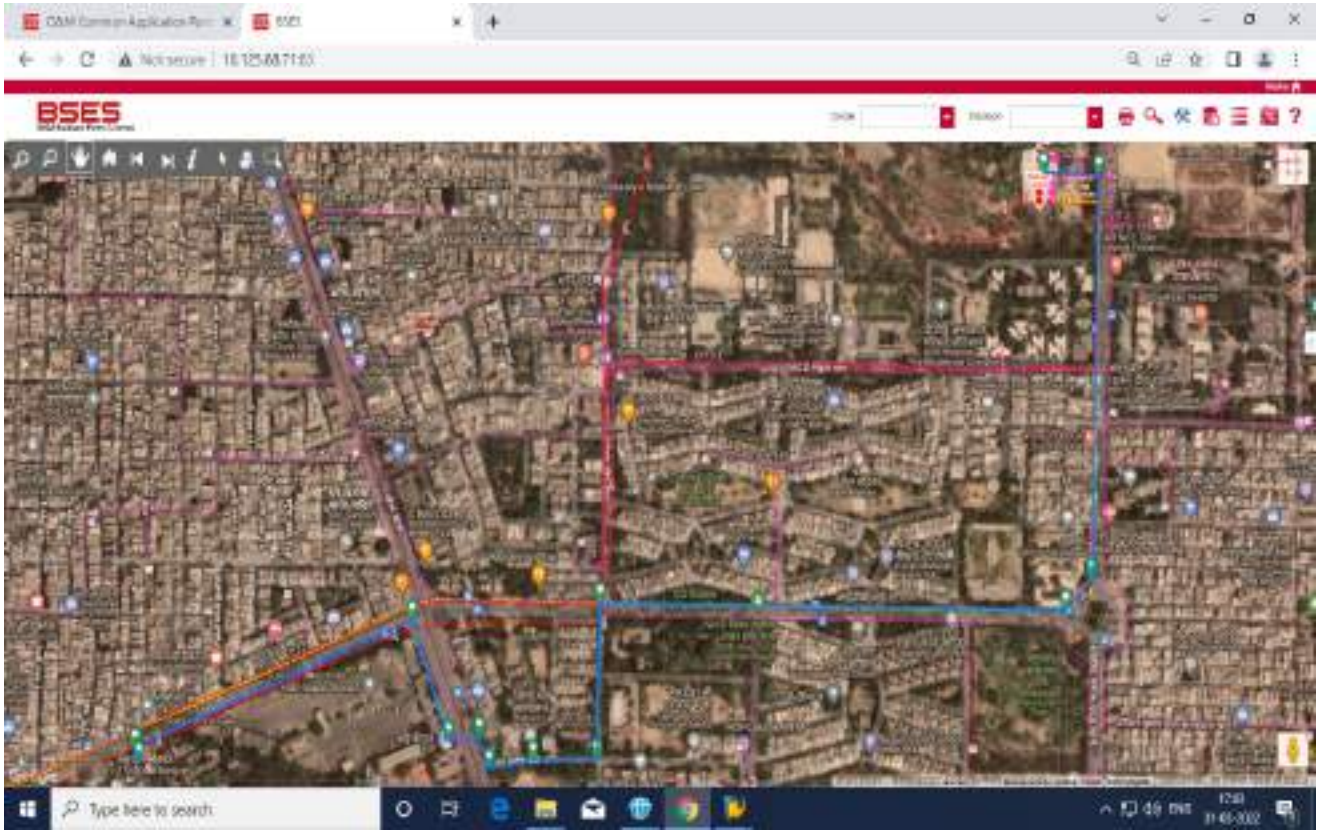
Technical deviation from specification if any, shall be listed out in below format

Sl no	Specification cl no	Deviation	Remark

SCHEDULE -II
BRPL APPROVED MAKE LIST OF MAJOR ITEMS

Sl no	Items Description	Approved Make	Remark
1	11kV Motorised RMU	1. Schneider Electric 2. Lucy Electric 3. Siemens 4. ABB 5. C-Sec Technologies	
2	11 kV Jointing and Termination KIT	1. Raychem 2. 3M 3. Compaq 4. Yamuna Denson 5. BBC Cellpack	
3	11kV Metering Cubicle	1. Adhunik 2. Perfect sales 3. Concord	
4	HDPE Pipes	1. Flow well 2. Tirupati 3. Narendra Polyplast 4. Eon plast	

3.02.00 Route Map



Single Line diagram for DTC_Mayapuri

ANNEXURE-IV

TECHNICAL SPECIFICATIONS

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

TECHNICAL SPECIFICATION

FOR

11KV INDOOR SWITCHGEAR

NEW GRIDS

Specification no – SP-HTSWG-01-R2

Prepared by	Hemanshi Kaul		Rev: 1
Reviewed by	Abhinav Srivastava		Date: 11 Mar 2021
Approved by	K.Sheshadri		Page 1 of 17

RECORD OF REVISION

S. No	Revision no & Date	Revision Clause No.	Revision Details
1	R1 11.03.21	15.1.0 & 15.1.1	Sync check feature added in the relays.
2	R1 11.03.21	15.1.0 – 15.1.4	Relays shall be directional
3	R1 11.03.21	26.1.19	Vacuum interrupter make mentioned. Schneider, Siemens, BEL, BHEL, ABB, CGL & L&T.

1.0 CODES & STANDARDS:

Material, equipment and methods used in the manufacture of switchboard shall confirm to the latest edition of following standards: -

Standard Name / No	Standard's Description
Indian Electricity Rules 1956	Relevant safety regulation of CEA
Indian electricity act 1910	Latest edition
Switchgear and control gear	IEC: 60694, IEC: 60298, IEC: 62271-200, IEC: 60529. IS: 3427, IS 12729, IS 12063, IS:13947, IS: 9046
Circuit Breaker	IEC 62271-100, IS 13118, IS 2516
Isolators and earthing switches	IEC 62271-102
Current Transformers	IS:2705, IEC:60185
Voltage Transformer	IS:3156, IEC:60186
Indicating Instruments	IS:1248
Energy Meters	IS: 13010
Relays	IS 8686, IS 3231, IS 3842
Control switches and push buttons	IS 6875
HV Fuses	IS 9385
Arrangement of switchgear bus bars, main connections and auxiliary wiring	IS 375
Code of practice for phosphating iron & steel	IS 6005
Colours for ready mixed paints	IS 5
Code of practice for installation and maintenance of switchgear	IS 3072

2.0 PANEL CONSTRUCTION

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

2.1	Enclosure Type	Free standing, indoor, Fully compartmentalized, Metal clad, Vermin Proof
2.2	Enclosure degree of protection	IP 4X for High Voltage compartment IP 5X for low voltage compartment
2.3	Enclosure Material	Pre – Galvanized CRCA steel
2.4	Load bearing members	Minimum 2.5 mm thick
2.5	Doors and covers	Minimum 2.0 mm thick
2.6	Gland Plate (detachable type)	3.0mm MS for multicore and 5.0mm Aluminum for single core cables. All gland plates should be detachable type with gasket
2.7	Height of complete Panel	Maximum 2700mm, operating height maximum 1600mm
2.8	Dimension of Instrument Chamber	Depth (500mm) (Minimum)
2.9	Extensibility	On either side
2.10	Separate compartment for	Bus bar, circuit breaker, HV incoming cable, HV outgoing cable PT, LV instruments & relays.
2.11	Transparent inspection window	For cable compartment at height of cable termination.
2.12	Bus end cable box	For direct cable feeder from bus.
2.13	Breaker compartment door	Separate, with lockable handle (Design with breaker trolley as the front cover is not acceptable). Door of one panel should not cause hindrance for opening of adjacent panel.
2.14	Inter compartmental connections	
2.14.1	Breaker to bus bar compartment	Through seal off bushings
2.14.2	Breaker to cable compartment	Through seal off bushings
2.15	Pressure relief devices	To be provided for each HV compartment.
2.16	Bus support insulator	Non hygroscopic, track-resistant, high strength, Epoxy insulators (calculation for validating dynamic force withstand capability to be submitted during detailed engineering)
2.17	Fixing arrangement	Doors – Concealed hinged, door greater than 500mm shall have minimum three sets of hinges Covers – SS bolts Gasket - Neoprene Gasket arrangement shall be Provided between panels.
2.18	Required HV cable termination height in the cable compartment	650mm (Minimum) for 11KVfrom bottom of the panel
2.19	Panel Base Frame	Steel base frame as per manufacturer's standard.
2.20	Handle	Removable bolted covers with "C" type handle for cable chamber and busbar chamber. Panel no/identification to be provided on cable box cover also.

2.21	**Circuit Breaker**	
2.22	Type	Truck type Only.
2.23	Mounting	On withdrawable truck or trolley, with locking facility in service position.
2.24	Switching duty	a) Transformer (oil filled and dry type) b) Motor (of small and large ratings – DOL starting with starting current 6 to 8 times the full load current & with a maximum 3 starts per hour) c) Underground cable with length up to 10km.
2.25	Interrupting medium	Vacuum
2.26	Breaker operation	Three separate identical single pole units operated through the common shaft.
2.27	Operating mechanism	Re-strike free, Trip free, with electrical anti-pumping feature
		One O-C-O operation possible after failure of power supply to the spring charging motor.
		Motor wound, spring, charged, stored energy type with manual charging facility
2.28	Breaker Indications and push buttons	
2.28.1	ON/OFF/Emergency trip push button	a) Manual / mechanical b) Emergency Off push button will be provided with a protective flap. c) Mechanical ON shall have padlocking facility.
2.28.2	Mechanical ON-OFF indication	On breaker trolley front
2.28.3	Operation counter	On breaker trolley front
2.28.4	Test-service position indicator	On breaker trolley front
2.28.5	Mechanism charge/discharge indicator	On breaker trolley front
2.29	Breaker positions	Service, test and isolated
2.30	Inter changeability	Possible, only with breaker of same rating
2.31	Breaker control	On panel front only
2.32	Handle	Breaker shall be provided with handles for easy handling, rack in-out operation and manual spring charging as applicable.
2.33	Type of terminal connector at breaker limbs	Jaw Type/Finger type Contacts for breaker limb connection with bus and cable end
3.0	**Functional Requirements**	
3.1.0	Interlock and safety devices	
3.1.1	Breaker compartment door opening	Opening of door and rack out to test / isolated position should be possible with breaker in OFF position only.
3.1.2	Breaker compartment door closing	Should be possible even when breaker is in isolated position
3.1.3	Racking mechanism safety interlock	Mechanical type
3.1.4	Racking in or out of breaker inhibited	When the breaker is closed
3.1.5	Racking in the circuit breaker inhibited	Unless the control plug is fully engaged

3.1.6	Disconnection of control plug inhibited	As long as the breaker is in service position
3.2.0	Additional Requirement	
3.2.1	Exposure to live parts	In case the breaker panel door is required to be opened during a contingency, the personnel should not be exposed to any live parts. Suitable shrouds / barriers / insulating sleeves should be provided.
3.2.3	Operation of breaker	In either service or test position
3.2.4	Closing from local	Only when local/remote selector switch is in local position
3.2.5	Closing from remote	Only when local/remote selector switch is in remote position
3.2.6	Tripping from local	Irrespective of selector switch
3.2.7	Tripping from remote	Irrespective of selector switch
3.2.8	Testing of breaker	In test or isolated position keeping control plug connected
3.3.0	Safety shutters	
3.3.1	Automatic safety shutter for female primary disconnects	To fully cover contacts when breaker is withdrawn to test. Independent operating mechanism for bus bar & cable side shutters, separately pad lockable in closed position.
3.3.2	Label for identification	For bus side and cable side shutters
3.3.3	Warning label on shutters of incoming and other connections	Clearly visible label “isolate elsewhere before earthing” be provided
3.4.0	Breaker electrical operation features	
3.4.1	No. of Trip coil	2 Nos for each breaker. Shunt Trip coil shall operate correctly for all value of voltages between 70% & 110% of rated voltage. Trip coil shall be suitable for Trip circuit supervision relay for monitoring.
3.4.2	Closing Coil	One no. for each Breaker Closing coil shall operate correctly for all value of voltages between 85% & 110% of rated voltage.
3.4.3	Trip circuit supervision	To be given for breaker close and open condition
3.4.4	Trip circuit supervision relay contact	For indication, alarm & to inhibit closing of breaker
3.4.5	Emergency Trip Push button contact	Wired directly to trip coil (wired to Master trip relay if second trip coil provided)
3.4.6		Wired to inhibit closing of breaker
3.4.7	Master trip relay contact	Wired to inhibit closing of breaker
3.4.8	DC Control supply bus in all panels	Fed by two DC Incoming source in bus coupler panel with auto changeover facility
3.4.9	PT supply bus in all panels	Fed normally by Bus PT with automatic changeover facility to incomer line PT
4.0.0	**Surge suppressors**	
4.1.0	Provision	To be provided in all panels except bus coupler and BPT
	Type	Gapless, metal oxide type
5.0.0	**Current Transformers**	

5.1.0	Type	Shall be cast resin type with insulation class of E or better.
	Rating and technical particulars	For all other feature refer technical particulars.
	CBCT	If specified, bidder shall clearly mention his proposal for mounting the same.
6.0.0	**Potential Transformer**	
6.1.0	Type	Shall be cast resin type with insulation class of E or better.
6.1.1	Mounting	It shall be mounted on a withdrawable carriage. Mounting of PT on the breaker truck is not acceptable. In case it is mounted on the panel rear top, access to the PT and the reinforcement in the panel for allowing a person to stand should be provided.
6.1.2	Neutral	The HV neutral connection to earth shall be easily accessible for disconnection during HV test.
7.0.0	**Feeder and Bus Earthing**	
7.1.0	Earthing arrangement	Through separate earthing truck for bus and feeder.
7.1.1	Short time withstand capacity of earthing truck	Equal to rating of breaker. Refer technical parameters.
7.1.2	Operation from front	Mechanically operated by separate switch.
7.1.3	Interlocks	To prevent inadvertent closing on the live circuit, with padlocking arrangement to lock truck in close or open position.
8.0.0	**Equipment Earthing**	
8.1.0	Material of earthing bus	Copper
8.2.0	Earth bus joints	All bolted joints in the bus will be made by connection of two bolts.
8.3.0	Rating	Sized for rated short circuit current for 3 seconds.
8.4.0	Enclosure and non-current carrying part of the switchboard/components	Effectively bonded to the earth bus
8.5.0	Hinged doors	Earthed through flexible copper braid
8.6.0	Circuit breaker frame / carriage	Earthed before the main circuit breaker contacts/control circuit contacts are plugged in the associated stationary contacts.
8.7.0	Metallic cases of relays, instruments and other LT panel mounted equipment	Connected to the earth bus by independent copper wires of size not less than 2.5 sq mm with green color insulation. For this purpose LT compartment should have a clear designated earth bus to which earth connections from all components are to be connected.
8.8.0	CT & PT neutral	Earthed at one place at the terminal blocks through links.
9.0.0	**Meters**	
9.1.0	Meters	Flush Mounted
9.2.0	Ammeter	Taut band, moving iron type
9.2.1	Size	96 X 96 mm
9.2.2	Panels where to be provided	All panels except Bus PT
9.2.3	Ammeter selector switch	To be provided

9.2.4	Accuracy class	1.0
9.3.0	Voltmeter	Taut Band, moving iron type
9.3.1	Size	96 X 96 mm
9.3.2	Panels where to be provided	Incomer and bus PT panel
9.3.3	Voltmeter switch	To be provided
9.3.4	Accuracy class	1.0
9.4.0	Energy meter	To be provided alongwith complete communication arrangement. Refer Chapter 35 for technical specification.
9.4.1	Panels where to be provided	All panels except bus coupler and bus PT
9.4.2	Accuracy Class	As per BSES Requirement
9.5.0	Multi functional meter – 3Phase 4 wire Connection	Scrolling facility with LCD display for parameters like power factor, KW, KVA ampere etc. accuracy 0.5 with RS 485 port.
9.6.0	Power Quality Analyser	To be provided alongwith complete communication arrangement. Make and model no. shall be Schneider make PM 8000 Series
9.6.1	Panels where to be provided	All incomer panels
10.0.0	**Indication**	
10.1.0	Indication	Flush mounted
10.2.0	Lamps	High intensity, clustered LED type
10.2.1	Breaker ON	Red
10.2.2	Breaker Off	Green
10.2.3	Spring Charged	Blue
10.2.4	DC Control supply fail	Amber
10.2.5	AC Control supply fail	Amber
10.2.6	Auto trip	Amber
	Service position	White
	Test position	White
10.2.7	Heater circuit healthy	Yellow (Indication with integrated push button for checking)
10.2.8	Trip circuit healthy	White
10.2.9	PT supply as applicable	R, Y, B
10.3.0	Hooter with isolation switch	Hooter for AC and Alarm for DC supply failure
11.0.0	**Selector switches and push buttons**	
11.1.0	Selector switch	Flush mounted on LV compartment door, with shrouded terminals
11.2.0	TNC Switch with pistol grip	Lockable spring return to normal position
11.3.0	Local / SCADA selector switch	As Per BSES Requirement
11.5.0	Selector switch for ammeter	6 way 7 position
11.6.0	Selector switch for voltmeter	6way 7 position
11.7.0	Rotary ON/Off switches	For heater / illumination circuit
11.7.1	Rating	16 A
11.8.0	Push button	Flush mounted on LV compartment door, with shrouded terminals
11.8.1	Emergency trip push button	Red color with stay put

11.8.2	Accept push buttons	Black color – Trip alarm / DC fail alarm
11.8.3	Reset push buttons	Yellow color – Trip alarm / DC fail alarm
11.8.4	Test push buttons	Blue color – for heater circuit healthy
11.8.5	Rating	10 A
12.0.0	**Internal Wiring**	
12.1.0	Internal wiring	1100V grade PVC insulated (FRLS) stranded flexible copper wire.
12.2.0	Size	2.5 sq. mm for CT circuit, 1.5 sq mm for PT and 1.5 sq. mm for control circuit
12.3.0	Colour code	
12.3.1	PT	R ph – Red Y Ph – Yellow B Ph – Blue Neutral – Black
12.3.2	CT	R ph – Red Y Ph – Yellow B Ph – Blue Neutral - Black
12.3.3	Others	DC – grey, AC-black, Earth – green
12.4.0	Ferrules	At both ends of wire
12.4.1	Ferrule type	Interlocked type (one additional red color ferrule for all wires in trip circuit)
12.5.0	Lugs	Tinned copper, pre-insulated, ring type,fork type and pin type as applicable. CT circuits should use ring type lugs only.
12.6.0	Spare contacts of relays, timers etc	Wired up to the terminal blocks
12.7.0	Wiring enclosure	Plastic channels, inter panel wiring through PVC sleeves or suitable grommets.
12.7.1	Inter panel wiring	Wiring with ferrule to be terminated in the adjacent shipping section will be supplied with one end terminated and the other end bunched and coiled.
13.0.0	**Terminal Blocks (TB)**	
13.1.0	Rating and Type	1100V grade, moulded piece, stud type screw driver operated terminals complete with insulated barriers, washers, nuts and lock nuts.
13.2.0	Marking and covers	White fiber markings strip and clear plastic, slip-on/clip-on terminal covers to be provided.
	Disconnecting Facility	To be provided in CT and PT terminals.
	Shorting and Earthing Facility	To be provided in CT Terminals
13.3.0	Spare terminals	20% in each type of TB row
13.4.0	TB shrouds & separators	Moulded non-inflammable plastic material
13.5.0	Clearance	
13.5.1	Clearance between 2 sets of TB	100 mm min.
13.5.2	Clearance with cable gland plate	250 mm min
13.5.3	Clearance between AC / DC set of TB	100 mm min
13.6.0	Test Terminal blocks	Screw driver operated stud type for metering circuit

14.0.0	**Relays and protection**	
14.1.0	Technology and Functionality	Numerical, microprocessor based with provision for multifunction protection, control, metering and monitoring.
14.1.1	Mounting	Flush Mounting, IP 5X
14.1.2	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.
14.1.3	Programming and configuration	Relay shall utilize a user friendly setting and operating multi-lingual software in windows environment with menus and icons for fast access to the data required. Programming software and communication cord for offered relays should be included in scope of supply.
14.1.4	SCADA Interface port	RS 485 rear port for interfacing with SCADA on IEC 61850 protocol. If relays have any other rear port, hardware/software required to achieve the above said protocol for compatibility will be in supplier's scope.(IF any required converter needs to be consider by vendor).
14.1.5	PC Interface port	Front port (preferably serial) for configuration/data download using PC. Cost of licensed software and communication cord, required for programming of offered protection relays shall be included in the cost of switchgear.
14.1.6	User Interface	An alphanumeric key pad and graphical LCD display with backlight indicating measurement values and operating messages. It should be possible to access and change all settings and parameters without the use of PC.
14.1.7	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.
14.1.8	Event and Fault records	Relay shall have the facility of recording of various parameters during event/fault with option to set the duration of record through settable pre fault and post fault time. Relay shall store records for last 10 events and 10 faults (minimum). It should be possible to download records locally to PC or to remote SCADA.
14.1.9	General Features of Numerical Relays	Measurement of Event Recording , Disturbance Recording, 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.
14.1.10	Self diagnosis	Relay shall be able to detect internal failures. A watchdog relay with changeover contact shall provide information about the failure.
14.1.11	Time synchronization	All relays shall be capable of being synchronized with the system clock using SCAD interface and PC.
14.1.12	Digital Input and Digital Output of numerical relays	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 (Incomer , Out

		going, Capacitor Bank , Buscoupler, Station Transformer & Bus PT).
14.1.12	Operation Indicators	LEDs with push button for resetting.
14.1.13	Test Facility	Inbuilt with necessary test plugs for Relays and Meters.
15.1.0	**Protection Relays for 11Kv Incomer panel**	
	Relay 1	3 phase over current and Earth fault protection with IDMT. Definite time and instantaneous characteristics. Relay shall have both directional and non directional features independently.
		Under voltage and overvoltage protection
		PT supervision (fuse failure monitoring)
		Sync Check function
	Relay 2	High Impedance Restricted Earth fault protection.
	Note	Combining functions of Relay -1 and Relay-2 in single relay is not acceptable.
15.1.1	**Protection Relays for 11Kv Bus section panel**	
	Relay 1	Directional 3 phase over current and Earth fault protection with IDMT, Definite time and instantaneous characteristics.. Relay should have Sync check function.
15.1.2	**Protection Relays for 11Kv Outgoing panel**	
	Relay 1	Directional 3 phase over current and Earth fault protection with IDMT, Definite time and instantaneous characteristics.
15.1.3	**Protection Relays for 11Kv Station Transformer panel**	
	Relay 1	Directional 3 phase over current and Earth fault protection with IDMT, Definite time and instantaneous characteristics.
15.1.4	**Protection Relays for Capacitor panel**	
	Relay 1	Directional 3 phase over current and Earth fault protection with IDMT, Definite time and instantaneous characteristics.
		Earth fault protection
		Under voltage and overvoltage protection
		PT supervision (fuse failure monitoring)
	Relay 2	Neutral unbalance relay (voltage based) for each step
		Timer for on time delay (minimum 300seconds)
	Note	Combining of functions of Relay -1 and Relay -2 in single relay is not acceptable.
16.1.0	Auxiliary Relay – General Features	
16.1.1	Auxiliary Relay use for Circuit supervision, trip and timer relays	Static or electromechanical type
16.1.2	Reset mechanism for auxiliary relays	Self reset contacts except for lock out relays.

16.1.3	Reset mechanism for lockout relays	Electrical reset type for all type panel.
16.1.4	Operation Indicators	With hand-reset operation indicators (flags) or LEDs with pushbuttons for resetting.
17.1.0	Auxiliary relays – Requirement	
17.1.1	For each breaker	Anti pumping (94), lockout(86) and trip circuit supervision (74) relays
17.1.2	PT selection relays	To be provided for selection between Bus PT and Line PT of respective sections.
17.1.3	Switchgear with two incomers and bus coupler	Lockout (86) contact of each incoming breakers to be wired in series in closing circuit of other incoming breakers and bus coupler.
17.1.4	Auxiliary relays, coupling relays, transducers etc.	To effect interlocks and to exchange signals of status & control from remote.
17.1.5	**General Requirements for all relays/contactors**	
17.1.6	Auxiliary Supply	220/50VDC. All relays / contactors shall be suitable for continuous operation at 15% overvoltage.
18.1.0	**Space Heaters**	
18.1.1	Space heaters	Thermostat controlled with switch for isolation
18.1.2	Space heater location	Breaker & HV cable compartment to be mounted on a insulator. Heater position in cable compartment should be easily accessible after cable termination. Heater position in breaker chamber shall be accessible with breaker racked-in.
19.1.0	**Switch and sockets**	
19.1.1	Lamp with switch	For LV & cable chamber
19.1.2	Universal type (5/15A) socket with switch	In LV chamber
20.1.0	**Name Plates and Marking**	
	Nameplates	To be provided as per the following description
	Equipment Nameplates	a. All equipment mounted on front side as well as equipment mounted inside the panels shall be provided with individual name plates with equipment designation engraved. b. All front mounted equipment shall be also provided at the rear with individual name plate engraved with tag numbers corresponding to the one shown in the panel internal wiring to facilitate easy tracing of the wiring.
	Feeder Nameplates	a. Large and bold name plate carrying the feeder identification/numbers shall be provided on the top of each panel on front as well as rear side. On rear side, nameplate should be provided on frame. b. Rear bottom of each panel shall have a nameplate clearly indicating the following: Customer Name – Project details; PO No and date; Drawing Reference No.etc.
	Rating Plate	Following details are to be provided on Panel and CB rating plate; a. Customer Name – BSES Delhi

		b. P.O.No. and Date – As per respective PO.
	Material	Non – rusting metal or 3 ply lamicoid. Nameplates shall be black with white engraving lettering. Stickers are not allowed.
	Fixing	All nameplates / rating plates shall be riveted to the panels at all four corners. Bolting / screw2ing is not acceptable.
	Markings	Each switch shall bear clear description identifying its function. Similar inscription shall also be provided on each device whose function is not other wise identified. If any switch or device does not bear this inscription separate nameplate giving its function shall be provided for it. Switch shall also have clear inscription for each position indicating e.g. Trip – Neutral close, ON-OFF etc.
21.1.0	**Surface treatment & painting**	
21.1.1	Surface treatment	Sand blasting or by seven tank process
21.1.2	Paint type	Powder coated. Pure polyster base grade A structure finish
21.1.3	Paint shade	RAL 7032 for external & internal surface
21.1.4	Paint thickness	Minimum 50 microns
22.1.0	**Inspection and testing**	
22.1.1	Type Tests	The product must be of type tested quality as per all tests in Indian standards
22.1.2	Type test report validity period	Last five years from date of bid submission
23.1.0	Stage and Final Inspection	All the Qty. of Panels will be inspected by BSES as per approved QAP.
23.1.1	Acceptance & routine test	As per the specification and relevant standards. Charges for these tests shall be deemed to be included in the equipment price.
		The Owner/owner reserves the right to witness all the tests.
23.1.2	Notice to Owner for conducting type tests.	At least three weeks in advance.
23.1.3	Test reports of acceptance and routine tests before dispatch for approval	To submit six copies
23.1.4	Submission Of QAP	QAP will be submitted by suppliers with submission of Schematic Drawings.
24.1.0	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
25.1.0	Training	Training on relays and equipment operations shall be provided to the officials of BRPL will be in the Scope of Suppliers.
26.1.0	**Approved Make of components for 11KV Switchgear Panel**	
26.1.1	Numerical Relays	ABB / SCHNEIDER / SIEMENS Numerical relays used in complete switchboard should be of same make.

26.1.2	Auxiliary Electromechanical Relays	ABB / Alstom / Schneider / Siemens
26.1.3	Contactor / Auxiliary Relays	Schneider Electric / Siemens / ABB
26.1.4	Analog Ammeter / Voltmeter	AE / Rishabh
26.1.5	Indication LEd , Lamp	Teknic/ Siemens
26.1.6	Push Button	Teknic
26.1.7	Field Terminal Block	Phoneix / Elemex / Connect well
26.1.8	MCB	Schneider / Siemens / ABB
26.1.9	Hooter	Alan
26.1.10	Panel Light	Philips / Bajaj / Surya
26.1.11	Power Socket	Anchor / Reputed make
26.1.12	Multifunction Meter	Rishab
26.1.13	Wires for wiring	KEI / Finolex / Polycab
26.1.14	Test Terminal Block	Areva / IMP / Nelster
26.1.15	Control Switch	Areva / Switron
26.1.16	Instrument Transformers	ECS / Pragati / Kappa / Narayan power tech
26.1.17	Surge Arrestor	Oblum / Lamco / Raychem
26.1.18	Energy Meter	HPL (Grid Meter for BRPL)
26.1.19	Vacuum interrupter make	Schneider, Siemens , BEL,BHEL,ABB , CGL & L&T.

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.

Volume – I Technical Specification for 11KV Indoor Switchgear

ANNEXURE – B

GUARANTEED TECHNICAL PARTICULARS (DATA BY OWNER)

1.0.0	**Switchgear**	
1.1.0	Type	Metal clad, air insulated with VCB type circuit breaker
1.2.0	Service	Indoor
1.3.0	Mounting	Free standing, floor mounted
1.4.0	System voltage	11KV
1.5.0	Voltage variation	+ / - 10%
1.6.0	Frequency	50HZ + / - 5%
1.7.0	Phase	3
1.8.0	Rated voltage	12KV
1.9.0	Rated current @ 50 DEG C ambient	As per SLD
1.10.0	Short time rating for 3 sec.	26.3KA
1.10.1	Insulation level (PF rms / impulse peak)	28 / 75 KV
1.11.0	System ground	Effectively earthed
1.12.0	Enclosure degree of protection	IP – 4X for high voltage compartment and IP – 5X for metering and protection compartment
1.13.0	Bus bar – Main @ 50^0 C ambient	Rating as per SLD, Short time rating as per 1.10
1.14.0	Material	Silver plated/ tinned electrolytic copper
1.15.0	Bus Bar sleeve	Sleeved with shrouds on joints. Tape on joints is not acceptable.
1.16.0	Bus identification	Colour coded
1.17.0	Temperature rise	40DEG C for conventional joints, 55DEG C for silver plated joints
1.18.0	Auxiliary bus bar	Electrolytic grade tinned copper
1.19.0	Auxiliary DC Supply	220V/ 50V DC
1.20.0	Auxiliary AC supply	240V AC 50HZ
1.21.0	Hardware	Stainless steel
1.22.0	Earth bus	Aluminum
1.23.0	Power and control cable entry	From bottom
2.0.0	**Circuit Breaker**	
2.1.0	Voltage class, insulation level, short time rating	As specified for switchgear
2.2.0	Rated current	As per SLD. Use of two breakers in parallel to meet the required current rating shall not be acceptable.
2.3.0	Duty cycle	O – 0.3sec – CO – 3min – CO
2.4.0	Short circuit rating	
2.5.1	AC sym. Short circuit current	26.3KA

2.5.2	Short circuit making current	62.5KA
2.6.0	Operating time	
2.6.1	Break time	Not more than 4 cycles
2.6.1	Make time	Not more than 5 cycles
2.7.0	Range of auxiliary voltage	
2.7.1	Closing	85% - 110%
2.7.2	Tripping	70% - 110%
2.7.3	Spring charging	85% - 110%
2.8.0	No. of spare aux. Contacts of breaker, for owner's use	Minimum 6 NO + 6 NC
2.8.1	No. of spare contacts of service and test position limit switch	2 NO
3.0.0	**Current Transformers (Refer SLD)**	
3.1.0	Voltage class, insulation level, short time rating	As specified for switchgear
3.2.0	Type	Cast resin, window / bar primary type
3.3.0	Class of insulation	Class E or better
3.4.0	Ratio	As per SLD, secondary shall be 1 A
3.5.0	Number of secondary	3
3.6.0	Accuracy class	
3.6.1	Protection core	5P20
3.6.2	Core balance CT	PS
3.6.3	Protection Diff / REF	PS
3.6.4	Metering	0.2s
3.6.5	VA output	As per calculation
3.6.6	Excitation current of PS class CT's	30mA at Vk/4
3.6.7	Primary operating current sensitivity of CBCT's.	5A
4.0.0	**Voltage Transformers (Refer SLD)**	
4.1.0	Type	Cast resin, draw out type, single phase units
4.2.0	Rated Voltage	
4.2.1	Primary	11000/√3
4.2.2	Secondary	110/√3
4.2.3	No of phases	3
4.2.4	No. of secondary windings	2
4.2.5	Method of connection	Star/Star
4.2.6	Rated voltage factor	1.2 continuous, 1.9 for 30 seconds
4.2.7	Class of insulation	Class E or better
4.3.0	Accuracy class	
4.3.1	- Protection	3P
4.3.2	- metering	0.2
4.4.0	Primary and secondary fuses	HRC current limiting type, primary fuse replacement shall be possible with VT in withdrawn position
5.0.0	HV Fuses	
5.0.1	Voltage class	12KV
5.0.2	Rupturing capacity	50KA

5.0.3	Rated current	As per application
6.0.0	**Surge Arrestors**	
6.0.1	Rated voltage	9kV
6.0.2	Maximum continuous operating voltage (MCOV)	7.65kV
6.0.3	Discharge current	10kA
6.0.4	Discharge Class	3

S. NO	DESCRIPTION	OUTGOING
1	**Main Busbar/Jumpers**	
1.1	2000/ 2000 A	0
1.2	2000/1250 A	0
1.3	2000/800 A	1
2	**Vaccum Circuit breakers**	
2.1	VCB - 2000A	0
2.2	VCB - 1250A	0
2.3	VCB - 800A	1
3	**Surge arrester**	3
4	**Epoxy Resin Cast CTs**	
4.1	2000-1600/1-1A , 15VA/0.2S, 15VA/5P20	0
4.2	2000-1600/1-1A, PS, PS	0
4.3	400/1-1A, 15VA/0.2s, 15VA/5P20	3
4.4	800-400/1-1A , 15VA/0.2S, 15VA/5P20 for Cap F	0
5	**Potential Transformer - Single Phase with Fuse - Withdrawable type.**	
5.1	11/v3/110/v3/110/v3 50VA/0.2 , 50VA/3p	0
6	Meters & Switches	
6.1	Digital Ammeter ASS	1
6.2	Digital Voltmeter VSS	0
6.3	MFM 0.2 Class	1
6.4	TNC switch	1
6.5	L/R switch	1
6.6	PB - heater ckt check	2
7	**Numerical Protective Relays with IEC 61850+103 Dual port /communication protocol**	
7.1	Directional O/C and E/F (50, 50N,67,67N,25,79)	1
7.2	REF Relay (64)	0
7.3	Directional O/C, E/F, U/V and O/V (50, 50N, 67,67N, 27, 59,25,79)	0
7.4	Neutral displacement Relay (Voltage based) For each step	0
7.5	PT Monitoring relay	0

8	Auxillary Relays	
8.1	Antipumping	1
8.2	Bkr contact multiplier	1
8.3	Master trip Relay	1
8.4	Trip Circuit Supervision	1
9	Timer for Capacitor switching	0
10	DC fail/ AC fail annunciation	1
11	Indicating lamps	As per spec
12	Hooter	0
13	TTB	1
14	Emergency Trip button	1
15	PT Selection scheme	DDE
16	5A Switch and socket	1
17	Heater	2
18	Earthing Trucks for Bus side	
19	Earthing Trucks for cable side	
20	PQ Analyzer	0
21	Energy Meter - HPL Make	1

BSES

Technical Specification for

11 kV Cables

Conventional - 1CX1000, 3Cx400, 3CX300 and 3CX150 sqmm

Cable in Co-Extruded Duct – 3Cx400 & 3Cx300 sq mm

Specification No: BSES-TS-15-HTC-R0

Rev:		0
Date:		6 Apr 2022
Prepared by	Abhishek Vashistha	
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Approved by	Gaurav Sharma	
	K. Sheshadri	

Index

General Specification

1.0.0 Codes & Standards

The cables shall be designed, manufactured and tested in accordance with the following National Standards and IEC Standards.

National Standards

IS 7098 Part-2	Cross linked polyethylene (XLPE) insulated PVC sheathed cables for working voltages from 3.3 kV up to and including 33 kV.
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.
IS 0462 (Part 1) / 1983	Fictitious Calculation Method for determination of dimensions of protective covering of cables

International Standards

IEC 60183	Guide to the selection of high voltage cables
IEC 60228	Conductors of insulated cables. Guide to the dimensional limits of circular conductors.
IEC 60332 – 3	Tests on electric cables under fire conditions. Part 3: Tests on bunched wires or cables.
IEC 60502 – 2	Power cables for rated voltages from 6 kV (Um = 7.2 kV) up to 30 kV (Um = 36 kV)
IEC 60811 Pts 1 through 5	Common test methods for insulating and sheathing materials of electric cables.
IEC 885 Pts 1 through 3	Electric test methods for electric cables.
IEC 28	International Standard of Resistance for Copper
IEC 332	Test on Electric Cables under fire conditions

2.0.0 Cable Construction Features

This Specification generally covers following types / sizes of TR-XLPE H. T. Cables used in BSES network in Delhi area, mostly under-ground (buried, with chances of flooding by water) or for laying on racks, in ducts, trenches, conduits, and so on.

Note: (Ref.: Table stating Cable sizes given below.)

Cable Code:

As per IS, cable designations comprise of following codes / options, as applicable for this Specification:

(N.A. - Not applicable for Specification)

-	(with Copper conductor)	(N.A.)
A	Aluminium conductor	

2X	XLPE insulation	

W	Steel round Wire armour	(N.A.)
WW	Double steel round Wire armour	(N.A.)
Wa	Non-magnetic round Wire armour	
F	Steel formed wire (strip) armour	
FF	Double steel formed wire (strip) armour	(N.A.)
Fa	Non-magnetic formed wire (strip) armour	(N.A.)
-	(“un-armoured” or without armour)	(N.A.)

Y	PVC outer sheath	

Sr. No.	Description	Conductor Material	Cable Code
1.	11 kV, 3c x 150 sq. mm.	Al	A 2X F Y
2.	11 kV, 3c x 300 sq. mm. (conventional)	Al	A 2X F Y
3	11 kV, 3c x 300 sq. mm. cable in co-extruded Duct	Al	A 2X F 2Y 2Y
4	11 kV, 3c x 400 sq. mm. (conventional)	Al	A 2X F Y
5	11 kV, 3c x 400 sq. mm. cable in co-extruded Duct	Al	A 2X F 2Y 2Y
6.	11 kV, 1c x 1000 sq. mm.	Al	A 2X Wa Y

Description of each item mentioned in the Specification (the text, BOQ, GTP or any site specific requirement) shall be followed, along with IS: 7098 – Part 2.

2.1.1	**Conductor**	a) Electrolytic Grade Stranded Aluminium Conductor b) Grade: H2 as per IS: 8130 / 1984 (For Al) c) Stranded, compacted and circular in shape d) Class 2 e) "Longitudinal Water-Blocking Arrangement" (or water-tight construction or water barrier protection) shall be provided within the Conductor. i) As per manufacturer's procedures, 100 % water-tight conductor shall be achieved. iii) Make & Type of materials to be used (i.e. Water-swellable tapes / yarn / powder, etc.) shall also be stated in the List of Sub-Vendors for pre-order approval. f) All detailed constructional features shall be shown in the cross-sectional drawing.
2.1.2	**Conductor Screen**	Extruded semi-conducting material. (Also refer Cl. 2.1.3.) (Tapes are not acceptable)
2.1.3	**Insulation**	a) Extruded XLPE (Cross-Linked Poly-Ethylene) Insulation, with water-tree retardant (WTR) property b) The required compound used shall be from BSES-approved sub-vendors and not from any other (refer Annexure – C). c) Uniform thickness of insulation shall be within

		the permissible values as per IEC Standards; eccentricity check shall be carried out to ensure this. d) Insulation Color : natural
2.1.4	**Insulation Screen**	a) Freely-strippable semi-conducting screen, which should not require application of heat for its removal. (Refer Cl. 2.1.3.) b) Text "Do not Heat - Freely Strippable" to be printed on insulation screen (at every 600 mm interval). c) Round shape over the outer semi-con shall be within the permissible limits as per IEC standards; Ovality (2% max) check shall be carried out to ensure this. d) Compound used shall be suitable for the operating temperature of the Cable and shall be compatible with the insulation used.
2.1.4A	**XLPE Process**	
2.1.4A-1	11 kV	Dry Cure and Dry Cool process only.
2.1.4A-2	Not in use	
2.1.4A-3	Extrusion	It is mandatory that Conductor Screen, Insulation and Insulation Screen shall be extruded simultaneously, in a Single One-Time Process (i.e. as a triple-head extrusion) to ensure homogeneity of layers over the conductor, and absence of voids.
2.1.4A-4	Make of Compounds for Insulation and Semi-conducting	Any deviation from Approved Makes mentioned in Annexure-C shall not be acceptable, unless the deviation has been specifically approved by BSES during tendering stage
2.1.5	**Water-Swell able Tape**	a) Semi-Conducting Water-Sellable Tape shall be provided, under the copper tape, on each core.

		b) Nominal thickness : 0.3 mm c) Weight: 118 gm / sq. m approx. d) Swell height: ≥ 12 mm in 1 min. e) Compatible to strippable / non-strippable semi-con, over which it is applied.
2.1.6	**Core Identification**	a) For 3-core cables, cores shall be identified by coloured strips (Red, Yellow, Blue), applied helically / longitudinally below the copper tape. The coloured strips shall carry the name of cable manufacturer permanently printed at 1 meter intervals; this is to provide additional identification of manufacturer of the cable.
2.1.6A	Copper Tape	Copper Tape shall be applied helically over the layer formed after application of insulation screen, water-swell able tape and identification strip. Zero negative tolerance in thickness of copper tape
2.1.7	**Filler**	a) All interstices, including center interstices shall be filled by PP filler. b) PP Filler shall be non-hygroscopic, not having any effect on other compounds used, stable at cable temperatures, etc. c) PVC filler is not acceptable. d) Filler is not applicable for single-core cables.
2.1.8	**Binder Tape**	As per manufacturer's standard
2.1.9	**Inner Sheath**	Extruded Inner Sheath of Black PVC type ST-2 (IS 5831)
2.1.10	**Armour**	a) For 3-core Cables : Galvanised Steel flat strip armour b) For 1-core Cables :

		Non-magnetic round wire armour (hard-drawn aluminium wire) c) Minimum area of coverage of armouring shall be 90 % (min.). At any time, the gap between any two adjacent armour strips / wires shall not be more than the width of strip / diameter of wire. d) Zero negative tolerance is for : • Thickness of armour strip • Diameter of armour wire
2.1.11	**Binder Tape**	Rubberised cotton tape
2.1.12	**Outer Sheath**	
2.1.12.1	**For Conventional cable**	a) Extruded outer sheath of PVC (ST-2 as per IS 5831) with termite-repellant and anti-rodent properties. Color - Blue (Outer Sheath shall be FRLS-type, if chosen by purchaser.)
2.1.12.2	**For 3Cx300 & 3Cx400 sq mm CCD cable (Cable in Co-extruded duct)**	a) Inner Layer- Extruded PE compound Type HDPE ST7 (Black)- Thickness 3.00 mm b) Outer Layer- Extruded PE compound Type HDPE ST7 ; Thickness 2 mm, color Orange (IS 557) or other color as per Tender requirement
		b) Shape of the cable over the outer sheath shall be circular, when manufactured / completed. Regular Ovality check shall be carried out at factory, to detect any abnormality. Manufacturing quality shall be such that cable will retain its circular shape, even after it is laid at site.
		c) The Outer Sheath shall be embossed as well as laser printed with following minimum text at a interval of 1 mtr: 1. The voltage designation 2. Type of construction / cable code

		(e.g. A2XFY) 3. Manufacturer's Name and Trade-mark 4. Number of cores and nominal cross-sectional area of conductor 5. Name of buyer / purchaser, 6. Month & Year of manufacturing 7. IS reference, i.e. IS : 7098 8. Batch No. / Lot No. (For traceability purpose, in case of any, in case of any manufacturing defect or otherwise arising in the cable in future.) 9. Purchase Order Number & date 10. Word ' FRLSH ', in case the cable is of FRLSH type. Note: a) Drum No. & Progressive (sequential) length marking shall be provided by Laser Printing at every meter with proper contrast in coloring b) Progressive length marking for every drum shall be starting from zero for every drum.
2.1.13	**Sealing-end Cap at both ends** (for Cables)	Cable both ends (inner and outer end) shall be sealed as per drawing MISC/E/4-1131/1698. One PVC cap with Polyurethane compound shall be provided as primary sealing and heat-shrink end-cap shall form a secondary sealing over the PVC cap.
2.1.14	**Pulling-eye Assembly at one end, Sealing-end cap at other end** (if required as per tender requirement)	A cable pulling-eye assembly as per Drg. No. MISC/E/4-1131/1698 shall be provided at the loose end (outer end) of the cable on each drum. Sealing material shall be filled in inside the spaces / gaps between the pulling-eye assembly and cable outer sheath. Further, a heat-shrinkable sleeve shall be provided over the pulling-eye assembly and outer

		sheath of cable. If pulling eye is required as per tender requirement, sealing end cap shall be required for only one end of cable.
3.0.0	(This number not used.)	
4.0.0	**Testing & Inspection**	Tests shall be carried out in accordance with IS 7098 (Part-2).
	a) Type Tests (IS 7098, IEC)	1) <u>To Qualify in Tender:</u> Cables must be of type tested quality. Type Test Reports shall be submitted for the type, size and rating of cable offered in the bid. For participation in the tender Type Test report shall be submitted from CPRI/ERDA only and shall not be more than 5 years old from the date of tender. If the report is more than 5 years and but less than 10 years old than bidder to submit undertaking that there is no design changes from the Type test conducted. 2) <u>Type Test Required After Award of PO:</u> Type test on one cable drum of each type/rating from any lot shall be conducted at CPRI/ERDA on sample basis as per relevant IS/IEC. Sample shall be sealed by BSES during inspection of cable. This type test is applicable subject to BSES requirement and cost shall be borne by BSES.
	b) BSES QAP (Typical)	In general, all tests mentioned in the BSES QAP (Characteristics – Typical) mentioned in Annexure-F shall be included in the Routine Tests, Type Tests and Acceptance Tests stated above.
	c) Routine Tests	1. Measurement of Electrical Resistance 2. HV Test with power frequency AC voltage 3. Partial Discharge test 4. “Strippability Test” at both the ends of cable for each drum, to check the freely-strippable

		property of the Insulation Screen (outer semi-con). 5. Impulse voltage test of one drum 6. Armour coverage measurement 7. Physical test-Dimensions of each and every layer and components. Test results from the above tests must appear in the documents forwarded by the vendor for Inspection call / waiver.
	d) Inspection	1. The Buyer reserves the right to witness all tests specified on completed cables. 2. The Buyer reserves the right to inspect cables at Sellers works at any time prior to dispatch, to verify compliance with the specifications. 3. In-process (stage inspection) and final inspection call intimation shall be given at 10 days advance to the purchaser along with complete manufacturing scheduled. 4. Minimum lot size of Cables to be offered for inspection shall be mutually agreed between Purchaser and Vendor, before placing the order. Vendor shall raise inspection call only after a minimum lot size is ready and with due factory routine tests already carried out.
	e) Acceptance Tests	Acceptance Tests shall be conducted as per Cl. 18.2 of IS 7098 (Part-2) and the approved Quality Assurance Plan (QAP) for each lot of cables. Following tests shall also be carried out during the Acceptance Tests : a) "Wafer Boil Test" for checking integrity of semi-conducting layers-in each lot. b) "Void-and-contamination Test" for the Insulation-in each lot c) "Strippability Test" at both the ends of cable for each drum, to check freely-strippable property of

		the Insulation Screen (outer semi-con) - in each lot. d) "Water Penetration Test (WPT)", as per applicable IEC standards, to check adequacy of water-blocking arrangement provided inside the conductor -in each lot. e) Impulse voltage test – in each lot sample basis. f) Heating Cycle along with potential once per PO on sample basis.
	f) Test Certificates (TC)	Three sets of complete Test Certificates (Routine tests and Acceptance tests) shall be submitted along with the delivery of cables. Soft copy of the TCs shall be separately e-mailed to the Purchaser. **Note :** Make/grades of critical materials (such as, for conductor screen, insulation, insulation screen, etc.), actually used during manufacturing of cables for order-on-hand, shall be clearly stated in the TCs forwarded by the Manufacturer, enabling references in future.
5.0.0	**Drawing, Data and Manuals**	a) Refer Annexure-A regarding Document Submission. b) Cross-Sectional Drawing shall show every feature of construction, including the thickness / diameter over every layer. This drawing shall also state the text to be embossed over the outer sheath - i.e. type/size, etc. of the cable, drum no./lot no., sequential marking over every meter, printing text on outer semi-con ("Do Not Heat-Freely Strippable"), font sizes to be used, additional text, if any, etc. Also, drum details, markings to be made on both sides of the drum, and so on.

5.0.1	Documents to be submitted along with bid	The vendor shall submit : a) Cross-sectional drawing b) GTP (all data to appear) c) Type Test certificates d) Fault Level Calculation for armour and copper tape screen e) Complete Cable Catalogue and Manual f) Armour Coverage Calculation g) Raw materials make list
5.0.2	Documents after award of contract	Within 15 days, the seller has to submit four sets of above-mentioned drawings, along with one soft copy for buyer's approval.
5.0.3	Final As-Built Drawings	One soft copy of all documents, including type & routine test certificates.
6.0.0	**Drum length & tolerance**	Cable length per drum
6.0.1	a) 11 kV, 3Cx150 sqmm b) 11kV , 3Cx300 sqmm c) 11 kV, 1Cx1000 sqmm d) 11kV , 3Cx400 sqmm	300 mtr +/- 5% or 500 mtr +/- 5% (100% of the ordered quantity) as per tender requirement
6.0.2	Overall tolerance	- 2 % for the total cable length for the entire order.
6.0.3	Short length of cables	Manufacturer shall take prior approval from Purchaser for any supply of short length cables. For 11 kV cables, minimum acceptable short length cables can be 250 meter. In any case, manufacturer shall not put two cable pieces of different short lengths in same cable drum.

		Only one short length drum shall be accepted and in last lot only.
7.0.0	**Packing, Shipping, Handling & Storage**	
	a) Packing	a) Both the ends of the cables shall be properly sealed to prevent any deterioration of the cable, due to ingress of water, etc. b) Cable inner end (starting end) shall project, outside the completely wound cable, by sufficient length enabling verify cable details, including the initial length marking. c) Similarly, outer end of the cable shall be saddled / secured to the drum properly to prevent any external damage to the end at any time. d) Before putting on wooden planks, protective covers (thick plastic sheets, etc.) shall be secured over the wound cable, to avoid any abrasion by wooden planks, over the outer sheath of the cable. e) After providing the protective covers, the cable drums shall be finally closed by wooden planks (with saddles), without leaving any gaps between the planks; i.e. 100 % covering shall be ensured.
	b) Drum Identification Markings:	Direct marking (i.e. text painting through stencils, etc.) shall be done on the drums, instead of attaching labels, which may be misplaced/lost over a period of time. a) Drum identification number b) Cable voltage grade c) Cable code (e.g. A2XFY, etc.) d) Number of cores and cross sectional area e) Cable quantity, i.e. cable length (meter)

		f) Purchase order number & date g) SAP item code h) Total weight of cable and drum (kg) i) Manufacturer's Name j) Buyer's name k) Month & Year of Manufacturing l) Direction of rotation of drum m) Cable length final end-markings (i.e., reading at the inner end and reading at the outer end, just before packing, shall be marked on the drum.)
	c) Shipping information	The seller shall give complete shipping information concerning the weight, size of each package
	d) Transit damage	The seller shall be responsible for any transit damage due to improper packing.
	e) Type of Drum	Wooden or Steel drums as per tender requirement (all the drums shall be non returnable except otherwise mentioned in the tender), as per relevant IS / IEC.
	f) Cable Drum handling	The drums shall be with M.S. spindle plate (with nut-bolts) of adequate size to suit the spindle rods, normally required for handling the drums, according to expected weight of the cable drums.
8.0.0	**Quality Assurance Plan (QAP)**	
8.0.1	Vendor's QAP	Manufacturer shall submit QAP in line with BSESQAP (Annexure-F) for purchaser's approval before starting of manufacturing which is mandatory
8.0.2	Inspection Points	As per BSES approved QAP and special BSES requirement if any to cross check the product quality. Seller must have to meet the special requirement of BSES during inspection.
9.0.0	**Progress Reporting**	

9.0.1	Outline Document	To be submitted for purchaser's approval for outline of programmes for production, stage-inspection, testing, final inspection, packing, dispatch and documentation.
9.0.2	Detailed Progress Report	To be submitted to Purchaser once a month containing : i) Progress on material procurement ii) Progress on fabrication (as applicable) iii) Progress on assembly (as applicable) iv) Progress on internal stage-inspection v) Reason for any delay in total programme vi) Details of test failures, if any, during manufacturing stages. vii) Progress on final box-up Constraints / Forward Path
10.0.0	**Deviation**	a) Deviations from this specification shall be listed separately by bidder clause wise (format given in Annexure- H) along with optional offer and has to submit the list along with bid/quotation. BSES will review the deviations and if BSES is agreed with the deviation, seller has to take written confirmation from BSES on deviation during tender evaluation. b) In the absence of any separate list of deviations from the bidders with bid as well as written confirmation from BSES on deviations, it will be assumed by the Buyer that the Seller complies with the Specification fully. c) Any deviations mentioned in any other submitted bid documents (i.e.in filled GTP, Catalog, BSES old approval, buyer's/seller's standards etc.) by seller without separate deviation sheets will not consider as a deviation from this tech spec at any stage of contract.

Annexure – A

Scope, Documentation and Delivery schedule

Document/Drawing submission shall be as per the matrix given below:

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

S.No.	Detail of Document	For Tender	For Approval/Review	Final Submission
1	Guaranteed Technical Particulars (GTP)	Required	Required	Required
2	Deviation Sheet, if any	Required	Required	Required
3	Detailed cross sectional drawing of cable and drum	Required	Required	Required
4	Installation Instructions		Required	Required
5	Manual/Catalogue	Required	Required	Required
6	Cable de-rating factors		Required	Required
7	Type test reports of offered type and rating of cable	Required	Required	Required
8	BIS certificate	Required		
9	Make of Raw Materials	Required	Required	Required
10	Inspection and test reports, carried out in manufacturer's works			Required
11	Routine Test Certificates			Required
12	Test certificates of all the raw materials			Required

Annexure - B

GUARANTEED TECHNICAL PARTICULARS (GTP)

Note:

1) For every type / size of cable, every data shall be mentioned.
2) Seller may submit separate GTP for every type / size of cable, as suitable.
3) GTP requirements are generally as per IS: 7098 (Part-II).
4) GTP shall be read in line with purchaser's Project Site Specific Requirement.

Sr. No.	Description	Buyer's requirement	Unit	Seller's Data
1.0	Purchase Req. No.	-		
2.0	Guarantee Period (Min.)	60 Months (from date of commissioning) / 66 Months (from date of receipt at purchaser's store) whichever is earlier		
3.0	Applicable IS / IEC Standard followed by vendor	IS 7098 Part-2 / IEC 60502-2		
4.0	Make	-		
5.0	**Type** (as required by purchaser)			
	a) 11 kV, 3c x 150 sq. mm.	A2XFY		
	b) 11 kV, 3c x 300 sq. mm.	A2XFY		
	c) 11 kV, 3c x 300 sq. mm. CCD	A2XF2Y2Y		
	d) 11 kV, 3c x 400 sq. mm.	A2XFY		
	e) 11 kV, 3c x 400 sq. mm. CCD	A2XF2Y2Y		
	f) 11 kV, 1c x 1000 sq. mm.	A2XWaY		
6.0	**Voltage Grade**			
	a) 11 kV, 3c or 1c	6.35 / 11	kV	
7.0	Maximum Conductor temperature			
A	Continuous	90	deg. C	
B	Short time	250	deg. C	
8.0	**Conductor**	Compacted, Circular, Water tight construction is mandatory		

Technical Specification for 11 kV Cables (1CX1000,3Cx400, 3CX300 and 3CX150 sqmm)

A	Material and Grade	As per Cl. 2.1.1		
B	Size	As shown under 5.0 above		
C	Wires in each conductor	As per Table 2 of IS 8130	Nos.	
D	Conductor Shape	As per Cl. 2.1.1 c		
E	Dia. of wires in each conductor before compaction	Manufacturer Standard	Mm	
F	Diameter over conductor		Mm	
G	Maximum Conductor resistance at 20 ° C			
	a) 11 kV, 3c x 150 sq. mm.	0.2060	ohm/km	
	b) 11 kV, 3c x 300 sq. mm.	0.1000	ohm/km	
	c) 11 kV, 3c x 400 sq. mm.	0.0778	ohm/km	
	d) 11 kV, 1c x 1000 sq. mm.	0.0291	ohm/km	
H	Longitudinal Water Blocking Arrangement within conductor	Is it provided and shown in the cross-sectional drawing? (Yes / No)		
I	Short circuit current-carrying capacity of conductor		kA for 1 sec.	
9.0	**Conductor Screen** (inner semi-con)			
A	Material & type	As per Cl. 2.1.2		
B	Thickness (min)	0.50	Mm	
C	Diameter over conductor screen		Mm	
D	Make and grade of semi-conducting compound			
10.0	**Insulation**			
A	Insulation Material	As per Cl. 2.1.3		
B	Nominal thickness			
	a) 11 kV, 3c or 1c	3.6	Mm	
C	Minimum thickness			
	a) 11 kV, 3c or 1c	3.14	Mm	
D	Diameter over Insulation		Mm	
E	Make and grade of Insulation compound			
F	Eccentricity	As per IEC standards	%	
G	Water-tree retardant property	Required		
11A.	**Insulation Screen** (outer semi-con)			
a.	i) Thickness of freely strippable Semi conducting screen	0.50	Mm	
	ii) Make and grade of semi-conducting compound			
	iii) Printing	As per Cl. No. 2.1.4 (Yes / No)		

	iv) Ovality of the core (max)	2	%	
b.	Diameter over Insulation Screen (approx.)		Mm	
11B.	**Water-Swellable Tape** (if required by Purchaser)			
	a) Thickness b) Weight c) Swell height d) Compatible to strippable / non-strippable semi-con, over which it is applied. e) Make & Grade f) Pre-slitted packed tapes from sub-vendors approved by BSES	a) 0.3 mm b) 118 gm / sq. m c) ≥ 12 mm in 1 min. d) Yes / No e) Pl. state f) Yes / No		
11C.	**Cable Core identification** a) By coloured strips over cores applied helically / longitudinally b) Manufacturer's name shall be permanently printed on the strips, at close intervals.			
11D.	**Copper Tape**			
	i) Dimensions	a) Thickness : 0.06 + 5 % b) Width : 50 mm C) Overlap: 10% d) no negative tolerance in thickness of copper tape	Mm	
	ii) Fault current-carrying capacity of copper tape	Manufacturer's Standard (Calculation sheet shall be attached)	… kA for … sec.	
11E.	Diameter over laid up core (approx.)		Mm	

Technical Specification for 11 kV Cables (1CX1000,3Cx400, 3CX300 and 3CX150 sqmm)

12.0	**Filler** (Material and type)	As per Cl. 2.1.7 (Specify no. & size of filler at center & core interstices)		
	a) 11 kV, 3c x 150 sq. mm.			
	b) 11 kV, 3c x 300 sq. mm.			
	c) 11 kV, 3c x 400 sq. mm.			
	d) 11 kV 1core	Not applicable		
12A.0	**Binder Tape**	over laid-up cores		
13.0	**Inner Sheath**			
A	Material and type	As per Cl. 2.1.9		
B	Minimum thickness			
	a) 11 kV, 3c x 150 sq. mm.	0.6	Mm	
	b) 11 kV, 3c x 300 sq. mm. (conventional & CCD)	0.7	Mm	
	c) 11 kV, 3c x 400 sq. mm. (conventional & CCD)	0.7	Mm	
	d) 11 kV, 1c x 1000 sq. mm.	0.7	Mm	
C	Approx. dia. over inner sheath		Mm	
14.0	**Armour**	as per purchaser's requirements		
A	Material			
	a) 11 kV, 3c	G. I. Strip	No.	
	b) 11 kV 1c	non-magnetic wire armour (Aluminium wire)	No.	
B	Armour – Wires a) Diameter of wire b) Number of wires (min.)	As per Table 6 of IS 7098 Part-2 (zero negative tolerance for diameter)	mm. no.	
C	Armour – GI strips a) Width of strip & Thickness of strip b) Number of strips (min.)	a) 6.1 x 1.4 (zero negative tolerance for thickness) b) Vendor to specify	mm no.	
D	Approx. Equivalent Area		sq. mm.	
E	Area covered by armour	Min. 90 % Calculation shall be attached.	%	
F	Dia. over armour - approx.		Mm	
G	Fault current carrying capacity of armour	Calculation sheet shall be attached.	… kA for … sec.	
15.0	**Outer Sheath**			
A	Material and type	As per Cl. 2.1.12		

B	Thickness (min.)	** As per Table-5 of IS 7098 Part-2		
	a) 11 kV, 3c x 150 sq. mm.	**	mm	
	b) 11 kV, 3c x 300 sq. mm. Conventional cable	**	mm	
	c) 11 kV, 3c x 400 sq. mm. Conventional cable			
	d) 11 kV, 1c x 1000 sq. mm.	**	mm	
	e) 11 kV, 3c x 300 sq. mm. CCD cable	As per Cl. 2.1.12		
	f) 11 kV, 3c x 400 sq. mm. CCD cable			
C	Color	As per Cl. 2.1.12		
D	Embossing (details as per Cl. 2.1.12)	Yes		
E	FRLS Properties	As per customer's requirement		
16.0	Approx. overall diameter		mm	
17.0	Standard drum length with tolerance			
	a) 11 kV, 3Cx150 sqmm b) 11kV , 3Cx300 sqmm conventional or CCD c) 11kV , 3Cx400 sqmm conventional or CCD d) 11kV , 1Cx1000 sqmm	500 mtr +/- 5% or 300 mtr +/- 5%	meters	
17A	Overall order tolerance-~~{R1}~~	- 2 % for the total cable length for the entire order.		
18.0	**Cable Drum**			
a.	Type of drum	Wooden/ Steel non returnable (Specify the relevant IS / IEC followed for drum design)		
b.	Markings on the drum (as per Cl. 7.0.0)	On both faces		
18A.0	**Cross-Sectional Drawing** (ref. Cl. 5.0.0)	Is drawing submitted, showing every feature of constructions?		

		(Yes / No)		
19.0	a. Sealing-end Cap (provided at the both Ends)	Yes/No Is manufacturer's / Sub-Vendor's drawing submitted? (Yes / No)		
	b. Pulling Eye at one end and Sealing-end Cap provided at other end	Yes/No Is manufacturer's / Sub-Vendor's drawing submitted? (Yes / No)		
20.0	**Weights**			
	a) Net weight of cable (approx.)		kg / km	
	b) Weight of empty drum	500 mtr/300 mtr	Kg	
	c) Weight of Cable with drum	500 mtr/300 mtr	Kg	
	d) Size of Drum	500 mtr/300 mtr	mm	
	e) Drawing of Drum	Required	EA	
21.0	Continuous current rating for standard I. S. condition laid Direct			
	a) In ground 30° C		Amp	
	b) In duct 30° C		Amp	
	c) In air 40° C		Amp	
22.0	(not used)			
23.0	Electrical Parameters at Maximum Operating temperature:			
A	AC Resistance		ohm / km	
B	Reactance at 50 c/s		ohm / km	
C	Impedance		ohm / km	
D	Zero sequence impedance		ohm / km	
E	Positive sequence impedance		ohm / km	
F	Negative sequence impedance		ohm / km	
G	Capacitance		micro-farad / km	
H	Conductance		Amperes per volts	
I	Inductive susceptance		mho	
J	Capacitive susceptance		ohms	
24.0	Recommended minimum bending radius	12 x O. D.	mm	

Technical Specification for 11 kV Cables (1CX1000,3Cx400, 3CX300 and 3CX150 sqmm)

25.0	De-rating factor for following Ambient Temperatures :	Ground / Air		
	a) At 30° C			
	b) At 35° C			
	c) At 40° C			
	d) At 45° C			
	e) At 50° C			
26.0	Group factor for following numbers of cables laid :	Touching Trefoil		
	a) 3 Nos.			
	b) 4 Nos.			
	c) 5 Nos.			
	d) 6 Nos.			
27.0	Recommended pressure for laying cable using power winch	30 N / mm2	N / sq. mm.	
28.0	Process of Cross-linking of Polyethylene			
	a) 11 kV, 3c or 1c	Dry Cure process and Dry Cooling only		
29.0	**Type test** (TTR - Type Test Report)	Is copy of latest valid TTR for respective sizes enclosed? (Yes / No)		
30.0	**Quality Assurance Plan** (QAP)	Is QAP Format (Annexure-F), duly filled in and enclosed? (Yes / No)		
31.0	**List of Sub-Vendors** for construction items (Annexure-C)	Is this list enclosed for BSES approval? (Yes / No)		

Annexure - C

List of Sub-Vendors for critical items

Vendor/Bidder to state sub-vendors' names for other items, wherever approved names are not mentioned, for purchaser's approval during tendering stage else purchaser shall impose as per their requirement and bidder to follow the same in post-order stages.

Ser. No.	Raw Materials		Name of the Make
1.	XLPE Compound	1	Dow Chemicals , U.S.A.
		2	Borealis , Sweden
		3	Hanwha , South Korea
2.	Semi-Conducting Compound	1	Dow Chemicals, U.S.A.
		2	Borealis , Sweden
		3	Hanwha , South Korea
3.	Conductor Water-Blocking tapes / yarn	1	Lantor
		2	Geca
		3	Miracle
		4	Scapa
		5	Sneham International
4.	Water-Swellable Tapes (Pre-slitted)	1	Lantor
		2	Geca
		3	Miracle
		4	Scapa
		5	Sneham International
5.	Aluminium Rod	1	Bharat Aluminium Co. Ltd. (BALCO)
		2	Hindustan Aluminium Co. Ltd. (HINDALCO)
		3	National Aluminium Co. Ltd. (NALCO)
		4	Vedanta (Sesa Sterlite)

Ser. No.	Raw Materials		Name of the Make
6.	Copper Tape	1	Aggarwal Metal
		2	Indian Smelting
		3	Luvata Swedan
		4	Outokumpu Copper Strip AB, Swedan
7	Galvanised Steel Wires / Strips	1	Tata
		2	Balaji
		3	Systematic
		4	Mica Wires Pvt. Ltd.
		5	Bansal Industries
8	PVC Compound	1	Kalpana
		2	Universal
		3	SCJ Plastic
		4	Sriram Polytech
		5	Shri Ram Vinyl, Kota
9	P. P. Fillers	1	Vijoy Polymers
		2	Yash Polymers
		3	AVSL Industries
10	Core Identification Tape	1	AVSL Industries
		2	Yash Polymer
		3	Vijoy Polymers
11	PE Compound	1	Borealis
		3	Shakun
		4	Kalpana

Annexure - D

Service Conditions

(Atmospheric / Soil conditions at Site)

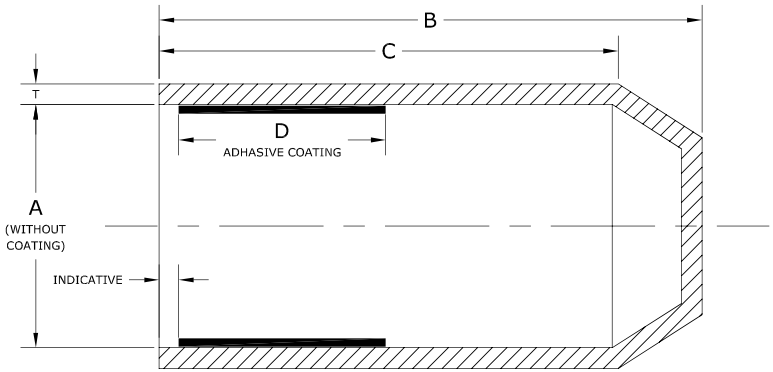
B.	**Delhi**	
a)	Average grade atmospheric condition	Heavily polluted, dry
b)	Maximum altitude above sea level	1000 M
c)	Air temperature Ambient	i) Highest : 50 deg C ii) Average : 40 deg C iii) Minimum : 0 deg C
d)	Relative Humidity	100 % max
e)	Thermal Resistivity of Soil	150 deg. C. cm / W max.
f)	Seismic Zone	4
g)	Rainfall	750 mm concentrated in four months

ANNEXURE E

DIMENSIONS

SIZE	A EXP.(Min.)	A REC.(Max)	B EXP.(Min.)	C EXP.(Min.)	D EXP.(Min.)	LC %	T (WALL REC. ± 20 %)
EC 120/150	75	34	120	105	50	± 10	4.2
EC 240/300	100	62	130	110	70	± 10	3.5
EC 400	145	75	155	120	70	± 10	4.6

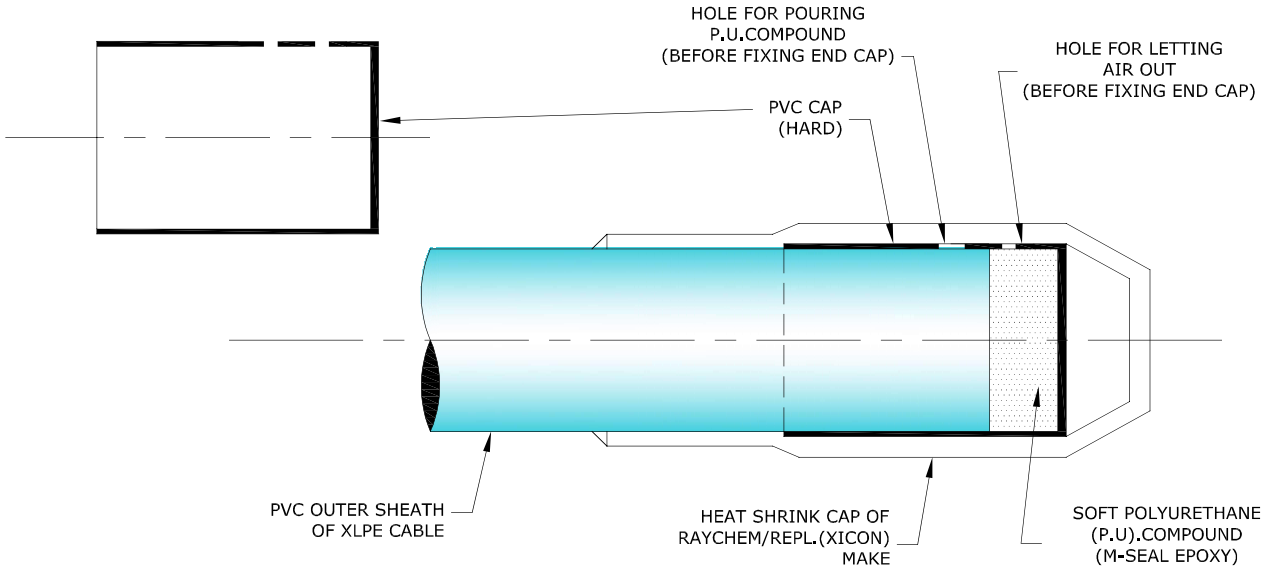
EXP - Expanded (as supplied), REC - Recovered freely, LC - Longitudinal Change,T - Wall Thickness, EC - End Cap



END CAP
(AS SUPPLIED)
SECTIONAL VIEW

MATERIAL SPECIFICATIONS

	Characteristics	Test Class	Value	Test Method
A	**Physical Properties**			
1	Specific Gravity	Type	1.05 ± 0.2	ASTM D-1505
2	Water Absorption	Type	1 % (max)	ASTM D-570 / ISO 62
3	Tensile Strength	Routine	10 N /sqmm (min)	ASTM D-412 / ISO 37
4	Ultimate Elongation	Routine	300% (min)	ASTM D-412 / ISO 37
5	Hardness	Type	45 shore D ± 3	ASTM D-2240
6	**Thermal Test**			
B	Thermal Ageing (120°C for 500 hrs)			
1	Tensile Strength	Type	8 N/sqmm (min)	ASTM D-412 / ISO 37
2	Ultimate Elongation	Type	200% (min)	ASTM D-412 / ISO 37
C	**Electrical Properties**			
1	Volume Resistivity	Type	10^{12} ohm-cm. (min)	ASTM D-257 / IEC 93
2	Dielectrical Strength	Type	10 kV/mm. (min)	ASTM D-149 / IEC 243
3	Dielectric Constant	Type	5 (max)	ASTM D-150 / IEC 250



END CAP
(AFTER HEAT SHRINKING OVER THE CABLE END)

Note : 1) All dimension in mm
2) Colour Black
3) Size as mentioned in the table shall be stencilled on respective item

BSES

DRAWING No. MISC/E/4-1131/1698

SCALE :NOT TO SCALE | DATE: 09-05-2011

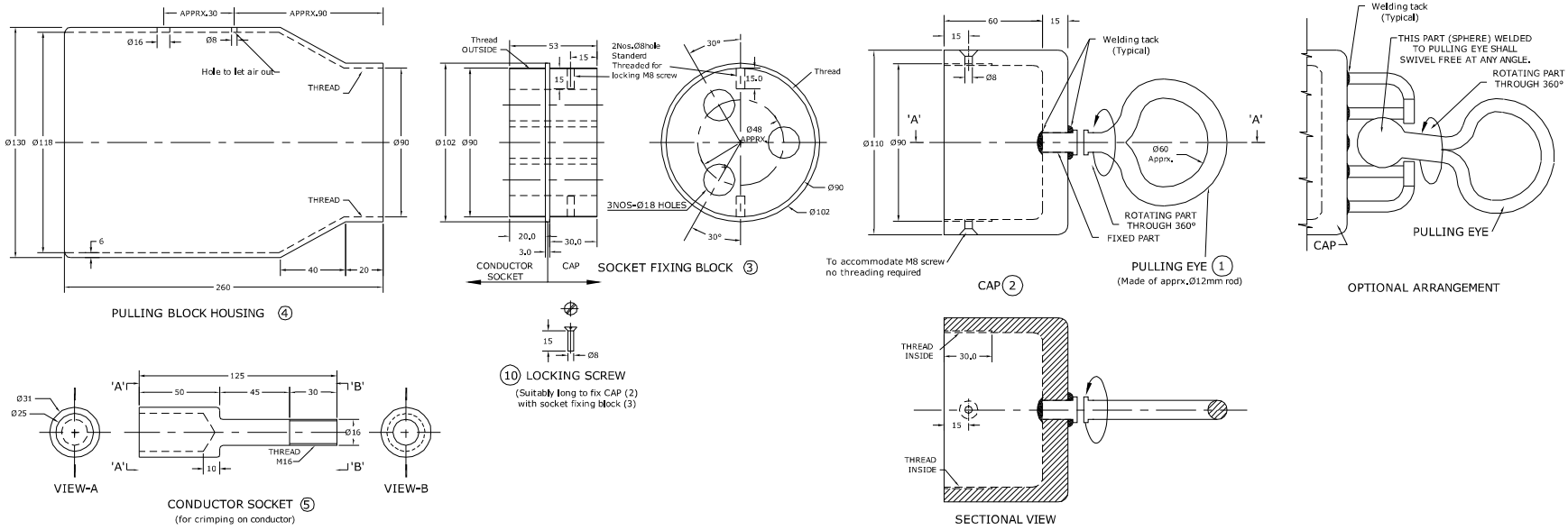
END SEALING CAP
(FOR XLPE CABLE)

DRAWN BY:	CHECKED BY:	APPROVED BY:

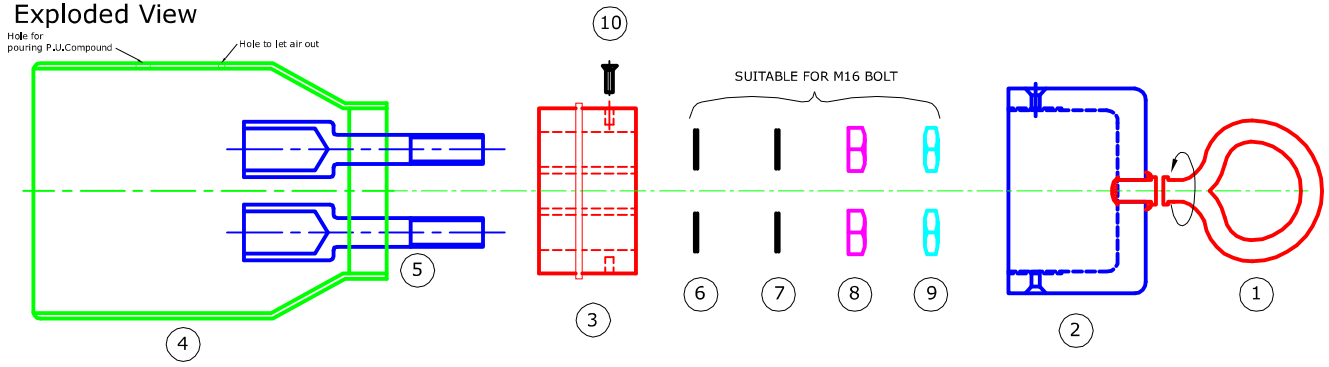
REVISIONS

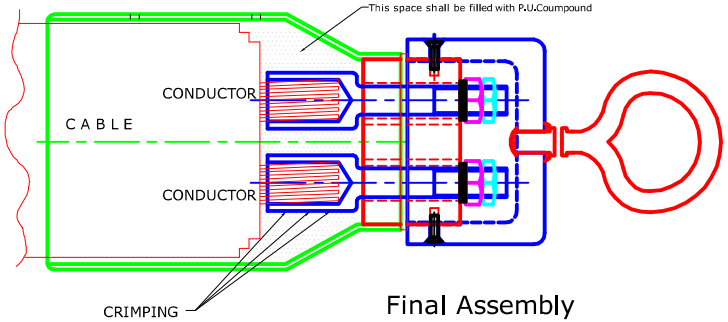
Addl V.P.

ANNEXURE F



Exploded View





Final Assembly

EXAMPLE:
1) For cable size 33kV, 3/C X 400sq mm Al XLPE.
2) Diameter over conductor : 23.8mm apprx.
   Overall diameter : 108±3mm apprx.
   Pulling force applicable on the cable : 30 N/sq mm
   Pulling eye shall withstand total force of : 36000N+Safety margin

NOTE:
1) All Dimensions are in mm, unless otherwise stated.
2) This drawing is typical / indicative.Separate dimensioned drawing for cable pulling eye assembly, suitable for required size & rating of cables, shall be submitted for approval,prior to manufacturing.
3) After fixing cable pulling eye, P.U.(Poly-Urethane) Compound shall be poured to occupy inner spaces to avoid ingress of Water / Moisture.
4) After P.U.Compound oozes/flows out from the cable side,the same edge shall be sealed with suitable sleeve/Tape.

NO.	DISCRIPTION	QTY.	MATERIAL
10	LOCKING SCREW	2	M.S.Zinc-Plated
9	LOCK NUT	3	M.S.Zinc-Plated
8	NUT	3	M.S.Zinc-Plated
7	SPRING. WASHER	3	M.S.Zinc-Plated
6	PLAIN WASHER	3	M.S.Zinc-Plated
5	CONDUCTOR SOCKET	3	AL.
4	PULLING BLOCK HOUSING	1	M.S.Zinc-Plated
3	SOCKET FIXING BLOCK	1	M.S.Zinc-Plated
2	CAP	1	M.S.Zinc-Plated
1	PULLING EYE	1	M.S.Zinc-Plated

BSES

DRAWING No. MISC/E/4-1133/1699

SCALE :NOT TO SCALE | DATE: 09-05-2011

CABLE PULLING EYE ASSEMBLY (TYPICAL)

DRAWN BY: | CHECKED BY: | APPROVED BY:

REVISIONS

Addl V.P.

ANNEXURE G : QUALITY ASSURANCE PLAN (QAP)

FOR 11 kV H. T. CABLES

S. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			Remark
									SV	MFR	BSES	
1	2	3	4	5	6	7	8	9	10	11	12	13
	Legend : SV : Sub-Vendor of Cable Manufacturer, MFR : Cable Manufacturer, MPS : Material Purchase Specification,											
	P : Perform, W : Witness, V : Verification											
A	**RAW MATERIAL**											
1	Aluminium/Copper Rod	a) Tensile strength	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		b) Resistivity	Major	Electrical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		c) Diameter	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		d) Chemical composition	Major	Chemical	Sample	MPS	MPS	Test certificate	P	V	V	
		e) Surface finish	Major	Visual	Sample			-	P	P	_	
2	PVC Compound	a) Tensile Strength	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		b) Elongation at break	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		c) Thermal stability	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
3	**TR-XLPE** Compound (Borealis/Dow chemical/ Hanwa)	a) Packing	Minor	Visual	100%	MPS	MPS	-	P	V	-	
		b) Tensile Strength	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		c) Elongation at break	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		d) Hot set test	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		e) Volume Resistivity	Major	Electrical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		f) Cure Curve (Max. Torque)	Major	Physical	Sample	MPS	MPS	Reg./Sheet	-	P	V	
		g) Density	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
4	Semi-conducting Compound (Borealis/Dow chemical/ Hanwa)	a) Packing	Minor	Visual	100%	MPS	MPS	-	P	V	-	
		b) Volume Resistivity	Major	Electrical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		c) Tensile Strength	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		d) Elongation at break	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		e) Cure Curve (Max. Torque)	Major	Physical	Sample	MPS	MPS	Reg./Sheet	-	P	V	
		f) Density	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
5	Copper tape	a) Thickness & width	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		b) Tensile Strength	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		c) Elongation at break	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		d) Resistivity	Major	Electrical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
6.	Armour wires/strips (Galvanised steel)	a) Dimensions	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		b) Surface condition/finish	Major	Visual	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		c) Tensile Strength	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		d) Elongation at break	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		e) Torsion test for round wire	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		f) Wrapping test	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		g) Mass of zinc coating	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		h) Uniformity of zinc coating	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		i) Adhesion test	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		j) Resistivity test	Major	Electrical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
7	Water Swellable	a) Dimensions	Minor	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	

ANNEXURE G : QUALITY ASSURANCE PLAN (QAP)

FOR 11 kV H. T. CABLES

S. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			Remark
									SV	MFR	BSES	
1	2	3	4	5	6	7	8	9	10	11	12	13
	Legend : SV : Sub-Vendor of Cable Manufacturer, MFR : Cable Manufacturer, MPS : Material Purchase Specification,											
	P : Perform, W : Witness, V : Verification											
	tape	b) Swelling height	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		c) Resistivity	Major	Electrical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		d) Weight	Major	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
8	Steel Drum	a) Dimension	Major	Meas.	1 sample per size	IS 10418 / Purchase order		-	P	P	-	
		b) Finish & workman ship	Minor	Visual	1 sample per size	Compliance to standard Engineering norms & free from surface defects		-	P	P	-	
9	Binder tape	a) Dimensions & material	Minor	Physical	Sample	MPS	MPS	-	P	P	-	
10	Polypropylene filler	a) Size	Minor	Physical	Sample	Purchase order	Purchase order	-	P	P	-	
11	Heat shrinkable end cap	a) Bore diameter	Major	Physical	1 sample per size	--	--	-	-	P	-	
		b) Length of end cap	Minor	Physical	1 sample per size	--	--	-	-	P	-	
B	**PROCESS INSPECTION**											
1	Wire Drawing	a) Diameter	Major	Physical	Sample			Reg./Sheet	-	P	V	
		b) Surface finish	Major	Visual	100 %	Smooth & free from defects		--	-	P	-	
		c) Tensile test (for Al)	Major	Physical	Sample	IS: 8130/84	IS: 8130/84	Reg./Sheet	-	P	V	
		d) Elongation test (for Cu)	Major	Physical	Sample	IS: 8130/84	IS: 8130/84	Reg./Sheet	-	-	V	
		e) Wrapping test (for Al)	Major	Physical	Sample	IS: 8130/84	IS: 8130/84	Reg./Sheet	-	P	V	
2	Stranding	a) No. of wires/strands	Major	Physical	At the time of m/c setting			Reg./Sheet	-	P	V	
		b) Lay length & Lay direction	Major	Physical	-do-			-	-	P	V	
		c) Dia of conductor	Major	Physical	During setting & once in each shift			Reg./Sheet	-	P	V	
		d) Surface finish	Major	Visual	100 %	No surface defects and free from sharp edges, scratches, grease, oil etc.		-	-	P	-	
3	Core extrusion (Conductor screen, Insulation & insulation screen)	a) Compound Make/Grade	Major	Visual	During m/c setting			-	-	P	-	Insulation screen shall be freely strippable, without application of heat.
		b) Thickness of insulation & extruded S.C. layers	Major	Physical	During m/c setting after stabilisation	Tech. Data Sheet / IS 7098/II/2011	Tech. Data Sheet / IS 7098/II/2011	Reg./Sheet	-	P	V	
		c) Surface finish	Minor	Visual	100 %	Smooth & free from defects		-	-	P	-	
		d) Printing on outer semi- conducting layer	Major	Visual	100 %	"DO NOT HEAT, FREELY STRIPPABLE"		-	-	P	-	
		e) Tensile Strength	Major	Physical	Sample	IS 7098/II/2011	IS 7098/II/2011	Reg./Sheet	-	P	V	
		f) Elongation at break	Major	Physical	Sample	IS 7098/II/2011	IS 7098/II/2011	Reg./Sheet	-	P	V	
		g) Hot set test	Major	Physical	Sample	IS 7098/II/2011	IS 7098/II/2011	Reg./Sheet	-	P	V	
		g1) Ovality of core	Minor	Physical	Sample	Tech. Data Sheet	Tech. Data Sheet	Reg./Sheet	-	P	V	

ANNEXURE G : QUALITY ASSURANCE PLAN (QAP)

FOR 11 kV H. T. CABLES

S. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			Remark
									SV	MFR	BSES	
1	2	3	4	5	6	7	8	9	10	11	12	13
	Legend : SV : Sub-Vendor of Cable Manufacturer, MFR : Cable Manufacturer, MPS : Material Purchase Specification,											
	P : Perform, W : Witness, V : Verification											
		h) Eccentricity of insulation	Minor	Physical	Sample	Tech. Data Sheet	Tech. Data Sheet	Reg./Sheet	-	P	V	
		i) Core diameter	Minor	Physical	Sample	Tech. Data Sheet	Tech. Data Sheet	Reg./Sheet	-	P	V	
		j) Void & contamination test for insulation (Silicon Oil test)	Major	Physical	Sample			-	-	P	V	
		k) Wafer boil test for extruded semi-conducting layers	Major	Physical	1 sample/lot	BIS draft Specn	BIS draft Specn	Reg./Sheet	-	P	V	
4	Taping - water Swellable semi-conducting	a) Dimensions	Minor	Physical	Sample	Tech. Data Sheet	Tech. Data Sheet	-	-	P	-	
		b) Tape Application (Overlap)	Minor	Visual	During m/c setting	Suitable overlap	Suitable overlap	-	-	P	-	
5	Taping - Copper tape	a) Width & Thickness of tape	Major	Physical	During m/c setting	Tech. Data Sheet	Tech. Data Sheet	Reg./Sheet	-	P	V	
		b) Number of tapes	Major	Visual	During m/c setting	Tech. Data Sheet	Tech. Data Sheet	Reg./Sheet	-	P	V	
		c) Tape application (Overlap)	Minor	Visual	During m/c setting	Tech. Data Sheet	Tech. Data Sheet	-	-	P	-	
6	Laying up	a) Identification of cores	Major	Visual	During m/c setting	Tech. Data Sheet	Tech. Data Sheet	-	-	P	-	Cores shall be laidup with PP fillers & suitable tape binder shall be provided over laid up assembly
		b) Direction of lay, core Sequence & Lay length	Major	Visual	During m/c setting	IS 7098/II/2011, PIL-W-02	IS 7098/II/2011, PIL-W-02	-	-	P	-	
		c) Application of binder tape	Minor	Visual	During m/c setting	Tech. Data Sheet		-	-	P	-	
		d) Shape of laid up assembly	Minor	Visual	100%	Reasonably circular	Reasonably circular	-	-	P	-	
7	Inner sheath	a) Material & type	Major	Visual	During m/c setting	Tech. Data Sheet	Tech. Data Sheet	-	-	P	-	
		b) Thickness	Major	Physical	During m/c setting & drum change	Tech. Data Sheet & IS 7098/II/2011	ech. Data Sheet & IS 7098/II/2011	Reg./Sheet	-	P	V	
		c) Surface finish	Minor	Visual	100 %	Surface shall be smooth & free from defects		-	-	P	-	
		d) Colour of inner sheath	Major	Visual	100 %	Tech. Data Sheet	Tech. Data Sheet	-	-	P	-	
8	Armouring	a) Dimension of armour wires/strips	Major	Physical	During m/c setting	Tech. Data Sheet	Tech. Data Sheet	Reg./Sheet	-	P	V	No negative tol. on strip thickness/wire diameter
		b) No. of armour strip/wire	Major	Counting	During m/c setting	Tech. Data Sheet	Tech. Data Sheet	Reg./Sheet	-	P	V	
		c) Armour coverage	Minor	Visual	During m/c setting	IS 7098/II/2011	IS 7098/II/2011	-	-	P	-	
		d) Direction of lay	Major	Visual	During m/c setting	IS 7098/II/2011	IS 7098/II/2011	-	-	P	-	
		e) Lay length/Gear setting	Minor	Visual	During m/c setting			-	-	P	-	
		f) Surface finish	Major	Visual	100 %	No cross over/over riding of wire/strip		-	-	P		
9	Outer sheath/Rewinding	a) Material & type	Major	Visual	During m/c setting	Tech. Data Sheet	Tech. Data Sheet	-	-	P	-	
		b) Anti rodent & termite additives	Major	Visual	Each loading			Reg./Sheet	-	P	V	

ANNEXURE G : QUALITY ASSURANCE PLAN (QAP)

FOR 11 kV H. T. CABLES

S. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			Remark
									SV	MFR	BSES	
1	2	3	4	5	6	7	8	9	10	11	12	13
	Legend : SV : Sub-Vendor of Cable Manufacturer, MFR : Cable Manufacturer, MPS : Material Purchase Specification,											
	P : Perform, W : Witness, V : Verification											
		b) Thickness	Major	Physical	Each length	Tech. Data Sheet	Tech. Data Sheet	Reg./Sheet	-	P	V	
		c) Overall diameter	Major	Physical	Each length	Tech. Data Sheet	Tech. Data Sheet	Reg./Sheet	-	P	V	
		d) Surface finish & colour of sheath	Major	Visual	100 %	Surface smooth & free from defects. Colour as per Tech. Data Sheet		-	-	P	-	
		e) Cable length verification	Major	Visual	Each length	Manufacturing Plan	Manufacturing Plan	-	-	P	-	
		f) Marking	Major	Visual	Each length	As per approved GTP/cross sectiona drawing		Reg./Sheet	-	P	V	
C	**FINAL INSPECTION**											
1	Routine tests	a) High Voltage	Critical	Electrical	100 %	IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	V	
		b) Conductor Resistance	Critical	Electrical	100 %	IS 8130/84	IS 8130/84	Test Report	-	P	V	
		c) Partial Discharge	Critical	Electrical	100 %	IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	V	
		d) Impulse	Critical	Electrical	One sample per lot			Test Report		P	V	
		e) Armour Coverage	Critical	Physical	One sample per lot			Test Report		P	V	
		f) Physiacal Dimensions	Critical	Physical	One sample per lot			Test Report		P	V	
		g) Freely Strippable insulation screen (Strippability Test)	Major	Physical	One sample per lot	Factory Standard	Factory Standard	Test Report	-	P	V	
2	Stage Inspection	Wire Drawing	Major	Visual	100 %	Tech. Data Sheet	IS/IEC	Test Report	-	P	W	Stage Inspection shall be conducted subject to BSES requirement
		Extrusion process	Major	Visual	100 %	Tech. Data Sheet	IS/IEC	Test Report	-	P	W	
		Raw maerial inspection at factory	Major	Physical	100 %	Tech. Data Sheet	IS/IEC	Test Report	-	P	W	
		Wrapping of Aluminium	Major	Physical	100 %	Tech. Data Sheet	IS/IEC	Test Report	-	P	W	
		Tensile test for Aluminium	Major	Physical	100 %	Tech. Data Sheet	IS/IEC	Test Report	-	P	W	
		a) Annealing test for copper	Major	Physical	Appendix A to IS 7098/II/2011, each lot sample basis	IS 8130/84	IS 8130/84	-	-	P	V	Verification of process records.
		b) Tensile test for aluminium	Major	Physical		IS 8130/84	IS 8130/84	-	-	P	V	
		c) Wrapping test for aluminium	Major	Physical		IS 8130/84	IS 8130/84	-	-	P	V	Tests N/A on finished conductor.
		d) Conductor resistance test	Major	Electrical	Appendix A to IS 7098/II/2011, each lot sample basis	IS 8130/84	IS 8130/84	Test Report	-	P	W	
		e) Test for thickness of insulation & sheath	Major	Physical		IS 7098/II/2011 & Tech. Data sheet	IS 7098/II/2011 & Tech. Data sheet	Test Report	-	P	W	
		f) Hot set test for insulation	Major	Physical		IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	W	

ANNEXURE G : QUALITY ASSURANCE PLAN (QAP)

FOR 11 kV H. T. CABLES

S. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			Remark
									SV	MFR	BSES	
1	2	3	4	5	6	7	8	9	10	11	12	13
	Legend : SV : Sub-Vendor of Cable Manufacturer, MFR : Cable Manufacturer, MPS : Material Purchase Specification,											
	P : Perform, W : Witness, V : Verification											
3	Acceptance tests	g) Tensile strength & Elongation at break of insulation & outer sheath	Major	Physical	Each Lot Sample Basis	IS 7098/II/2011 & IS 5831/84	IS 7098/II/2011 & IS 5831/84	Test Report	-	P	W	
		h) Partial discharge test	Critical	Electrical		IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	W	
		i) High voltage test	Critical	Electrical		IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	W	
		j) Insulation resistance (Volume resistivity) test	Major	Electrical		IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	W	
		k) Tests for dimension of armour wires/strips	Major	Physical		IS 3975, IS 10810 Pt. 36 & Tech. Data sheet		Test Report	-	P	W	
		l) Test for anti termite & anti rodent property of outer sheath	Major	Physical		Tech. Data Sheet	Tech. Data Sheet	Reg./Sheet	-	P	W	
		m) Rewinding of cable on drum	Major	Visual		To check cable appearance, drum appearance, cable winding, packing, embossing/printing/sequential marking		Reg./Sheet	-	P	W	
		n) Void & contamination test for insulation (Silicon Oil test)	Major	Physical				Reg./Sheet	-	P	W	
		o) Wafer boil test for extruded semi-conducting layers	Major	Physical				Reg./Sheet	-	P	W	
		p) Freely Strippable insulation screen	Major	Physical		Factory Standard	Factory Standard	Test Report	-	P	W	
		q) Water Penetration test (WPT) on core (i.e.Logitudinal Water Blocking Test)	Major	Physical		IEC:60502	IEC:60502	Test Report	-	P	W	**Test shall be conducted for leakage of water through conductor.**
		r) Armour coverage	Major	Physical		As per data sheet & FS	As per data sheet & FS	Test Report	-	P	W	
		s) Ovality	Major	Physical		As per data sheet	As per data sheet	Test Report	-	P	W	
		t) Eccentricity	Major	Physical		As per data sheet	As per data sheet	Test Report	-	P	W	
		u) Mass & uniformity & zinc coating on armour	Major	Physical		As per data sheet & FS	As per data sheet & FS	Test Report	-	P	W	
		v) Resistivity of Strip armour	Major	Electrical		As per data sheet & FS	As per data sheet & FS	Test Report	-	P	W	
		w) Swelling height of water swellable tape	Major	Physical		As per data sheet & FS	As per data sheet & FS	Test Report	-	P	W	
		x) Flammability test	Major	Physical		As per IS-78098/II/2011	As per IS-78098/II/2011	Test Report	-	P	W	
		y)Impulse withstand test	Critical	Electrical		IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	W	

ANNEXURE G : QUALITY ASSURANCE PLAN (QAP)

FOR 11 kV H. T. CABLES

S. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			Remark
									SV	MFR	BSES	
1	2	3	4	5	6	7	8	9	10	11	12	13
	Legend : SV : Sub-Vendor of Cable Manufacturer, MFR : Cable Manufacturer, MPS : Material Purchase Specification,											
	P : Perform, W : Witness, V : Verification											
		z) Ageing & Water absorption test(Gravimetric) on Insulation & Outer sheath	Major	Physical		IS 5831/84	IS 5831/84	Test Report	-	P	W	
		z1) Heating Cycle with Potential	Critical	Electrical	sample basis, once per PO			Test Report	-	P	W	
		z2) Raw Material Verification in all aspects	Major	Physical	Each Lot					P	W	
		Z3) OFC Continuty Test and verification of outer sheath marking with continuous 15mm red strip for OFC embedded identification	Major	Physical	Each Lot					P	W	
4	Type tests at vendor's works	a) Tests on conductor										
		i) Annealing test for copper	Major	Physical		IS 8130/84	IS 8130/84	-	-	P	V	Verification of process records. Tests N/A on finished conductor.
		ii) Tensile test for aluminium	Major	Physical		IS 8130/84	IS 8130/84	-	-	P	V	
		iii) Wrapping test for aluminium	Major	Physical		IS 8130/84	IS 8130/84	-	-	P	V	
		iv) Conductor resistance test	Major	Electrical		IS 8130/84	IS 8130/84	Test Report	-	P	V	
		b) Tests for armouring wires/strips										
		i) Dimensions of wire/strip	Major	Physical		IS 3975, IS 10810 Pt. 36 & Tech. Data sheet		Test Report	-	P	W	
		ii) Tensile strength & Elongation at break	Major	Physical		IS 3975	IS 3975	Test Report	-	P	W	Only for Steel wires/strips
		iii) Torsion test for wire	Major	Physical		IS 3975	IS 3975	Test Report	-	P	W	
		iv) Winding test for strip	Major	Physical		IS 3975	IS 3975	Test Report	-	P	W	
		v) Uniformity of zinc coating	Major	Chemical		IS 3975	IS 3975	Test Report	-	P	W	
		vi) Mass of zinc coating	Major	Chemical		IS 3975	IS 3975	Test Report	-	P	W	
		vii) Resistivity of wire/strip	Major	Electrical		IS 3975	IS 3975	Test Report	-	P	W	
		c) Test for thickness of insulation & sheath	Major	Physical		IS 7098/II/2011 & Tech. Data sheet	IS 7098/II/2011 & Tech. Data sheet	Test Report	-	P	W	
		d) Physical tests for insulation									W	
		i) Tensile strength & Elongation test	Major	Physical		IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	W	
		ii) Ageing in air oven	Major	Physical		IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	W	
		iii) Hot set test	Major	Physical		IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	W	
		iv) Shrinkage test	Major	Physical		IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	W	
		v) Water absorption (gravimetric)	Major	Physical	One sample per Tender	IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	W	
		e) Physical tests for outer sheath									W	

ANNEXURE G : QUALITY ASSURANCE PLAN (QAP)

FOR 11 kV H. T. CABLES

S. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			Remark
									SV	MFR	BSES	
1	2	3	4	5	6	7	8	9	10	11	12	13
	Legend : SV : Sub-Vendor of Cable Manufacturer, MFR : Cable Manufacturer, MPS : Material Purchase Specification,											
	P : Perform, W : Witness, V : Verification											
		i) Tensile strength & Elongation test at break	Major	Physical		IS 5831/84	IS 5831/84	Test Report	-	P	W	
		ii) Ageing in air oven	Major	Physical		IS 5831/84	IS 5831/84	Test Report	-	P	W	
		iii) Shrinkage test	Major	Physical		IS 5831/84	IS 5831/84	Test Report	-	P	W	
		iv) Hot deformation test	Major	Physical		IS 5831/84	IS 5831/84	Test Report	-	P	W	
		v) Loss of mass in air oven	Major	Physical		IS 5831/84	IS 5831/84	Test Report	-	P	W	
		v) Heat shock test	Major	Physical		IS 5831/84	IS 5831/84	Test Report	-	P	W	
		vi) Thermal stability test	Major	Physical		IS 5831/84	IS 5831/84	Test Report	-	P	W	
		f) Electrical tests in sequence									W	
		i) Partial discharge test	Critical	Electrical		IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	W	
		ii) Bending test	Major	Physical		IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	W	
		iii) Partial discharge test	Critical	Electrical		IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	W	
		iv) Dielectric power factor as a function of voltage	Major	Electrical		IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	W	
		v) Dielectric power factor as a function of temperature	Major	Electrical		IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	W	
		vi) Heating cycle test	Major	Electrical		IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	W	
		vii) Dielectric power factor as a function of voltage	Major	Electrical		IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	W	
		viii) Partial discharge test	Critical	Electrical		IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	W	
		ix) Impulse withstand test	Critical	Electrical		IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	W	
		x) High voltage test	Critical	Electrical		IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	W	
		g) Insulation resistance (Volume resistivity test)	Major	Electrical		IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	W	
		h) Flammability test	Major	Physical		IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	W	
D	**PACKING & MARKING**											
1	Packing & Marking	a) Cable end sealing	Major	Visual	100 %	IS 7098/II/2011/ Agreement	IS 7098/II/2011/ Agreement	-	-	P	W/V	BSES representative may verify these characteristics on randomly selected drums.
		b) Pulling eye at leading end- removed from vendor scope, end cap shall be provided at both the end of cable	Major	Visual	100 %	As per agreement	As per agreement	-	-	P	W/V	
		b) Stencilling/Marking on drum	Minor	Visual	100 %	IS 7098(Part 2):2011/ Agreement	IS 7098(Part 2):2011/ Agreement	-	-	P	V	

ANNEXURE G : QUALITY ASSURANCE PLAN (QAP)

FOR 11 kV H. T. CABLES

S. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			Remark
									SV	MFR	BSES	
1	2	3	4	5	6	7	8	9	10	11	12	13
	Legend : SV : Sub-Vendor of Cable Manufacturer, MFR : Cable Manufacturer, MPS : Material Purchase Specification,											
	P : Perform, W : Witness, V : Verification											

Note

1. Checks specified above for Raw Material, In-Process and Final Inspection shall be as relevant to the specific cable construction.
2. Number of samples shall be selected as per Factory Standard/Agreement wherever 'sample' is indicated for extent of check.
3. Plant standards shall be followed in case Technical Data Sheet does not include requirements for characteristics to be checked.
4. BSES may witness Raw material and in process inspection in addition to Routine/Acceptance tests at any time/stage of manufacturing.
5. BSES's Inspector may randomly select a cable drum for type testing at vendor's works.
6. For each of the offered lot for inspection, BSES may randomly select one cable drum for testing of end cap "Destructive testing" to verify adhesion of sealing cap to cable outer sheath. .
7. All factory Type Tests shall be Witnessed by BSES

Annexure- H

Testing and manufacturing process requirements w. r. t. TR- XLPE insulation

All cables made with TR-XLPE Insulation should be tested and/or certified to meet the following performance parameters as per ANSI /ICEA S-94-649 after one year AWTT.

Property	Units	Requirements Values
Min. Avg. Electrical Breakdown Strength(qual. test)	kV/mm	≥ 25
Impulse Strength	kV/mm	≥ 83
Water Tree Length	Mm	0.25
Max. Bowtie Tree Density	(Number per 16.4 cu. cm)	Maximum 15 (0.12-0.25 mm range)

Manufacturing processes to produce high-quality cables with the following characteristics:

- Cure consistency with hot set/creep less than 100%
- No voids larger than 75 microns per 16.4 cubic cm
- No ambers larger than 250 microns per 16.4 cubic cm
- No contaminants larger than 125 microns and less than 5 between 50-125 microns per cubic 16.4 cubic cm tested.
- Neutral indent on cable is less than 375 microns
- Cable insulation concentricity greater than 90% tested
- No protrusions greater than 75 microns at the conductor shield and 125 microns at the insulation shield

Annexure-I: Deviation Format

Sl. No.	Document Name	Clause No.	Deviation	Reason	Merit to BSES

BSES

Technical Specification of

LT Power Cable(Single & Multi-Core)

Specification no – BSES-TS-01-LTPC-R0

Rev:		0
Date:		31 Mar 2022
Prepared by	Abhishek Vashistha	
	Rohit Patil	
Reviewed by	Puneet Duggal	
	Amit Tomar	
Approved by	Gaurav Sharma	
	K. Sheshadri	

INDEX

Contents

1.0 SCOPE OF SUPPLY

The specification covers design, manufacture, shop testing, packing and delivery of 1100 Volts grade, Aluminium conductor XLPE insulated 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	Standard Test Method for density of Smoke from the burning or decomposition of cables
2.25	ASTM 2863	Standard Test Method for measuring of minimum oxygen concentration
2.26	IEC 60754-1	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 (sq.mm)</th><th>Multi core (sq.mm)</th></tr>
<tr><td>1</td><td>Compacted Circular</td><td>• 1cx25
• 1cx95
• 1cx300
• 1cx630
• 1cx1000</td><td>• 2cx10</td></tr>
<tr><td>2</td><td>Sector</td><td>---</td><td>• 2cx25
• 4cx25
• 4cx50
• 4Cx150
• 4Cx300
• 4Cx400</td></tr>
</table></td></tr>
<tr><td>3.2</td><td>Insulation</td><td>Extruded XLPE insulation as per IS : 7098 part-1</td></tr>
<tr><td>3.3</td><td>Core Identification</td><td>a) Single Core Cable – Natural
b) Two Core Cable – Red & Black
c) Four Core Cable – Red, Yellow, Blue and Black</td></tr>
<tr><td>3.4</td><td>Inner Sheath</td><td>a) For Single Core Cable – Inner Sheath Not Required
b) For 2 Core cable- Pressurized Extruded, Black PVC type ST-2 (IS 5831-1984)
c) For 4 core cable –Extruded 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) Armour not required for single core cables
d) Minimum area of coverage of armouring shall be 90%</td></tr>
</table>

		e) The breaking load of armour joint shall not be less than 95% of that of armour wire / strip f) Zero negative tolerance for thickness of armour strip shall be as per IS:3975 g) Zinc rich paint shall be applied on strip/wire and its joint surface.
3.6	Outer Sheath	a) Extruded FRLS outer sheath of PVC (ST-2) shall be as per IS:5831 b) Colour : • For multi core cables-**Orange/Yellow as per tender requirement** • For single core cables **– Orange/Black as per tender requirement** c) FRLS 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 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) FRLS iv) Manufacture name/Trade mark v) Number of Cores and nominal cross section area of conductor vi) Name of buyer i.e BSES vii) Month & year of manufacturing viii) IS reference , i.e. IS:7098 ix) P.O No. and Date x) Font size shall be 5/5mm xi) ISI mark The embossing shall be progressive, automatic, in line and marking shall be legible and indelible. Following points shall be 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 PVC caps
3.9	FRLS Properties	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 – IEC 60332 part -1

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 2C X 10 mm^2 Cable - 1000+/-5% Mtr • For all Other cable sizes - 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 acceptable length (Max. is 525 mtr) shall be 1 % of the total ordered qty. & no length shall be less than 250 mtr. Manufactures shall be taken prior approval from BSES 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	In event of order manufacturer has to submit the signed copy of QAP.
6.2	Inspection hold points	AS per approved QAP (QAP shall be approved at the time of GTP approval)
6.3	Routine Test	a) Measurement of Electrical Resistance b) HV test with power frequency AC voltage
6.4	Type Test	**For bid participation–** (a) Bidder must be submitted cable type tested report from CPRI/ERDA/NABL approved lab for the type, size & rating of similar or higher sizes of offered cable along with bid. **After award of P.O.-** (b) If a bidder has valid type test report from CPRI/ERDA lab for the type, size & rating of similar or higher sizes of offered cable (including FRLS)—No need to conduct fresh type test from CPRI/ERDA lab. (c) If a bidder has valid type test report from CPRI/ERDA lab for the type, size & rating of similar or higher sizes of offered cable (except FRLS)—Need to conduct only fresh type test of FRLS properties test from CPRI/ERDA/NABL lab(list of tests mentioned in clause 3.9)without any commercial implication to BSES. (d) If a bidder has valid type test report from NABL lab for the type, size & rating of similar or higher sizes of offered cable (including FRLS)—Need to conduct complete type test (including FRLS properties) from CPRI/ERDA lab without any

		commercial implication to BSES. (Type test shall not be more than 5 years old. If the type test report is more than 5 years old (max 10 years), it can be considered subject to no change in their design) (e) 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 in tensile strength and elongation 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)	a) For cable sizes up to 25 mm^2 – one sample for chemical composition and purity test of aluminium shall be conducted per300km of ordered quantity and multiple thereof. b) For cable sizes 50mm^2 – one sample for chemical composition and purity test of aluminium shall be conducted per 100km of ordered quantity and multiple thereof. c) 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. d) Chemical composition and purity test of aluminium shall be conducted from the lot offered to BSES on each size involved in the purchase order. Test shall be carried out at NABL accredited third party lab without any price implication to BSES. e) The sample will be selected either during acceptance test or after receipt of cable in BSES Stores.
6.6	Inspection	a) The buyer reserves the right to witness all tests specified on completed cables b) The buyer reserves the right to inspect cables at the seller's works at any time prior to dispatch either in finished form or during manufacturing, to prove compliance with the specifications. c) In-process and final inspection call intimation shall be given in 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 DOCUMENT SUBMISSION MATRIX

Document/Drawing submission shall be as per the matrix given below:

a. All documents/drawings shall be provided in soft copy only via mail or in returnable Pen drives
b. Language of the documents shall be English only.
c. Document check sheet compliance shall be the first sheet for each submission stage i.e. Technical bid, Drawing Approval, Pre Dispatch, Pre closure

d. No submission is acceptable without check list compliance.
e. Deficient/ improper or incomplete document/ drawing submission shall be liable for rejection.
f. Order of documents shall be strictly as per the check list.
g. Any document not included in the below table but necessary for detailed engineering shall be deemed to be included in bidder's scope

S No.	Detail of Document	Bid	Approval	Pre Dispatch
1	Guaranteed Technical Particulars (GTP)	Required	Required	
2	Deviation Sheet, if any	Required	Required	
3	Detailed cross sectional drawing of cable	Required	Required	
4	Dimensional drawing of cable drum	Required	Required	
4	Type test reports of offered type and rating of cable	Required	Required	
5	BIS certificate	Required		
6	Complete cable catalogue	Required		
7	Make of Raw Materials	Required	Required	
8	Cable de-rating factors	Required	Required	
9	Armour coverage calculation		Required	
10	Inspection test reports and Routine Test Certificates carried out in manufacturer's works			Required
12	Test certificates of all raw materials			Required
13	Calibration test reports of instruments			Required

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 a) Progress on material procurement b) Progress on fabrication (As applicable) c) Progress on assembly (As applicable) d) Progress on internal stage inspection e) Reason for any delay in total programme f) Details of test failures if any in manufacturing stages. g) Progress on final box up 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. BSES will review the deviations and if BSES is agreed with the deviation, seller has to take written confirmation from BSES on deviation during tender evaluation.

b) In the absence of any separate list of deviations from the bidders with bid as well as written confirmation from BSES on deviations, it will be assumed by the Buyer that the Seller complies with the Specification fully.

c) Any deviations mentioned in any other submitted bid documents (i.e.in filled GTP, Catalog, BSES old approval, buyer's/seller's standards etc) by seller without separate deviation sheets will not consider as a deviation from this tech spec at any stage of contract.

Deviation sheet format

Sl. No.	Document Name	Clause No.	Deviation	Reason	Merit to BSES

10.0 Annexure -A

GUARANTEED TECHNICAL PARTICULARS (Multi-core)

(Standard Cable sizes are 2cx10, 2cx25, 4cx25, 4cx50, 4C X 95, 4cx150, 4cx300, 4cx400)

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 D	
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	

Sr. No.	Description	Buyer's Requirement	Seller's data
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 D	
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)	……	

Sr. No.	Description	Buyer's Requirement	Seller's data
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	Orange	
D	Embossing Details	As per Cl.3.6 (e)	
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	

Sr. No.	Description	Buyer's Requirement	Seller's data
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	De-rating 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	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	

11.0 ANNEXTURE- B

GUARANTEED TECHNICAL PARTICULARS (Single Core)

(Separate GTP needs to be furnished for 25, 95, 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. 3.1	
B	Size (mm^2)	.....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 D	
6	Insulation	As per Table 3 of IS7098 Part-1	
A	Insulation Material	As per Cl. 3.2	

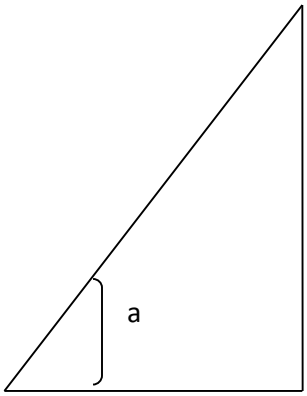
S.No.	Description	Buyer's Requirement	Seller's data
B	Nominal thickness (mm)		
(i)	For 1Cx300 mm^2	1.8 mm	
(ii)	For 1Cx500 mm^2	2.2 mm	
(iii)	For 1Cx630 mm^2	2.4 mm	
iv)	For 1Cx1000 mm^2	2.8 mm	
C	Diameter over Insulation (mm) Approx.	……	
D	Make of insulation compound	Ref: Annexure D	
7	Inner Sheath	Not applicable	
8	Armour	Not applicable	
9	FRLS Outer Sheath		
A	Material and Type	As per Cl. 3.6	
B	Minimum Thickness	As per Table 8 of IS 7098 Part-1	
C	Colour	Orange	
D	Embossing Details	As per Cl.3.6 (e)	
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	

S.No.	Description	Buyer's Requirement	Seller's data
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?	

S.No.	Description	Buyer's Requirement	Seller's data
		Yes /No	
23	FRLS Properties		
	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	

12.0 ANNEXTURE – C

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%.

13.0 ANNEXTURE – D

LIST OF SUB-VENDORS

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	Kkalpana Industries Ltd. KLJ Polymers and Chemicals Ltd. Universal SCJ Plastic Sriram Polytech Shri Ram Vinyl, Kota
4	GI Strip	Tata Balaji Systematic Mica Wires Pvt Ltd. Bansal Industries

BSES

Technical Specification of

Earthing Strip & GI Earthing Pipe

Specification no – BSES-TS-23-ESEP-R0

Rev:		0
Pages		7
Date:		06 April 2022
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	Sunil Yadav	
Reviewed by	Srinivas Gopu	
	Amit Tomar	
Approved by	Gaurav Sharma	
	K. Sheshadri	

INDEX

1.0 SCOPE OF SUPPLY

The specification covers the manufacturing, testing and inspection of Earthing Pipe and Earthing strips at manufacturers works before dispatch.

2.0 CLIMATIC CONDITION

The material to be supplied against this specification shall be suitable for satisfactory operation under following climatic condition

Location : At various location in the Delhi	
Maximum ambient temperature (ºC)	50
Minimum ambient temperature (ºC)	0
Maximum altitude above mean sea level (m)	1000
Relative Humidity (%)	100
Rainy month	June to October
Maximum Rainfall (mm)	1450
Wind Pressure (Kg/Sq.m)	195
Seismic Zone	Zone IV as per IS : 1893

3.0 CODES & STANDARDS

Earthing Pipe and Earthing Strip shall be designed, manufactured and tested in Accordance with the following Indian standards.

IS 1239: Part (1)	Steel Tubes, Tubular And Other Wrought Steel Fittings
IS 6745/72	For galvanising testing
IS 4759	Hot-dip zinc coatings on structural steel and other allied products
IS 1161: 1998	Steel Tubes for Structural Purposes
IS 1387: 1993	General requirements for the supply of metallurgical Materials
IS 228 :1987	Methods of chemical analysis of steels
IS 2633: 1986	Methods for testing uniformity of coating of zinc coated articles
IS 2629: 1985	Recommended Practice for Hot-Dip Galvanizing of Iron and Steel
IS 2500: 2000	Sampling of lot by lot
IS 2062	Hot Rolled Medium and High Tensile Structural Steel
IS 808	Dimension for Hot Rolled Steel Beam, Column, Channel and Angle Section
IS 3043: 1987	Code of Practice for Earthing
IS 5561: 1970	Specification for electric power connection
IEC	

4.0 DESIGN PARAMETERS

4.1 EARTHING STRIPS

S. No.	Parameter	Requirement
4.1.1	Size	a) 25X3 mm; galvanized b) 50X3 mm; galvanized c) 50X6 mm; galvanized
4.1.2	Material	Material shall be mild steel, grade 'A', Designation E-250 as per IS 2062.
4.1.3	Make	TATA/SAIL/ESSAR/RINL/JSPL/JSW/BSES approved
4.1.4	Galvanization	Mass of zinc coating shall be min 610 gsm in accordance with IS 4759

4.2 GI EARTHING PIPE

S. No.	Parameter	Requirement
4.2.1	Type (Light, Medium, Heavy)	Medium
4.2.2	Size	Dia- 40mm NB
4.2.3	Thickness	Required
4.2.4	Max & Min outside diameter of tube	48.8 mm (max) & 47.9 (min)
4.2.5	Length of Pipe	2500 MM (+ 6 mm & - NOT ACCEPTABLE)
4.2.6	Make	TATA/SAIL/ESSAR/RINL/JSPL/JSW/BSES approved
4.2.7	Mass of Tube	3.56 Kg/m
4.2.8	Tolerance on thickness	(+) Not limited, (-) 8%
4.2.9	Tolerance on Mass	(+/-)10%
4.2.10	Galvanising thickness	80 Microns (min)
4.2.11	Tensile strength	320 N/mm2 (Mpa) (min)
4.2.12	Elongation percent	20%
4.2.13	Color of band	Blue Color
4.2.14	General	
a)	Supply of 6 Nos of M10*30mm elctrogalvanised Nuts+bolts+Plain& Spring Washer	Shall be provided

S. No.	Parameter	Requirement
b)	GI Strip Size	50 X 6 mm
4.2.15	Marking	a) Manufacture's name or trade mark b) ISI mark with CML No. c) Purchase no. shall be stencilled indelible link d) The manufacturer's identification symbol e) Hot marking at every running meter Name/logo of manufacturer, ISI, class of tube i.e. L for Light colour of Band

5.0 TESTING & INSPECTION

All the tests shall be carried out in accordance with IEC / IS standards.

5.1	Type Test	Type test report of Short time current test to be provided for Earthing Pipe in accordance with IEC 6approved by CPRI/ERDA Lab.
5.2	Visual Check	Material shall be visually checked and shall free from external defects.
5.3	Dimensional Check	The dimensional requirements shall be checked for material as per the drawing and requirement.
5.4	Acceptance Test	Following tests need to be conducted by the vendor during inspection (value shall be followed as per IS1239-part 1 and IS 4759) a) Chemical composition and galvanization test to be carried out from NABL approved lab on one sample sealed by BSES representative. b) Leak tightness test (Hydrostatic test) c) Bend test

6.0 DEVIATION

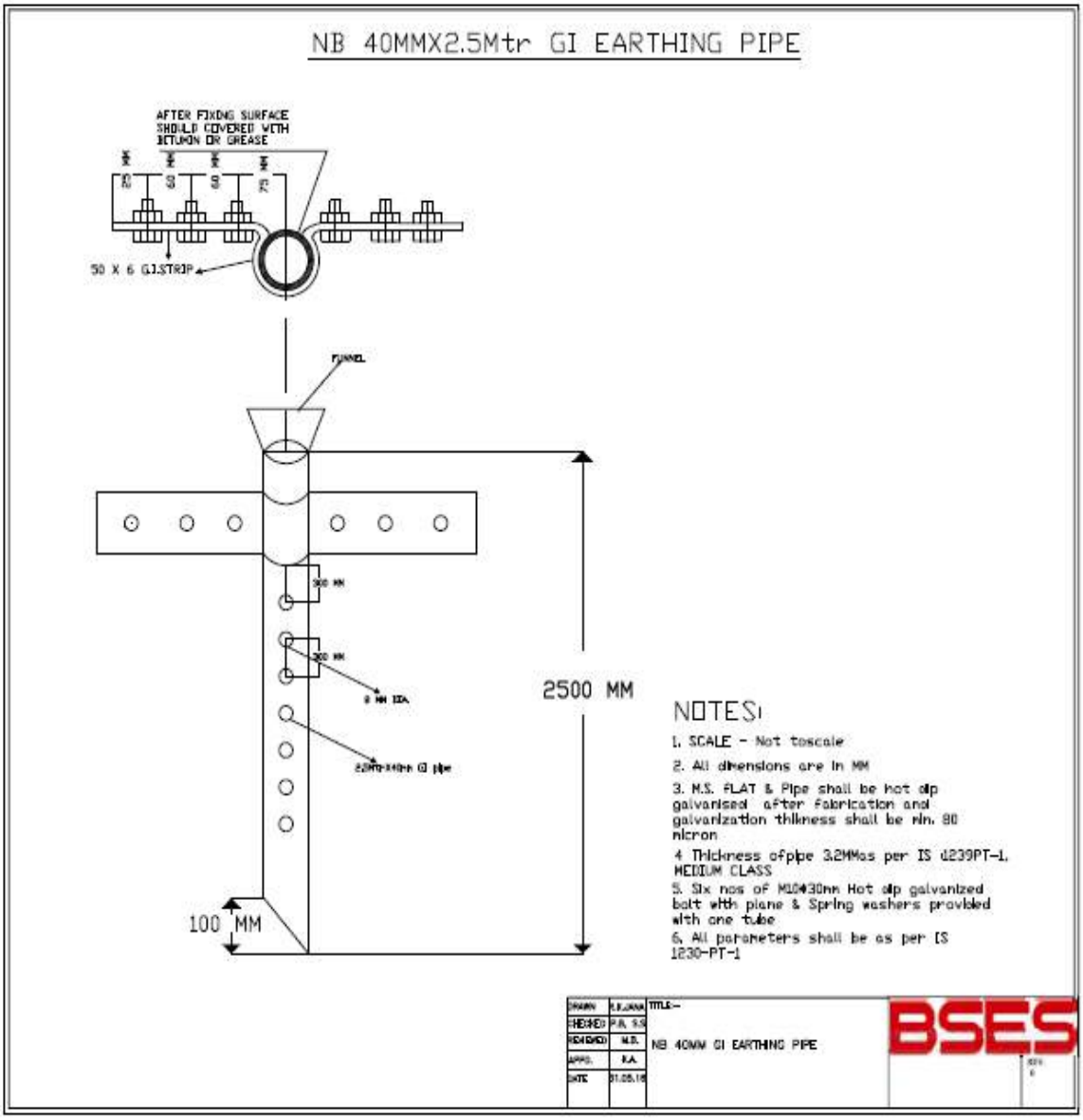
Deviations from this Specification shall be stated in writing with the tender by reference to the Specification clause/GTP/Drawing and a description of the alternative offer. In absence of such a statement, requirements of the Specification shall be met without exception.

7.0 DOCUMENTS SUBMISSION

Document submission shall be as per the matrix given below. All documents/drawing shall be provided in soft copy for each section. Language of the documents shall be English only. Deficient/improper drawing submission may liable for rejection.

S.No.	Detail of Document	For Tender	For Approval/Review	Final Submission
7.1	Guaranteed Technical Particulars (GTP)	Required	Required	Required
7.2	Deviation Sheet, if any	Required	Required	Required
7.3	GA and Dimensional Drawing	Required	Required	Required
7.4	Manufacturer's quality assurance plan and certification for quality standards		Required	Required
7.5	Make of Raw Materials	Required	Required	Required
7.6	Type Test Report	Required		
7.7	Inspection and test reports, carried out in manufacturer's works			Required
7.8	Routine Test Certificates			Required
7.9	Test certificates of all the raw materials			Required

8.0 Drawing of G.I. Earthing Pipe



BSES

TECHNICAL SPECIFICATION

OF

11 kV INDOOR METERING CUBICLE
Specification No.- BSES-TS-51-IMC-R0

Rev:		0
Date:		28 April 2022
Pages:		15
Prepared by	Ashish Joshi	
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Approved by	Gaurav Sharma	
	Gopal Nariya	

Table of Contents

1.0 Scope of supply

This specification covers design, engineering and manufacture, assembly, testing at manufacture's works, packing, transportation and delivery to BSES Store / site.

2.0 Codes and Standards

All Material against this specification shall conform to the relevant Indian standards /International Standards with latest amendments from time to time, in all respects. Some relevant standards are listed below:

Sl.no	Standard	Title
1	IS 62271 -200	AC metal enclosed switchgear and control gear
2	IS:2705-1992, Part 1	Current Transformers — Specification, General Requirements
3	IS 16227 – Part 1	Instrument Transformers, General requirements
4	IS 16227 – Part 2	Instrument Transformers, Additional Requirement for Current Transformer
5	IS 16227- Part 3	Instrument Transformers, Additional Requirements for Inductive Voltage Transformers
6	IS 16227- Part 4	Instrument Transformers, Additional Requirements for Combined Transformers
7	IS 60137	Insulated Bushings for Alternating Voltages above 1000 V
8	IS 4146	Application Guide for Voltage Transformers.
9	IS 4201	Application Guide for Current Transformers.
10	IS 15707-2006	Testing, Evaluation, Installation and Maintenance of AC Electricity Meters
11	IS:5561	Specification for electric power connectors
12	IS: 2062	Structural Steel (Std. quality)
13	IS: 5	Colors for ready mix paints
14	CEA regulations.	

Material conforming to other internationally accepted standards, which ensures equal or better quality than the standards mentioned above would be acceptable, subject to prior approval of BSES. In case the Bidders who wish to offer material conforming to the other standards, salient points of difference between the Standards adopted and the specific standards shall be clearly brought out in relevant schedule and approval must be taken from BSES during tendering stage. Four copies of such standards with authentic English Translation shall be furnished along with the offer.

In the case of conflict the order of precedence shall be as follows:

a. Indian Standards
b. IEC Standards
c. BSES Requirement

3.0 Service Conditions:

The Metering Cubical to be supplied against this specification shall be suitable for satisfactory continuous operation under the following service conditions:

a)	Maximum ambient temperature (Degree C)	50
b)	Relative Humidity (%)	100
c)	Maximum annual rainfall (mm).	1450
d)	Maximum wind pressure (Kg/Sq.m)	150
e)	Maximum Altitude above mean sea level (Meters)	1000
f)	Seismic level (Horizontal Acceleration)	0.30
g)	Climatic Conditions : Moderately Hot and humid tropical climate conductive to rust and fungus growth	
h)	Ref Ambient Max Temperature (Degree C)	50
i)	Ref Ambient Min Temperature (Degree C)	0

4.0 Design Feature:

The design and manufacturing of the required 11 kV Indoor CT/PT Metering Cubicle shall be in accordance with the best engineering practices, to ensure satisfactory performance throughout its service life.

4.1 The CT/PT Metering cubicle shall be complete with all components and accessories, which are necessary for their efficient performance and trouble free operation under various operating and atmospheric conditions, specified in clause no 3.

4.2 Some parts that may not be specifically included, but otherwise form part of the CT/PT Metering cubicle as per standard trade and/or professional practice and/or are necessary for proper operation of CT/PT Metering cubicle, must be considered subject to BSES acceptance. The successful bidder shall not be eligible for any extra charges for such accessories

4.3 All kind of accessories make shall be as per list given in the Annexure-I.

5.0 Construction

5.1 11 kV Indoor metering cubicle shall house Three (03) no's 11kV Current Transformer, 3 phase Potential Transformer, Meter chamber and provision for termination of 11kV, 3CX150mm2 to 3Cx400mm2 XLPE Cable.

5.2 The metering cubicle shall be fabricated with 3.0mm CRCA sheet. The panel shall be vermin proof and totally enclosed. The panel shall have four separate compartments. All the compartments shall be completely segregated from each other. The Upper compartment i.e. the "meter compartment" shall be suitable for housing 3 phase 4 wire Energy Meter (energy meter not in bidder's scope of supply) and associated wiring. The Lower compartment i.e. the CT/PT compartment shall house 11 kV current transformers (3 nos.) and 3 phase potential transformer. Two cable compartments suitable for termination of 11kV, 3CX150sqmm to 3CX400sqmm XLPE cable shall be provided for incoming and outgoing cables.

5.3 A separate and independent vermin proof door shall be provided for meter compartment with provision of locking and sealing arrangement. The locking arrangement shall be identical to the lockers provided in banks that are operable with two keys. Two sets of keys shall be provided with each cubicle. The meter compartment shall be completely lockable and sealable with at least one locking and two sealing arrangements on the door. The hinges of the doors shall be concealed type. Two earthing connections shall also be provided in the meter compartment for earthing. Door shall also be provided with flexible earthing braid. The meter compartment shall contain hanger arrangement of slotted angle for mounting meter so that meter can be adjusted vertically and horizontally (details of mounting arrangement will be provided by BSES). Clearances between all parts and components of panel should comply with relevant IS standard. The meter chamber shall be of IP-5X protection class, CT PT Compartment-IP 7X, Cable Compartment-IP 3X . All joints of metering cubicle shall be welded to provide ample mechanical strength. No metal part or joint shall have bolted arrangement except the front door.

5.4 04 No's lifting lugs shall be provided at the top of the metering cubicle for transportation. All nuts, bolts, flat and spring washers shall be SS only except termination nuts and bolts Termination. Nuts and bolt shall be brass along with reducer. Reducer to be used for termination of different type of cable lugs of cable size 11kV, 3CX150 sqmm to 3CX400 sqmm cable. Bimetallic washers must be provided for each and every termination.

The meter compartment shall be provided with a window of size 350 (W) X 300 (H) mm approximately with colourless transparent acrylic sheets and wire mesh shall be suitably fixed on the front door of the meter compartment to enable the meter reader to note down the reading. Provision for mounting serial port for meter reading should also be provided on the door of meter compartment.

CT/PT compartment shall be fabricated after bending the CRCA Sheets on three sides and fourth side shall be welded to make the complete assembly tamper proof. Pressure release device/ explosion vent should be provided on the CT PT compartment at the top side. Complete Metering cubical including cable termination compartment must be AFLR internal arc type tested with top release vent to release the arcing gas

5.5 Cable termination compartments (for incoming and outgoing) should have bottom cable entry provision along with gland plate (3.0mm thick) suitable for 11kV, 3CX150 sqmm to 3CX400sqmm XLPE aluminum cable and knockout punch must be provided accordingly Height adjustable HDPE clamp and support arrangement should be provided for both incoming and outgoing cables. Each cable termination compartments should have at-least two sealing arrangements. Clearance of cable box gland plate from ground shall be sufficient (900 mm minimum) for bending of 11KV Cable. Height of cable termination point from gland plate inside the cable box shall be 550mm (minimum). 3M/Raychem/K.D.Joshi make boots should be provided for incoming and outgoing cable terminations (6 nos. for each metering cubicle).

5.6 The Panel shall be sand blasted and subjected to seven-tank process for surface treatment. The paint shall be powder coated with pure polyester grade 'A' structured finish. The colour shade shall be RAL 7032. Minimum paint thickness of 80 microns shall be maintained.

5.7 The total height including base channel shall not be more than 2000mm. Width and depth should be minimum possible and may be increased suitably to accommodate CT's/PT's.

5.8 All the moving edges shall be provided with Polyethylene Foam Gasket firmly glued to the surface, to make the metering panel dust & vermin proof.

5.9 All the doors must be sealed with Polyethylene Foam Gasket for corner sealing to prevent dust and moisture entry to the compartment.

5.10 Insulation class of the CT and PT should be minimum E. Maximum temperature rise over ambient of 50 Deg C will be 65 Deg C as per IS 16227 Part 1.

6.0 Current transformer

The metering current transformers shall be suitable for 12kV, 50Hz (height system voltage) effectively earthed neutral system. The CT shall be single core, epoxy resin cast, copper wound primary type with rated burden 2.5VA and accuracy class 0.5s or better conforming IS 16227 Part 2. Instrument security factor shall be less than or equal to 10. CTs should have solid copper bus bar type primary terminals for connection with main busbar/bushing terminal. Secondary terminals of CTs should be made of copper or brass. The short time current rating of current transformer shall be as follows.

S. No	CT Ratio	Short time rating	Size of main bus bar
1	15 / 5 A	6KA for 1 sec	30 x 4sqmm
2	30 / 5 A	6KA for 1 sec	30 x 4sqmm
3	60 / 5 A	18KA for 1 sec	30 x 4sqmm
4	100 / 5A	18KA for 1 sec	30 x 4sqmm
5	150 / 5 A	18KA for 1 sec	30 x 4sqmm
6	300 / 5 A	21KA for 1 sec	40 x 6 sqmm

7	400 / 5 A	21KA for 1 sec	40 x 6 sqmm

7.0 Potential transformer

The Potential Transformer shall be indoor dry type Epoxy resin cast, Copper wound suitable for 3 phase 12kV (maximum system voltage), 50Hz effectively earthed neutral system. The PT shall be connected in star to have ratio 11kV/√3 / 110/√3 V with rated burden of 10 VA per phase and accuracy class 0.5 or better conforming to **IS 16227 Part 3.** Primary terminal of PT should be of copper. Secondary terminals of PT should be made of copper or brass.

Major design parameters for CT and PT are as follows:-

S No.	Description	Requirement for CT	Requirement for PT
1	Nominal System Voltage (KV RMS)	11kV	11kV
2	Highest System Voltage (KV RMS)	12kV	12kV
3	Type	Single phase Indoor CT's	Three single phase Star/Star PT.
4	Accuracy Class	0.5s	0.5
5	Rated frequency	50Hz	50Hz
6	Rated Secondary Current Amp.	5 Amp	N / A
7	Rated continuous thermal current	1.2 times of rated primary current	NA
8	Max Ratio error	**As per IS 16227 Part 2**	**As per IS 16227 Part 3**
9	Max Phase angle error	**As per IS 16227 Part 2**	**As per IS 16227 part 3**
10	Rated burden	**2.5VA Per Phase**	**10VA/ Phase**
11	Rated voltage factor	N / A	1.2 times continuous and 1.5 times for 30seconds
12	Short time current rating		
12.1	Thermal rating	As provided in section 3.2	N / A
12.2	Dynamic rating	2.55 times of short time thermal current rating	N / A
13	One minute high voltage power frequency withstand voltage		

S No.	Description	Requirement for CT	Requirement for PT
.13.1	On primary winding kV rms On secondary winding kV rms	• 28KV (rms) for 1 minute for 11 kV class • 3KV (rms) for 1 minute	28KV (rms) for 1 minute for 11 kV class 3KV (rms) for 1 minute
13.2	1.2 / 50 impulse withstand voltage	75 kV (peak) for 11 kV class	75 kV (peak) for 11 kV class
14	Winding materials	Copper	Copper
15	Insulation security factor	< 10	N / A

8.0 Wiring

Secondary wiring of CTs and PTs shall be done with 2.5 sq. mm PVC insulated cables with stranded copper conductor. CT and PT wiring should run in independent rigid steel conduit pipes of appropriate size from CT/PT compartment to meter compartment. Conduit pipes shall be clamped with the inner wall of the panel and shall be so laid that none of the wires can be tampered from outside.

Current transformer and Potential transformer secondary wiring shall be colour coded as per IS and shall be suitably ferruled for identification. No link or test terminals shall be provided in wire from CT/PT to meter terminals. All kind of wires must be terminated with pin/ring type lugs with proper ferrule marking.

9.0 Bushing

Bushing should be made of homogeneous epoxy / polymeric material free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality. Bushings shall be designed to have ample insulation level, mechanical strength and rigidity for the conditions under which they will be used.

The hollow Cast resin epoxy bushing**s shall conform to IS-60137.**

Bushing clamping accessories, bolts, studs etc. shall be hot dip galvanized. All the nuts and washer shall be SS-304. All iron parts shall be hot tin galvanized and all points shall be airtight. All current carrying contact surfaces shall be bimetallic type. The creepage distance of the bushing shall not be less than 31mm/kV.

Bushing shall **be tested in accordance with IS-60137. Routine as well as type tests reports in conformity with IS-60137 shall be f**urnished to the purchaser.

10.0 Earthing

The assembly comprising of the chassis, framework and the fixed parts of the metal casing shall be provided with two separate earthing terminals of 50X6 GI Strip. These terminals shall be provided over and above all other means provided for securing and earthing metallic enclosures (armour or other metallic coverage) or current- carrying cables.

The earthing terminals shall be readily accessible and so placed that the earth connection of the CT/ PT chamber is maintained when the cover or any other movable part is removed.

The earthing terminals shall be protected against corrosion and shall be metallically clean. Under no circumstances shall a movable metal part of the enclosure be insulated from the part carrying the earthing terminals when the movable part is in place.

2 nos. for each terminal GI M10 Nuts and Bolts shall be provided along with 50X6 GI Strip terminals to facilitate the strip connection to ground by BSES.

The earthing terminals shall be identified by means of the symbol marked in a legible and indelible manner on or adjacent to the terminals.

11.0 Connections

No joint in the primary winding of CT shall be acceptable. Connection between CT terminal and bushing terminals shall be done with solid copper bus bar of adequate size as per the table given in the specification (refer clause no. 3). Flexible copper strip / rope are not acceptable for primary connection. PT should be connected to primary bus bar through bus bar of appropriate size (connections using flexible conductor are not acceptable). All bus bars/connections in the CT/PT compartment shall be encapsulated in epoxy.

12.0 Provision for sealing

Holes must be provided for the purpose of sealing using the sealing wire of 3 ply on the following compartments

a. Meter compartment
b. Incoming cable compartment
c. Outgoing cable compartment

13.0 Name Plate and Marking

The metering cubicles shall be provided with a non-detachable type nameplate with legible and indelible marking of the following details:

a. BSES Property
b. Supplier’s name

c. P.O. No. & Year of manufacturing
d. Sr. No. of panel
e. Particulars of CT's such as ratio, VA burden, accuracy class, SC rating, BIL.
f. Particulars of PT's such as ratio, accuracy class, VA burden, BIL.
g. Standard connection diagram
h. Consumer account no
i. Sanctioned load.
j. Date of release of connection.
k. Circuit diagram along with CT PT rating details.
l. IP details
m. Voltage rating

Name plate having complete data shall be provided outside as well as inside the metering cubicle at a suitable place where it can be easily read. Name plate shall be anodized Aluminium fixed on the enclosure sheet with welded arrangement so that in case name plate is removed no passage holes are left.
In addition to nameplate, CT ratio of the cubicle should be indelibly marked in bold on the CT/PT compartment. Labels and color coding should be provided for phase identification.
Quality Assurance

14.0 Quality Assurance:

Vendor Quality Plan	To be submitted for purchaser approval
Inspection Points	To be mutually identified & agreed in quality plan

15.0 Testing, Inspection and Physical Inspection:

The Metering cubicle shall be subjected to the following tests

a.	Type test	a. Metering cubicle shall be type tested as per IS 62271 200 b. CT and PTs shall be type tested as per standard IS and IEC c. Bushings shall be type tested in accordance with as per standard IS and IEC d. Type tests should not pertain to period earlier than five years. e. In case type test report is more than five years old, bidder has to conduct the type test from CPRI/ERDA from BSES sample in accordance to IS, IEC as well as BSES requirement without any cost implication to BSES. In addition, below mentioned tests must be the part of type test report on complete metering cubical f. IP test g. Short Circuit test as per the table mentioned in the clause no

		6.0 h. Contract Resistance Measurement (CRM) i. Temperature rise test
b.	Inspections	a. Metering cubicle shall be tested as per relevant IS b. CT and PTs will be tested in accordance as per IS 2705 Part 1, IS 16227 Part 1, Part 2 and Part 3. c. Temperature rise test shall be carried out on complete unit on sample selected randomly from lot offered during inspection. d. During inspection, all routine and acceptance tests shall be carried out in presence of representative of purchaser. e. Complete verifications of Raw materials purchase and test certificate
c.	Physical Inspection	a. Checks of all mounting plates / fasteners. b. Checking of components as per drawing. c. Electrical circuits fasteners tightness / surface area contacts. d. Labels / identification / nameplates. e. All doors checks – safety and accessibility. f. Panel surface finish / smoothness.

16.0 Packing

16.1	Packing Protection	Against corrosion , Dampness, heavy rains, breakage and vibration
16.2	Packing for accessories and spares	Robust wooden non-returnable package case with all the protection mentioned above and identification Label mentioned in the sl. No 16.3
16.3	Packing identification Label	In each packing case, following details are required a. Individual serial no b. Purchaser's name c. PO no along with date and SAP code d. Equipment Tag no if any e. Destination f.Manufacturer name/Supplier name g. Address of manufacturer/Supplier/Its agent h. Country of Origin i. Month of year of manufacturer j. Gross and Net weight in kilogram k. All necessary slinging and stacking instruction l. All necessary storage instructions m. Case measurement

17.0 Shipping

17.1	Shipping	The bidders shall ascertain at an early date and definitely before the commencement of manufacture, any transport limitations such as weight, 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.
17.2	Packing	The seller shall be responsible for all kind of transit damage and shall be replaced by seller at free of cost if any.

18.0 Handle and Storage

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

19.0 Deviations

19.1	a) Deviations from this specification shall be listed separately by bidder clause wise (format given below clause no- 20.2) along with optional offer and has to submit the list along with bid/quotation. BSES will review the deviations and if BSES is agreed with the deviation, seller has to take written confirmation from BSES on deviation during tender evaluation. b) In the absence of any separate list of deviations from the bidders with bid as well as written confirmation from BSES on deviations, it will be assumed by the Buyer that the Seller complies with the Specification fully. c) Any deviations mentioned in any other submitted bid documents (i.e.in filled GTP, Catalog, BSES old approval, buyer's/seller's standards etc.) by seller without separate deviation sheets will not consider as a deviation from this tech spec at any stage of contract.

Drawing and Document Submission:

Drawing submission shall be as per the matrix given below. All documents/ drawing shall be provided on A4 sheet in soft copy with separators for each section. Language of the documents shall be English only. Deficient/ improper document/ drawing submission may liable for rejection				
SL	**Detail of Document**	**Bid**	**Approval**	**Pre Dispatch**
1	Guaranteed Technical particulars (GTP)	Required	Required	
2	Deviation Sheet, if any	Required	Required	
3	GA / cross sectional drawing of Meter Box showing all the views / sections	Required	Required	
4	Any accessories	Required	Required	
5	Manufacturer's quality assurance plan and certification for quality standards	Required	Required	
6	Type Test reports of offered model/ type/ rating	Required		
7	Complete product catalogue and user manual.	Required		
8	Customer Reference List	Required		
9	Recommended list of spare and accessories	Required		
10	Program for production and testing (A)		Required	Required
11	Detailed installation and commissioning instructions		Required	Required
12	As Built Drawing		Required	Required
13	Operation and maintenance Instruction as well as trouble shooting charts/ manuals		Required	Required
14	Inspection and test reports, carried out in manufacturer's works			Required
15	Routine Test certificates			Required
16	Test certificates of all bought out items			Required

Deviation sheet format.

Sl. No.	Document Name	Clause No.	Deviation	Reason	Merit to BSES

Annexure: I

Make List of Accessories

Sl.No.	Descriptions	Make
1	CT	Pragati
		NPT
		Gilbert and Maxwell
		Bidder self make
2	PT	Pragati
		NPT
		Gilbert and Maxwell
		Bidder self make
3	Wire (Copper)	Havells
		Finolex
		Polycab
4	Boot	Raychem
		3M
		K.D Joshi
		Shine Industries
5	Bus Bar (Copper)	Vedanta
		Hindalco
		Hindustan Copper
6	Terminal Block	Connectwell/Wago/ Elemx and Phoenix
7	Insulator	Aditya Birla
8	Paint make	Asian Paints
		Berger Paints
9	CRCA Sheet	SAIL
		Tata
		Jindal
10	Lock	Godrej
		Harrison
		Abloy
		Suzu

Annexure II - Guaranteed Technical Particulars

Bidder shall furnish the GTP format with all details against each clause of this specification.

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

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

BSES

Technical Specification of

Chemical Earthing Kit

Specification no – BSES-TS-06-CHER-R0

Rev:		0
No of Pages		18
Date:		04 April 2022
Prepared by	Abhishek Harsh	
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Approved by	Gaurav Sharma	
	K. Sheshadri	04/04/22

TECHNICAL SPECIFICATIONS OF CHEMICAL EARTHING

TABLE OF CONTENTS

TECHNICAL SPECIFICATIONS OF CHEMICAL EARTHING

1.0 SCOPE

This specification provides design, manufacturing, testing, inspection, packing, dispatch and installation of Chemical Earthing along with required accessories to BSES New Delhi store/ site, specified herein for their satisfactory operation in the network of BSES, New Delhi.

Such earthing shall last for minimum of 15 – 20 years and shall maintain the ohmic values despite of seasonal changes and water conditions. The conductivity of the material shall remain uncompromised

Chemical Earthing shall be used for various EHV, HV and LV equipments such as PTRs, Panels, Feeders, Distribution Transformers, Poles, Distribution boxes, RMUs etc.

2.0 STANDARDS

Chemical Earthing shall conform to the following International/Indian Standards and shall also abide the guidelines of CEA of India, which shall mean latest revisions, with amendments/changes adopted and published, unless specifically stated otherwise in the Specification.

S.No	International/ Indian standard	Title
1	IS 3043	Code for practice of Earthing
2	IEEE Std. 80	Guide for Substation Grounding

3.0 CLIMATIC CONDITIONS

1	Average grade atmospheric condition	Heavily polluted, dry
2	Maximum altitude above sea level	1000 M
3	Air temperature Ambient	i) Highest : 50˚C ii) Average : 30˚C iii) Minimum : 0˚C
4	Relative Humidity	100 % max
5	Thermal Resistivity of Soil	150˚C. cm / W (max.)
6	Seismic Zone	4
7	Rainfall	750 mm concentrated in four months

4.0 GENERAL TECHNICAL REQUIREMENT

4.1 GROUND RESISTANCE VALUE

Ideally the ground resistance value should be "ZERO". As per IEEE recommendation the ground resistance value should be 5 ohms or less for effective grounding for small sub-station.

In BSES, the primary guidelines shall be followed for a good earthing system in a Distribution Sub-Station & down stream LT Equipments / Installations are as under-

a) The impedance to ground should be as low as possible. In large Sub-Stations , it should not exceed 1 ohm and in small **Sub-Stations 5 ohm as per IEEE Std.80**, **cl no 14.1** and as per cl. no. 3.2.6 of Chapter-III of CBIP Technical report no. 3 (Revised) Reprinted 1990 & 1995 on Manual on Layout of Sub-Stations.

b) At condition in BSES area, Mesh resistance shall not cross 5ohm and that shall maintain throughout the warranty period without any maintenance.

The specification generally covers the technical parameters of Chemical Earthing kit, earthing pit and installation of chemical earthing.

The Chemical Earthing shall therefore be suitable for satisfactory operation under the climatic conditions listed in clause 3.0.

4.2 GENERAL REQUIREMENT

A. Supply:

1. Copper bonded electrode/Rod electrode or any suitably designed copper electrode of length of 3 meter with below size as per tender requirement.

   i. 17.2 mm dia (Minimum fault current carrying capacity 20kA for 1 sec)

   ii. 25 mm dia (Minimum fault current carrying capacity 44kA for 1 sec)

   Copper bonded rod shall be UL certified and type tested from CPRI/ERDA which are mandatory.

   Copper coating shall be 250 micron minimum.

2. Earth enhancing material shall have lower ground resistivity, better conductivity, corrosion protection of electrode, non leaching and environment friendly properties. 25kg shall be normal packaging. Restriction of Certain Hazardous Substances (ROHS) certification is required for the Chemical compound.

3. Inspection joint which shall be used for testing of pit resistance

4. Heavy duty Polyplastic cover for Earth pit

5. Copper bonded steel conductor (17.2 or 25 mm dia as per requirement) for mesh formation

6. Exothermic joint (L, T and Cross joint)

7. Exothermic welding accessories

8. GI Strip for connection of equipment to mesh

B. Service:

1. All the earthing shall be in mesh formation
2. Mesh resistance shall not cross 5ohm and that shall maintain throughout tha warranty period without any maintenance
3. All tools & tackles, equipment, boring equipment, hardware and services required for successful completion of the work shall be in OEM scope of work.
4. BSES reserves the right of inspection and monitor work progress time to time and ask for amendment / rework if the job is not up to the requirement.
5. Time is the essence of the contract and the bidder shall comply with the schedule and complete the execution of the contract within the time frame specified during award of contract.
6. All safety rules and codes as applicable to work shall be followed without exception. All safety and protective devices / appliances including belts, hand gloves, aprons, helmets, shields, goggles, and safety shoe shall be provided by the contractor to his personnel.

4.3 DESIGN PARAMETERS

1. Mesh resistance shall be less than 5 ohm and should never exceed 5 ohms throughout the warranty period

2. Fault current carrying capacity for the Earthing rod shall be as below

   i. 20 kA for 1 sec for 17.2 mm dia Rod

   ii. 44 kA for 1 sec for 25 mm dia Rod.

3. Enhancing material shall provide better conductivity, corrosion protection of electrode, non leaching and environment friendly

4. Chemical Earthing arrangement should be maintenance free for the warranty period

5. Minimum Warranty of 10 years

6. General Arrangement as per approved in Annexure –B

7. Soil resistivity shall be considered 100ohm mtr max.

4.4 INSTALLATION OF EARTH PIT

1. The pits shall be drawn with the help of a boring machine, an auger or any other means as required by site conditions and nature of ground strata

2. The pit for electrode shall be of 200 mm larger than the length of the pipe.

3. The top of the pipe will be approximately **150 mm** below the level of the Grade/ground level.

4. No. of Earth pits shall be as per BSES requirements.

5. The earth pit shall be placed at a distance of 3.0M apart minimum

6. In case of congested area , the distance between the earth pits shall not be less than 2.50 M.

7. Minimum of 1.0 M distance of Earth pit from electrical equipment and structures shall be maintained.

8. The earth pits shall be backfilled with Earth enhancing material.

9. Top of the pit shall be covered by polyplastic pit cover

10. After completion of earthing, area dressing shall be done by OEM

4.5 EARTH CONDUCTOR

1. 50X6/50x10 GI strips shall be used for equipments connection

2. Copper bonded conductor shall be laid 600mm below FGL for mesh formation

3. The connection of GI flat (50x6/50x10) with the Copper bonded electrode/Rod shall be done by M10 GI bolt joint. GI Bolt shall be provided by OEM of Earthing

4. The connection of GI flat (50x6/50x10) with equipments (with the earthing provision given by equipment OEM) shall be done by M10 GI bolt.

5. In case the copper bonded rod/GI flat is to cross any obstruction, it shall be laid 300 mm below the obstruction.

6. 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.

4.6 GROUND EARTH ENHANCEMET MATERIAL

Earth enhancement material is a superior conductive material that improves earthing effectiveness, especially in areas of poor conductivity (rocky ground, areas of moisture variation, sandy soils etc.). It may contain conductive cement, graphite, hydrous aluminium silicate, sodium montmorillonite etc. It improves conductivity of the earth electrode and ground contact area. It shall have following characteristics-

1. It should have low resistivity preferably below 0.12 Ohm-meters. Resistivity shall be tested by making a 20cm. cube of the material and checking resistance across the opposite face of the cube.
2. It shall not depend on the continuous presence of water to maintain its conductivity.
3. It should be a little alkaline in nature with pH value >7 but <9, test certificate from NABL approved laboratory to be provided for the composition so designed.
4. It should have better hygroscopic properties to absorb moisture. It should absorb and release the moisture in dry weather condition and help in maintaining the moisture around the earth electrode.
5. It should have capacity to retain >10% moisture at 105ºC. Test certificate from NABL approved lab to be submitted for the composition so designed.
6. It should have water solubility < 5%. Test certificate from NABL approved lab be submitted for the composition so designed.
7. It should be granular with granule size 0.1 mm to 3 mm.
8. It should be non toxic, non reactive, non explosive & non corrosive.
9. It shall be thermally stable between 0 degree centigrade to +60 degree centigrade ambient temperature.
10. It shall not decompose or leach out with time.
11. It shall not pollute the soil or local water table and meets environmental friendly requirement for landfill.

12. It should expand & swell considerably and removes entrapped air to create strong connection between earth electrode and soil.

13. It should be diffuses into soil pores and creates conductive roots enlarging conductive zone of earth pit.

14. It shall be permanent & maintenance free and in its “set form”, maintains constant earth resistance with time.

15. It shall not require periodic treatment or replacement.

16. It shall be suitable for any kind of electrode and all kinds of soils of different resistivity.

17. It shall not cause burns, irritation to eye, skin etc.

18. The Earth enhancement material shall be supplied in sealed, moisture proof bags. These bags shall be marked with Manufacturer’s name or trade name, quantity, batch no & date of manufacture, Buyer’s name, PO no, date of PO.

5.0 TESTS

5.1 GENERAL

BSES reserves the right to inspect the material at the time of tests. All tests shall then be performed in the presence of BSES representative. The Bidder shall have to give intimation in advance to witness the test. All the test results must be recorded in presence of the inspecting authority.

5.2 TYPE TESTS

All the product shall be type tested from CPRI/ERDA .Type test report shall not be more that 5 years old.

Type test report is valid only 5 years from the date of tender floating. In case of type test report is more than 5 years old, bidder has to conduct the type test from BSES sample at CPRI/ERDA without any cost implication to BSES.

5.2 ACCEPTANCE TESTS

1. Visual examination test
2. Dimensional verification

3. Resistivity verification

5.3 TESTING CHARGES

5.3.1	The testing charges for the type tests specified and as per relevant standard shall be borne by the bidder. All the manufacturers irrespective of quantity allotted to them, will have to carry out the Type Tests at their own cost and BSES will not have any bearing on this account. The type test reports shall not be older than 5 yrs and shall be valid till the validity of offer
5.3.2	In case of failure in any of the type tests, the manufacturer is required to modify the design of the material if required and repeat the particular type test and same shall pass within three times at his own expenses. The decision of the BSES in this regard shall be final. BSES at its own desecration may also cancel the order at the risk and cost of the manufacturer if the material fails twice in the type test.
5.3.3	Type test shall be done from CPRI/ERDA. Ensure that the tests can be completed in these laboratories within the time schedule guaranteed by them in the appropriate schedule. BSES reserves the right to specify the name of the laboratory also, if so felt.
5.3.4	The entire cost of testing for the acceptance and routine tests and tests during manufacture specified herein shall be treated as included in the quoted unit price of conductor.

5.4 ADDITIONAL TESTS

BSES reserves the right of getting done any other test(s) of reasonable nature carried out at Manufacturer's premises, at site, or in any other place/ third party lab in addition to the aforesaid type, acceptance and / or routine tests to satisfy with the fact that the material comply with the specifications. In such case all the expenses will be to Manufacturer’s account.

5.5 TEST REPORTS

5.5.1	Soft copies of type test reports shall be furnished through mail only. BSES may ask original type test report to verify soft copy. BSES will not receive any hard copy for their office record. BSES will give final dispatch clearance after validating type test report.

5.5.2	Record of routine test reports shall be maintained by the Manufacturer at their works for periodic inspection by the BSES's representative and shall be reviewed during inspection.
5.5.3	Test Certificates of tests done during manufacturing shall be maintained by the Bidder. These shall be produced for verification as and when desired by the BSES.

6.0 INSPECTION

6.0.1	BSES representative shall at all times be entitled to have access to the works and all places of the manufacturer and the representative shall have full facilities for unrestricted inspection of the Manufacturer's works, raw materials, store process and process of manufacture and conducting necessary tests as may be deemed fit, for certifying the quality of product.
6.0.2	The Manufacturer shall keep BSES informed in advance of the time of starting and of the progress of manufacturing of materials in its various stages so that arrangements can be made for inspection.
6.0.3	No material shall be dispatched from its point of manufacture and works before it has been satisfactorily inspected, tested, and necessary dispatch instructions are issued in writing, except for the cases where waiver of Inspection is granted by BSES, and even in this case also, written dispatch instructions will be issued. Any dispatches before the issue of Dispatch Instructions in writing will be liable for rejection and non acceptance by the consignee.
6.0.4	The acceptance of any quantity of material shall in no way relieve the Manufacturer of any of his responsibilities for meeting all requirements of the specification, and shall not prevent subsequent rejection if such material is later found to be defective.
6.0.8	Only soft copy of inspection report shall be furnished by manufacturer through mail. BSES shall not receive any hard copy of report for their office record.

7.0 QUALITY ASSURANCE PLAN

7.1 The bidder shall invariably furnish following information along with his offer, failing which his offer shall be rejected.

7.1.1	Statement giving list of important raw materials, names of sub manufacturers for the raw materials, list of standards according to which the raw materials are tested, list of tests normally carried out on raw materials in presence of manufacturer's representative and as routine and / or acceptance during production and on finished goods, copies of test certificates.
7.1.2	Information and copies of test certificates as in mentioned above in respect of bought out accessories.
7.1.3	List of manufacturing facilities available.
7.1.4	Level of automation achieved and list of areas where manual processing exists.
7.1.5	List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.
7.1.6	List of testing equipment available with the Manufacturer for final and calibration certificate
7.1.7	Testing of Earthing and its related accessories to be specified. In the case if the manufacturer does not possess all the Routine and Acceptance testing facilities, the bid / PO shall be rejected.
7.1.8	BSES reserves the right for factory inspection to verify the quoted offer. If any of the facts are found to be misleading or incorrect the offer of that Bidder will be out rightly rejected and he may be black listed.
7.1.9	Special features provided to make it maintenance free.

7.2 The bidder shall also submit following information to the BSES along with the technical Bid.

7.2.1	List of raw materials as well as bought out accessories, and the name of manufacturers of raw materials as well as bought out accessories.
7.2.2	Type test certificates of the raw material and bought out accessories.
7.2.3	Quality assurance plan (QAP) with hold points for BSES's inspection.

7.3 The Manufacturer shall submit the routine test certificates (only soft copy through mail) of all the bought-out items, accessories etc.

NOTE: Final QAP shall be approved by BSES.

8.0 DOCUMENTATION

Submission of drawings, calculations, catalogues, manuals, test reports shall be as mentioned below:

8.1 Drawing, Data and Manuals

The vendor shall submit-

- Cross sectional drawing
- GTP (all data to appear)
- Type test certificates
- Fault level calculation

Document Submission

Document/Drawing submission shall be as per the matrix given below:

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

SNo.	Detail of Document	Bid	Approval	Pre Dispatch
1	Guaranteed Technical Particulars (GTP)	Required	Required	
2	Deviation Sheet, if any	Required	Required	
3	Detailed cross sectional drawing	Required	Required	
4	Type test reports	Required	Required	
5	BIS certificate	Required		
6	Inspection test reports and Routine Test Certificates carried out in manufacturer's works			Required
7	Calibration test reports of instruments			Required

9.0 PACKING & FORWARDING

9.0.1	Shipping Information	The seller shall give complete shipping information concerning the weight, size of each package
9.0.2	Transit damage	The seller shall be responsible for any transit damage due to improper packing
9.0.3	Markings on Earthing Rod	• As per mentioned in the Drawing (Annexure-B)
9.0.4	Delivery Schedule	• Delivery period Start Date : From date of LOI / LOA • Delivery period End Date : As agreed with manufacturer • Material dispatch Clearance : After inspection by purchaser
9.0.5	Accessories	• Accessories shall be packed separately item wise with proper protection to prevent damage and easy handling. • Marking • Material description • Type • Dimension • PO number and date • SAP item code • Total weight • Manufacturer's name • Buyer's name • Month and year of manufacturing • Storage type

10.0 DEVIATIONS

10.0.1 Deviations from this specification shall be listed separately by bidder clause wise (format given below) along with optional offer and has to submit the list along with bid/quotation. BSES will review

the deviations and if BSES is agreed with the deviation, seller has to take written confirmation from BSES on deviation during tender evaluation.

10.0.2 In the absence of any separate list of deviations from the bidders with bid as well as written confirmation from BSES on deviations, it will be assumed by the Buyer that the Seller complies with the Specification fully.

10.0.3 Any deviations mentioned in any other submitted bid documents (i.e.in filled GTP, Catalog, BSES old approval, buyer's/seller's standards etc) by seller without separate deviation sheets will not consider as a deviation from this tech spec at any stage of contract.

Deviation Sheet Format-

S.no	Document Name	Clause No.	Deviation	Reason	Merits to BSES

ANNEXURE-A GUARANTEED TECHNICAL PARAMETERS

Note:

1) Every data shall be mentioned.
2) Seller may submit separate GTP for the earthing, as suitable.
3) GTP shall be read in line with purchaser's Project Site Specific Requirement.

TECHNICAL DATASHEET FOR EARTHING			
S.No.	**Parameter**	**BSES requirement**	**Vendor data**
1	Name ,Address and ph no of Manufacturer		
2	Ref IS No	IS 1239 (Part -1) 2004	
3	Type (Light, Medium, Heavy) Medium, B class	NA	
4	Size of copper bonded rod	17.2 mm / 25 mm	
5	Copper coating thickness	250 micron	
6	UL marking	Yes/No	

TECHNICAL SPECIFICATIONS OF CHEMICAL EARTHING

TECHNICAL DATASHEET FOR EARTHING

S.No.	Parameter	BSES requirement	Vendor data
7	CPRI/ERDA Type tested		
6	Length of Pipe	3 mtr	
11	Earth enhancing material	25kg/bag	
12	Plyplastic cover	Yes/no	
13	Exothermic Joint	L,T and cross joint	
14	Exothermic accessories	Yes/no	
15	GI Nuts and bolts	Yes/no	
16	Make of steel	SAIL /ESSAR/ TATA	
17	Embossing details	Name/logo of manufacturer, PO No., ISI, Class of tube i.e. M for Medium, Color of band (PO no provided in stencil), UL marked	
18	Colour Coding	BLUE colour band at both ends	
	Details of Drawings submitted		
19	Chemical composition Test	As per IS 1239-1	
17	Test	As per IS 1239-1	

Technical Requirement

Sl no	Descriptions		Bidders Data
A	Technical Requirement	1) Mesh resistance shall be less than 5 ohm	
		2) Fault current sustainability for Earthing rod shall be min 20 kA and 44 kA (1 sec) for 17.2 mm and 25 mm rod respectively.	
		3) Enhancing material shall be leaching free	
		4) All materials shall be corrosion free.	
		5) Warranty for maintaining pit resistance below 5 ohm- 10 years minimum. pit resistance shall be verified every 6 months by bidder.	

		6) Copper bonded rod and copper cladded steel shall be CPRI/ERDA tested and UL marked	
B	Materials	1) Minimum dimension of copper bonded rod shall be 17.2 mm/25 mmX3 Mtr. copper coating 250 micron.UL mark is mandatory	
		2) Pit shall be filled completely by earth enhancement material. 25Kg chemical shall be packed per bag	
		3) Polyplastic pit cover shall be provided. test report to submitted for review.	
		4) Inspection joint to be provided.	
		5) Exothermic joint (L,T and Cross Joint)	
		6) Exothermic Accessories	
		7) 50x6/50x10 GI Strip	
C	Services	1) All the drawings and installation manual to be submitted to CES for approval.	
		2) All kind of activity including tools for pit installation, resistance measurement shall be in bidder scope.	
		3) Exothermic welding, welding accessories	
		4) Nuts and bolt for connection of GI strips with equipments	
		5) Each pit resistance shall be verified by BSES. record of resistance value to be maintained by bidder and same shall be submitted to CES.	
		6) Laying of 50X6/50x10 mm GI strip shall be in bidder scope- for connection of equipements	
		7) Laying of copper cladded rod below 500mm depth for formation of mesh	
		8) Chemical earthing kit (copper bonded rod, chemical and polyplastic pit cover) installation	

11.0 SCOPE DEMARCATION

Supply:

Sl no	Descriptions	BSES	Vendor	Remarks
1	Chemical Earthing Kit (Copper Bonded Rod,	X	√	

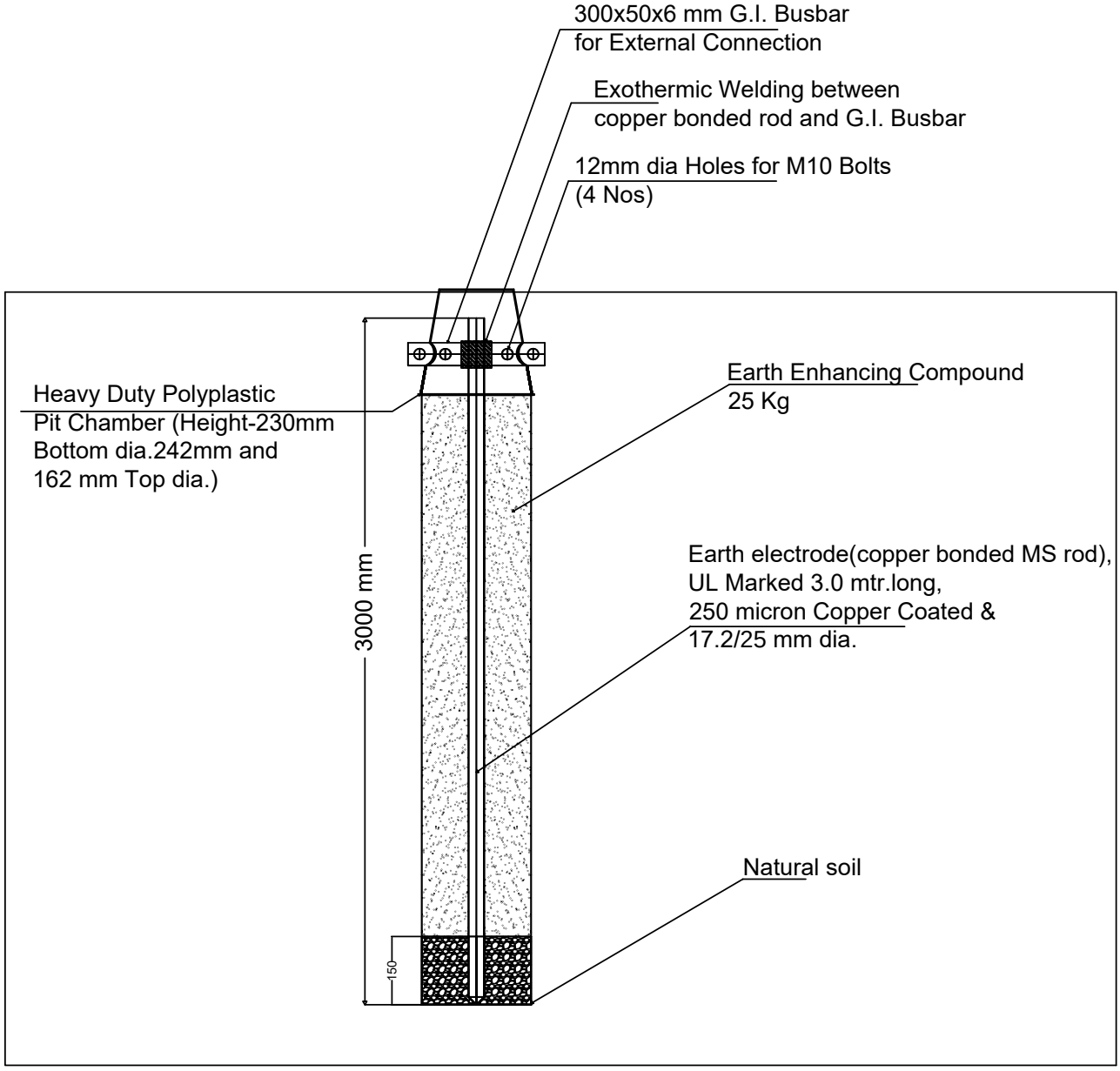
	25 kg chemical and Polyplastic Pit Cover)			
2	Copper Bonded Steel conductor for mesh formation	X	√	
3	Exothermic Joint	X	√	
4	Exothermic Joint Accessories	X	√	
5	50X6/50x10 GI Strip	√	x	
6	GI Bolt required for connecting the GI strip with equipment	X	√	

Services:

Sl no	Descriptions	BSES	Vendor	Remarks
1	Transportation of all kind of materials from BSES store to site	X	√	
2	Vehicle arrange for material transport	X	√	
3	Digging of Pit	X	√	
4	Installation of pit	X	√	
5	Digging for laying of copper bonded steel at 500mm depth for mesh formation	X	√	
6	Laying of copper bonded rod	X	√	
7	Exothermic jointing	X	√	
8	Connecting of equipment to mesh by 50X6/50x10 GI strip	X	√	
9	GI Bolting	X	√	
10	Any kind of drilling, hole making, welding for the job	X	√	
11	Measurement of soil resistivity	X	√	
12	Measurement of mesh resistance after finishing of earthing work (mesh resistance must be less than 5 ohm)	X	√	
13	MOM after job finishing	X	√	
14.	All kind of instrument, equipment required for job execution and for finishing	X	√	
15	PPE for workers	X	√	
16	Returning of scrap to BSES store if any	X	√	
17	Backfilling of trench, pit etc.	X	√	
18	Filling material reservation slip (MRS) in SAP	√	x	
19	BOQ estimation for Earthing work (type, size and length of GI strip,)	√	x	
20	Dismantling of existing earthing if any	X	√	

ANNEXURE-B: GENERAL ARRANGEMENT DRAWING OF CHEMICAL EARTHING ROD

ANNEXURE - B



CHEMICAL EARTHING

Note:

1. Kit content

a.17.2/ 25 mm dia, 3mtr. long copper bonded rod (250 micron copper coated) with 300x50x6 G.I.Busbar T-connection (T-connection with Exothermic Welding)

b. Earth enhancing compound.(25kg/bag).

c. Heavy duty Poly plastic pit cover.

2.Following information shall be printed by laser / engrave method marked on Rod

- **Manufacurer name**
- **Customer name**
- **Month / Year of manufacturing**
- **UL Mark**
- **P.O. No. & Date**
- **Dia- 17.2/25 mm, Length-3mtr., Thickness copper coated-250micron**

3. Fault current carrying capacity shall be min 20kA/44kA for 1 sec

DRAWN		TITLE:-	BSES
CHECKED		CHEMICAL EARTHING	
REVIEWED			DWG NO.
APPD			
DATE	22.02.2022		

BSES

TECHNICAL SPECIFICATION

FOR

LAYING OF 66 kV / 33 kV / 11 kV / 1.1 KV GRADE PVC / XLPE CABLES

Specification no: GN101-03-SP-06-03

BSES RAJDHANI POWER LTD			
Prepared by	Pronab Bairagi		Rev : 03
Reviewed by	Amit Tomar	31.10.17	Date : 31.10.2017
Approved by	Vijay Panpalia		Pages : 44
Registered Office: BSES Bhavan, Nehru Place, Delhi - 110019			

Index

General Specification

1.0 Codes & standards

Materials, equipment and methods used in the Laying of 11/33/66KV Cable shall conform to the latest edition of following –

S. No.	Reference No.	Name of Standard
1		Indian Electricity Rules, 1956
2		Indian Electricity Act, 1910
3		Indian Electricity Supply Act, 1948
4		Electricity Laws Act, 1991
5		National Electrical Code (Indian standards Institution)
6	IS 1255	Code of practice for installation and maintenance of Power Cable upto and Including 33KV rating.
7	IS 1554	PVC Insulated Electrical Cables upto 11KV
8	IS 2274	Code of Practice for electrical wiring installation – system voltage exceeding 650V
9	IS 7098 Part II	Crosslinked Polyethylene Insulated PVC sheathed cables for working voltages from 3.3KV upto and including 33KV
10	IS 7098 Part III	Crosslinked Polyethylene Insulated PVC sheathed cables for working voltages from 66KV upto and including 220KV
11	IS 5820	Specification of precast concrete Cable cover.

2.0 Design guidelines and Parameter for cable laying-

S. No.	Parameter	Details
2.1	Selection of Cable Route	The cable route selection shall be done by the concerned supervising engineer by first conducting route survey and selecting a route along with contractor keeping followings in mind: -The side of road which presents the least obstacles and the fewest roadways crossings. -The future consumers and existing cables in the route may influence the cable route. -Railway, road crossings, MCD and other government agencies may also influence in selection of cable route. -Plans for future building projects should be considered. -The route shall be as far as possible away from parallel running gas, water pipes and telephone/telecommunication cables.
2.2	Site Preparation	a) Barricading: • The identified cable route shall be barricaded continually before excavation. • Barricading shall be as drawing laid • Open Trench method shall be adopted as far as possible for trench preparation. b) Excavated Earth:

		• The excavated earth shall be so stored at site, that it shall not cause trouble to running traffic • All excavated earth shall be stored within the barricaded area. • c) Full height fence, barriers, barricades etc. shall be erected around the site in order to prevent the working area from the risk of accidents due to speedy vehicular movement. Same the way barricades protect the road users from the danger due to construction equipment and temporary structures. d) The structure dimensions of the barricades , material and composition, its colour scheme, BSES logo and details shall be in accordance with specification and drawing laid down in the tender documents. e) All the barricades shall be erected as per the design requirements of employer, numbered painted and maintained in good condition and also barricade in charge maintain a barricade register at site. f) All barricades shall be conspicuously seen in the dark/night time by the road users so that no vehicle hits the barricades. Conspicuity shall be ensured by affixing retro reflective strips of required size and shape at appropriate angle at bottom and middle portion of the barricades at a minimum gap of 1000 mm. In addition minimum one red light /red blinker and red beacon light should be placed at the top of each barricade. g) PPP to be provided by vendor to all workers and engineers. **h) Also refer Annexure- 7: Barricading and Safety**
2.3	Clearance	The desired minimum clearances are as follows – - Power cable to power cable – A minimum clearance equal to diameter shall be maintained. Trench drawings shall be referred to for guidance. - Power Cable to control cables – 0.2 M - Power cable to communication cable – 0.3M - Power cable to gas/water main – 0.3 M
2.4	Depth of Cable Laying	The desired minimum depth of laying from ground surface to the top of cable shall be: 650 / 1100V grade XLPE Cables – 75 cm 6.35 / 11KV grade XLPE Cables – 90 cm Low voltage and Control cable - 75 cm 19 / 33KV grade XLPE Cables - 1.2 M 38 / 66KV grade XLPE Cables - 1.5 M Cables at Road crossing - 1.0 M (min.) Cables at railways level crossings (measured from bottom of sleepers to the top of Pipe) - 1.0 M (min.) Whenever there is any obstacle at the laying depth, the cable should be lowered/ raised to cross the obstacle. However variation in the depth is to be approved by BSES. The Contractor shall provide the same in deviation report.
2.5	Width of Cable	The width and depth of Cable Trenches shall depend upon number of

	trenches	circuits and Voltage Grade. Annexure # 3 and drawings of this specification shall be followed.
2.6	Bending Radius of Cables	While pulling of the Cable from the drum or during laying following minimum bending radius shall be maintained so that the cable, in particular the insulation does not get damaged – A) Single Core Cables (PVC & XLPE) Upto 1.1KV grade – 15 X D Above 11KV grade - 20 X D B) Multi Core Cables (PVC & XLPE) Upto 1.1KV grade - 12 X D Above 1.1KV grade – 15 X D Where 'D' is overall diameter of the cable.
2.7	Maximum permissible Tensile Strength for Cables	For cables pulled with Stocking PVC and XLPE SWA Armoured cables P = 30 X D PVC and XLPE AWA Armoured cables P = 20 X D Where P= pulling force in Kgrm, D= Diameter of Cable in mm For Cables pulled by Cable eyes Aluminium conductor – 30 N/mm2 = 3 Kg/sq. mm Copper conductors - 50N/mm2 = 5 Kg/sq. mm Permissible force is calculated by multiplying the above values by cross sectional area (CSA) of conductor of each core and then number of cores.
2.8	Methods of Laying	a) Cables shall be laid in direct in ground, in trenches excavated therein and shall be protected with covers as given in the drawing. Cables shall also be drawn into pipes of ducts or laid in the formed trenches or troughs or on racks or supported in trays or cleats as required by the site exigencies. Where the cables are laid in the formed trenches, the installation shall include removal and replacement of the trench covers and the provision of temporary protective covers on the trenches where they cross the access ways. b) HDPE (PN6,PE80) or RCC ducts shall be used where cable cross roads and railways tracks. Spare ducts for future extensions should be provided. Spare duct should be sealed off. Buried ducts or ducting blocks shall project into footpath or upto the edge of road, where there is no footpath, to permit smooth entry of cable without undue bending. The diameter of the cable conduit or pipe or duct should be at least 1.5 times the outer diameter of the cable. Angular alignment of the duct across road crossings shall be predetermined to maintain safe bending radius when direction of cable trench changes before or after the road. c) The contractor shall lay cable by Horizontal direct drilling (HDD) in main roads and highway with heavy traffic, passage to public property where excavation is not possible. Contractor shall take approval for laying of cable by means of HDD wherever required from the supervising engineer. The cable laid by HDD shall be

		minimized so that it doesn't exceed by 12% of total route length. This is to avoid De-rating of Cables. d) Unless approved by BSES, the contractor shall lay the cables, direct in ground, in single layer. The cables shall be laid with the pre-determined and approved cable route. e) Spacing shall be maintained uniformly between the cables all along the length including the bends, as approved by BSES. To maintain the spacing, suitable non-metallic formers shall be placed uniformly with spacing not exceeding 5 meters. Every bend shall have at least one spacer. f) 75 mm of the sand bed shall be placed at the bottom of cable trench. g) After the cables have been laid the trench shall be filled with the sand and shall be well rammed to a level not less than 75 mm above the top of the cables all throughout the route. h) To protect the cables against external mechanical damage, which may be caused by other agencies, the cable shall be protected by suitable cover. (for drawing of RCC cable cover refer annexure VI). i) The type of the covers shall be as under - 1.1KV Cables – Single layer of brick thickness not less than 75 mm (3 inch) - 11KV Cables – sand stone of thickness not less than 75mm (3 inch). - 33KV Cables shall be protected by reinforced concrete cover of width 300 mm as per attached drawing with thickness not less than 50mm. - 66KV Cables shall be protected by reinforced concrete cover as per attached drawing with thickness not less than 50mm. The RCC cable cover shall be embossed as "BSES EHV CABLE". j) Back fill to be filled up to 75mm and the warning tape shall be installed continuously. The tape shall be yellow in colour with Black / Red lettering of minimum 20mm height. The approved warning message shall be written in English and Hindi/ local language. The minimum thickness and width of the tape should be 300 microns and 150 mm respectively. k) The trench shall be filled-up by loose soft soil (300mm) and Excavated soil as indicated in drawings.
2.9	Cable over	On Bridges the cables are generally supported on wooden cleats and

	Bridges	clamped on steel supports at regular intervals. The cables laid on bridges shall be provided with Sun shield. Approval from appropriate authorities (PWD/railways) as applicable shall be taken by contractor.
2.10	Laying of Single Core Cables	a) The single core cables shall be laid in trefoil formation. Single core cables can be laid individually in HDPE pipe in case of HDD only. (Details of HDPE Pipe as per Annexure-9) b) For single core cables laid in trefoil formation, plastic cable ties shall be used at interval of 1.0 (one) meter throughout the cable length to maintain the trefoil arrangement. c) To balance the inductance, the phase sequence in trefoil format shall be maintained by vendor (for double circuit) d) To prevent magnetic losses (eddy current and hysteresis losses), the base plate of the panels or the terminal box of the equipments, shall have aluminium plate. In case the entry into the building is through GI pipe, a "slit" in the GI pipe shall be necessary. Alternatively GI pipes may altogether be avoided and non-metallic pipes such as PVC or HDPE pipe shall be used. Concrete pipes having steel reinforcement (RCC pipe) are not to be used.
2.11	Earthing of Single Core Cables	a) Single point bonded earthing shall be employed to prevent flow of induced circulating current in the armour and screen and consequential de-rating of cables for feeder less than 2.0 KM. b) For feeder length more than 2 KM, mid point earthing shall be provided.
2.12	Violation of barricading guideline and safety norms	On violation of barricading guideline and safety norms, a fine of Rs.5000 /day shall be imposed. BRPL inspector/engineer in-charge shall be empowered to impose the above penalty.

3.0 General guidelines for Laying Cables

S. No.	Parameter	Details
3.1	General	a) Laying of the cables and handling of the same shall be undertaken, at all times, by adequate staff suitably trained and supplied with all the necessary plant, equipment and tools. b) The contractor shall be responsible for all the route survey, establishment of the position of the joints as per the site exigencies and the drum lengths of cables to be laid. While carrying out the route survey the contractor shall take into account the obstacles on the route whether above or below ground. The cable shall be planned to be laid in an orderly formation, free from unnecessary bends and crossings c) The contractor shall submit a drawing for the complete scheme

		showing the entire route, road crossings, location of joints and also the arrangement of cables to be laid. In case due to site exigencies, cables have to cross over within the trench, the same shall be shown in the drawing. For each and every job, these drawings shall be approved by BSES, prior to commencement of work. d) BSES shall arrange for all the material and manpower required for jointing and end termination. The Contractor shall provide pit, carry out excavation for creation of working space required for jointing by the jointer. All civil works, structural work, clamping and earthing shall be carried out by the contractor, so that the cables and accessories perform satisfactorily during the entire life time. e) The entry and exit of the cables into the building shall be through RCC or GI pipe except for single core cables, which shall be properly sealed and shall be duly supported as per the method and technique approved by BSES, so that the outer sheath of the cable does not get damaged at the entry and exit points. The sealing should be of adequate length so that it minimizes the risk of spreading of fire or ingress of water.
3.2	Handling and Storage of Cable drums (All empty drums are returnable)	a) The cable drums shall be transported upright, so that the weight is distributed on both the flanges. Under no circumstances the cable drum may be laid on its side. During transportation the drums must be properly secured. The cable drums should never be dropped from Lorry or a trailer, so as to prevent damage to the cable drum and also to the cable. Ramp may be used for unloading. The drums may be rolled over short distance, provided the correct direction of rolling as provided on the drum is observed. Alternatively, a mobile crane should be used for lifting and lowering the drum. A chain-pulley arrangement may also be used to lift the drums and deposit the same on ground if required. b) In case the drums are to be stored prior to cable laying, they should be arranged in such a way to leave some space between them for air circulation. It is desirable that the drums stand on battens placed directly under the flanges. Overhead covering is not essential except in heavy rainfall areas or during monsoon. Cable should however be protected from direct rays of sun by leaving the battens on or by providing some form of sunshade. In no case the drums shall be stored in a flat position with flanges horizontal. c) For transportation of the cable drums from storage site to work site, the drum should be mounted on a trailer or an open lorry and unloaded by mobile cranes. d) After cable laying, empty cable drums shall be taken return back by vendor from site at their own risk and cost. Cost of empty drums shall be deducted from vendor account during final settlement.
3.3	Cable Laying	a) The ground over which the drum is positioned at site should be

		properly consolidated and jacks placed on both sizes of the drum to make the pay-off arrangement stable. Suitable arrangement be made to stop the drum rotation, during cable laying preferably by square wooden poles kept temporarily pivoted over cable roller under the flanges which when required can be applied on the flange as a brake by personnel manning the drum. b) The cable should always be paved off from the top of the drum. The drum must be positioned in such a way that the arrow on the drum points opposite to the direction of rotation marked on the drum. c) It must be ensured that the cable is not dragged over sharp object or on the road surface, so as to avoid damage to the outer sheath of the cable. d) The pulling method to be used shall be approved by BSES. Cable supplier's recommended maximum pulling tension shall not be exceeded. e) Rollers shall be placed at intervals and the cable shall be pulled over the rollers. The rollers shall be kept lubricated so that they rotate freely, minimize friction to the cable in motion. Rollers shall be positioned at the bends to minimize side wall friction. The contractor shall ensure that PVC/HDPE sheath of cable is free from damage due to abrasion. f) The cable should not be pulled out from the drum by lifting of the coil while the drum is lying flat on the flange. This leads to twisting of the armour and cores resulting in permanent damage to the cable. g) To avoid ingress of moisture, it must be observed that the end capping of the cables is not damaged. Cut pieces of the cables must be capped immediately, before laying of the same is taken-up.
3.4	Excavation of the Trenches	a) The excavation of the trenches shall be commenced, with proper co-ordination with BSES, so that all the necessary clearances for the route are already obtained from the competent authorities, well in time. b) Before opening of the section of the trench, the contractor shall satisfy himself that the line of the trench is clear of underground obstructions, by taking out trial pits on the line of the trench. c) The exact location of each trench shall be approved on site by BSES. The trenches shall be kept as straight as possible and each trench shall be excavated to approved formation and dimensions. If necessary, the trenches shall be adequate shored by wooden planks and bracing to avoid trench cave-ins which would cause injury to the persons and also damage the cables laid. d) The bottom of each trench shall be firm and of smooth contour. The contractor shall take reasonable precautions to prevent damage to the highway or ground surface from a slip or breaking away of the sides of the trench. e) The trench excavation and filling in shall be so executed that all

		walls, roads, sewers, drains, pipes, cables, structures, places and things shall be reasonably secured against risk of subsidence or injury and shall be carried out to the satisfaction of the authorities concerned. Should, however, a damage to an existing or other services be made, the Contractor will arrange and pay for any necessary repair, to make good the damages. f) Where trenches pass from a footway to a roadway or at other positions where a change of level is necessary, the bottom of the trench shall rise or fall gradually. The rate of rise or fall shall be approved by BSES. g) Contractor shall ensure that during excavation and until restoration has been completed, for reasonable access of persons and vehicles to property or places adjacent to the route. h) When the excavation of the trenches has been accurately executed, the contractor shall inform BSES for approval. Laying of cables or building of structure shall not be started until the contractor has been advised by BSES to proceed with the work.
3.5	Excavated material	a) The materials excavated from each trench shall be placed so as to prevent nuisance or damage to adjacent ditches, drains fences, gateways and other property or things. Excavated material shall be stacked so as to avoid undue interference with traffic. b) Where, owing to traffic or for reasons of safety or other considerations, this is not permissible, the excavated material shall be removed from the site and returned for refilling the trench on completion of laying; surplus material shall be disposed off by the contractor at his own cost.
3.6	Pipes and Ducts	a) Care shall be taken to make the bend of the pipes or duct lines as easy as practicable and in no case of radius less than 3 meters. Where approved, split pipes may be used on bends, the pipes being fitted round the cable after laying. b) All road crossings shall be ducted. This applies to present and future roads as indicated on the route plans. The pipes and the ducts shall be laid in an approved manner and shall be surrounded by 150 mm of PCC (1:2:4) c) Ducts under the road shall be provided by the contractor, by non-disruptive method, if road cutting is not permitted by the concerned authorities Cable laying shall be done by Horizontal Direct drilling method (HDD). d) The cables shall be suitably protected at entry and exit from the pipes, so that the outer sheath does not come in contact with the edges of the pipes / ducts. The pipes and ducts shall have slope so that the seepage water can drain through the small opening provided on the lower side of the pipe sealing. e) The pipes and ducts shall be secured to the base at both ends and at regular interval, throughout the length, so that at no point the ducts or pipes get suspended over the threaded cable, and damage the same, thus defeating the very purpose of providing the pipe / duct.

		f) At all road crossings at least one spare duct / pipe shall be provided for future use. The pipe shall be thoroughly cleaned of obstructions. A draw wire or rope shall be left in each pipe to facilitate the drawing in of the cables. The duct end shall be sealed temporarily to prevent the entry of foreign matter. End caps and permanent markers shall be placed flush with footpath / roadways at both the ends. The pipes and ducts shall be cleaned again immediately before the cables are drawn in. g) The internal diameter of the pipe / duct should be such that the cables occupy only 40% of the area of the pipe / duct to avoid de-rating.
3.7	Joint Bays	The contractor shall provide all help so as to enable jointers to carry out their work efficiently and expeditiously. The method of securing and supporting cable joints and cables also the bonding and earthing thereof, shall be detailed on the drawing. The details shall be approved by BSES prior to commencement or work. The joint position should be staggered.
3.8	Back filling of trenches	a) Filling in of trenches shall not be commenced until BSES has inspected and approved the cables and accessories at site. The inspection should be got done on daily basis so that the trenches do not remain open unnecessarily, to avoid inconvenience to public. b) The trench shall be backfilled after putting all protections for cables. c) Soft soil shall be backfilled for 300 mm above the cable protection cover. d) Caution Tape shall be laid all along the cable route above the soft soil filling. e) Complete backfilling shall be done above the caution tape.
3.9	temporary Reinstatement	a) Where cables routes are in public highways, footpaths, gardens etc., the method of reinstatement will be subject to approval by MCD. All costs incurred will be at the contractor's expenses. b) The contractor shall be responsible for proper permanent reinstatement of the upper levels, which shall be carried out to the satisfaction of BSES and the MCD authorities concerned. c) Before finally leaving site, permanent reinstatement shall be executed by the contractor to the approval of MCD and the property owners and all costs incurred shall be to the contractor's account.
3.10	Permanent Reinstatement of Public Road,	a) In public roads and footways the surfaces and foundations shall be temporarily reinstated by the contractor. After settlement, temporary reinstatement material shall be removed as necessary and the permanent reinstatement shall be carried out to the approval of the appropriate highway authority / MCD. Stone and pre-cast concrete paving kerbs and channels shall also be finally reinstated by the contractor. b) Temporary reinstatement shall be maintained by the contractor until commencement of final reinstatement to ensure that the surface is always safe for the passage of pedestrians and vehicular traffic.

3.11	Identification	All cables shall be identified below the gland at each end, at joint position and at approved positions by means of bands engraved or punched with cable no. feeder name, size of cable, number of cores, phase colour etc. The bands shall be secured fastened in a permanent manner, and shall be made of material able to resist corrosion, dampness and mechanical damage.
3.12	Cable Route Markers	All cables routes shall have markers at suitable location with a gap not exceeding 30 meters. The route markers shall be approved design. Additional markers shall be provided at joint locations with approved markings.
3.13	Cable supports / Clamps	a) The contractor shall supply and install all the supports, racks, trays, cleats, saddles, clips and other parts required to carry and secure the cables, without risk so that there is no undue mechanical load or stress due to weight of the cable at each end. Cleats, saddles and clips shall be of the design as approved by BSES. No cable shall be laid on the trench floor. They shall be run in a neat and orderly manner and the crossing of cables within the trench shall be avoided as far as possible. Where cable runs unavoidably cross, a suitable supporting arrangement shall be provided to maintain an adequate gap between the cables b) Every cable shall be supported at a point not more than 500 mm from its termination.
3.14	Installation of Cables in tunnels / basement / below the panels etc	a) The design of cable support for cables installed in air in cable tunnels, basements etc. shall consist of vertical steel members spaced at approved interval and secured to the walls, floors and ceilings as necessary by means of bolts either cemented in position or expanded into cored holes. Each vertical support shall have bolted to it a number of steel brackets spaced at the intervals and designed to support and retain trays constructed of galvanized sheet steel of adequate section to carry the weight of the cables, plus space for an additional quantity of future cables at least 25% by weight and dimensions in excess of the cables installed under the contract and an additional load of 100 kg at the extremity without distortion. The trays shall be designed with raised edges to retain the cables and shall incorporate an interlocking feature so as to prevent movement between supports. b) The design and construction of all cable cleating and supporting arrangements shall suit the cable system design. The spacing of cable supports shall be approved by BSES. c) Cable run on trays shall be neatly dressed and where not provided with cleats shall be secured by heavy gauge, type approved metal reinforced, clips or saddles. Not more than six cables shall be embraced by one clip. d) Mild steel of appropriate sections, duly painted in an approved manner, shall be used for fabrication of cable supports. The steel shall be free from blisters, scales, laminations or other defects. Before final painting, the steel sections shall be provided with double coat of red primer.

3.15	Cable Protection at overhead Towers or Poles	Where the cables terminate on overhead line poles or towers located outside substation compounds the contractor shall provide suitable cable supporting galvanized steel work attached to the pole or tower and comprising backboard, runners, sheet, steel cover of not less than 3.0mm thickness, stays, cable cleats, anti climbing guard and all incidental items to provide secure protection for the cables. Isolators and Lightning arrestor if required to be installed shall be provided as free issue item to the contractor, however the erection and steel structure required shall be in scope of the contractor.
3.16	Sun Shades	All cables shall be protected from direct solar radiation by ventilated sun shields as approved by BSES.
3.17	Route Plan	a) BSES intents to show all the cable routes, location of joints and other underground obstructions on a GPS map. b) During the progress of the contract works the contractor shall record on a set of route plans and cross section drawings of an approved form, these details so that the same can be transferred on the GPS maps. Such particulars will allow an accurate reference to be made in the case of any fault or projected modification. These records shall show, amongst other data, both indoors and outdoors the exact position of every joint, cable end termination and also the particulars of the depth of the trench, the arrangement of the cables, with cable numbers and the position of all obstructions revealed during the course of excavations. These completed records shall be submitted to BSES within 15 days of completion of any particular route/feeder. The final bill shall not be processed by BSES unless this activity has been completed to the entire satisfaction of BSES
3.18	Site Facilities to be maintained by the Contractor	a) The contractor shall arrange for all the tools and tackles required for cable laying as per this specification. BSES shall arrange for all the material and manpower required for jointing and end termination. b) Illumination and Power supply shall be arranged by the contractor so that the work can be carried out round the clock. c) The contractor shall maintain functional dewatering pumping facility with suitable power supply so as to protect the cables and the joints from ingress of water due to rain or otherwise d) The contractor shall make arrangement to provide suitable scaffolding arrangement to carry out the termination work e) The contractor shall carry out proper barricading of the dug cable route and the joint bays and shall take all necessary precautions to avoid any public hazard f) Also refer Annexure-7: Barricading and Safety.
3.19	Type of Roads and guidelines for road restoration	The typical section of type of Roads (based on width) under PWD and MCD are :- - 20 Feet Wide road - 30 Feet wide road - 40 to 60 Feet Road - Other (which include Kota stone, Agra stone, Cement concrete, interlocking paving tiles, brick road, chequered tiles

		and asphalted road) The drawing are shown in annexure IV The guidelines for road restoration for various type of roads and surfaces are indicated in annexure V as :- - Bituminous road Type I (category I & II) - Bituminous road Type II (category III) - Cement concrete road - Kota/Rajasthan stone Road - Brick Road - Interlocking paving tiles. - Agra stone road - Chequered tiles road - Asphalted road

4.0 Testing

S. No.	Parameter	Details
4.1	Tests to be carried out during and after completion of Cable Laying	Testing of cable before jointing – - Cable shall be tested for Insulation Resistance prior to laying by opening the end and resealing end properly. Testing on complete Cable Installation – a) Insulation resistance of each core shall be measured against all the other cores and the metal screen connected to earth. b) The resistance of the conductor shall be measured. c) DC High voltage. For old cables test voltage shall be 1.5 times rated voltage or less depending on age of cable.(refer annexure # 2 for values) d) Charging of Cable at No-Load at Nominal working voltage for 24 Hours. e) After laying and before termination of cable a sheath test shall be conducted for 66KV Single core Cable as under :- At both ends the cable shall be raised from ground. From the end graphite coat applied over the outer PVC jacket shall be removed with a piece of glass for a length of 300mm. A spiked steel rod with an eye for attaching a wire shall be driven into the ground and connected to a nearby water or hydrant pipe. Insulation resistance of PVC jacket shall be measured between the aluminium wire armour and the spike with a 500/1000V insulation tester. Measured resistance shall not be less than 2.5M OHM per KM. Thereafter 10KV DC shall be applied for one minute in the same way. After the test the armour shall be kept earthed to the steel spike for 15 minutes for discharging residual charge.
4.2	**Statutory**	a) Road cutting permission

	clearance	Road cutting permission shall be taken from competent authority by vendor. How ever official fees shall be paid by BRPL. b) Electrical inspector clearance Electrical Inspector clearance shall be in vendor scope. How ever official fees shall be paid by BRPL.

5.0 Progress Reporting:

S. No.	Parameter	Details
5.1	Detailed Progress report	Progress report to be submitted by Contractor to BSES once in a Week containing i) Excavation status ii) Cable laying status iii) Status of preparedness for Jointing iv) Reason for any delay in total programme v) Details of damage to cable during laying. vi) Progress on final completion / Constraints / Forward path

6.0 Drawing, Data & Manuals:

S. No.	Parameter	Details
6.1	To be submitted After Completion of the Job	As the works is completed the following reports in quadruplicate shall be submitted to BSES for record purpose and shall be incorporated in the 'As constructed Records'. a) Feeder details (sending end, receiving end, SAP number of project etc) - Type of cables, cross section area, rated voltage. Details of construction, cable number & drum number. - Year and month of laying. - Actual total route length, cable length, length between joint to joints or end. - Location of cables and joints in relation to certain fixed reference points, for example buildings, hydrant, boundary stones etc. - Jointing reports detailing the date, weather conditions, jointers and supervising Engineers names, details of type of cable and type of joint or termination, location and joint bay number, ambient temperature. - Results of original electrical measurements and testing on cable installation. - Full written reports will be required of any damage occurring to cable or equipment together with remedial action proposed which will be subject to the approval of BSES.
6.2	Drawing and document sizes	Standard size paper A0, A1, A2, A3, A4

7.0.0 Deviations

Deviations from this Specification shall be stated in writing by the contractor. Written approval shall be obtained from BSES by the contractor. In absence of such a statement, it will be assumed by BSES that the Contractor complies fully with this specification during execution of the job.

Deviation mentioned in any other submitted tender docs like in GTP, QAP, Old PO, old WO, BRPL Standard, vendor standards etc. shall not be considered as a deviation at any stage of contract.

The format for approval of deviation attached in annexure # 1

Annexure # 1 – DEVIATION REPORT FORMAT

S. NO.	Clause No. of Specification	Details about deviation	Reason for deviation	Approved by (Sign & Name)

Annexure # 2 – DC HIGH VOLTAGE TEST

Rated Voltage of cable in KV	Test Voltage Between		Duration in Min.
	Any conductor and metallic sheath / Screen / armour	Conductor to conductor (for unscreened Cables)	
0.65 / 1.1	**3**	**3**	**15 Min**
6.35 / 11	**18**	**30**	
19 / 33	**60**	**----**	
38 / 66	**90**	**----**	

Reference value for DC High voltage Test.

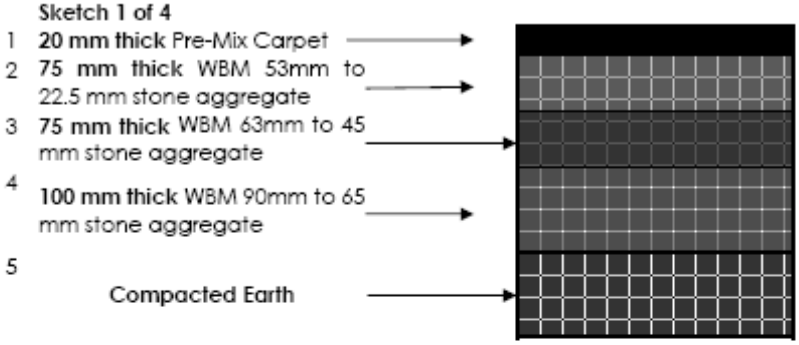
Annexure # 3 – CABLE TRENCH DETAILS

S. No.	Cable Size	Trench		Cable Trench drawing reference
		Width (mm)	**Depth (mm)**	
1	**1.1 kV LT Cables**			
a	3.5Cx150 mm^2 - Single Circuit	**400**	**875**	A – 1 (Drg. # 9)
b	3.5Cx150 mm^2 - Double Circuit	**400**	**875**	A – 1 (Drg. # 9)
c	3.5Cx150 mm^2 - Triple Circuit	**400**	**875**	A – 1 (Drg. # 9)
d	3.5Cx300 mm^2 - Single Circuit	**400**	**875**	A – 1 (Drg. # 8)
e	3.5Cx300 mm^2 - Double Circuit	**400**	**875**	A – 1 (Drg. # 8)
f	3.5Cx300 mm^2 - Triple Circuit	**400**	**875**	A – 1 (Drg. # 8)
2	**11 KV Cables**			
a	3Cx150 / 300 mm^2 - Single Circuit	400	**1055**	A – 2 (Drg. # 6)
b	3Cx150 / 300 mm^2 -Double Circuit	650	**1055**	B – 1 (Drg. # 7)
3	**33 kV Cables**			
a	3Cx400 mm^2 - Single Circuit	**400**	**1235**	A – 3 (Drg. # 3)
b	3Cx400 mm^2 - Double Circuit	**650**	**1235**	B – 2 (Drg. # 4)
c	3Cx400 mm^2 - Quadruple Circuit	**650**	**1235**	B – 2 (Drg. # 5A)
d	3Cx400 mm^2 - Quadruple Circuit	**650**	**1545**	B – 3 (Drg. # 5B)
e	3Cx400 mm^2 - Quadruple Circuit	**1200**	**1235**	C – 1 (Drg. # 5C)
4	**66 kV Cables**			
a	1Cx630/1000 mm^2 - Single Circuit	**650**	**1445**	B – 4 (Drg. # 1)
b	1Cx630/1000 mm^2 - Double circuit	**1200**	**1445**	C – 2 (Drg. # 2)
c	3Cx300 mm^2 - Double circuit	**1200**	**1445**	C – 2 (Drg. # 2A)

Annexure # 4 – Standard Road Profile

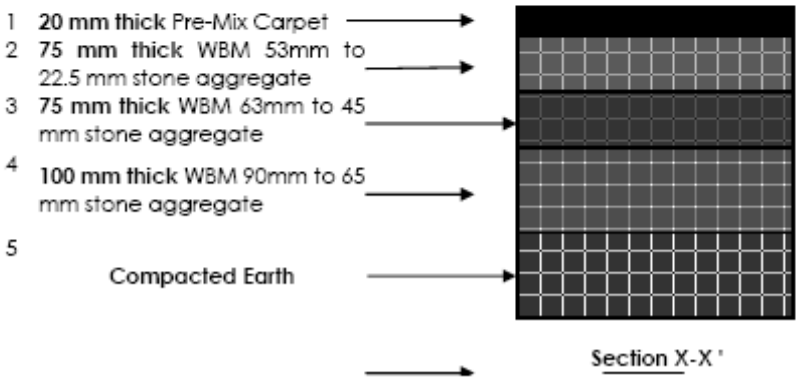
STANDARD ROAD PROFILE
20' - 00 " FEET WIDE ROAD (Road type 1)

Sketch 1 of 4



Sketch 2 of 4

30' - 00 " FEET WIDE ROAD (ROAD TYPE II)

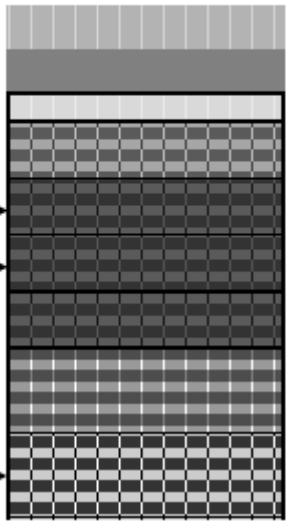


Section X-X '

Sketch 3 of 4

40'-00 " TO 60'-00" FEET WIDE ROAD

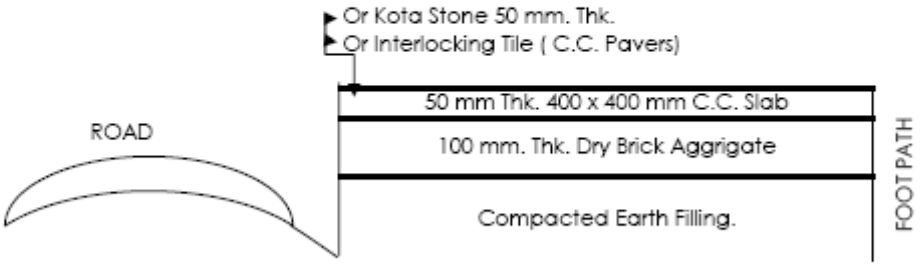
1 **50 mm thk.**(Dense Asphaltic coat) (DAC)
2 **50 mm thk.**(Dense Bituminous)
3 **20 mm thick** Pre-Mix Carpet
4 **75 mm thick** WBM 53mm to 22.5 mm stone aggregate
5 **75 mm thick** WBM 63mm to 45 mm stone aggregate
6 **75 mm thick** WBM 63mm to 45 mm stone aggregate
7 **75 mm thick** WBM 63mm to 45 mm stone aggregate
8 **100 mm thick** WBM 90mm to 65 mm stone aggregate
9 Compacted Earth



Section A-A '

Sketch 4 of 4

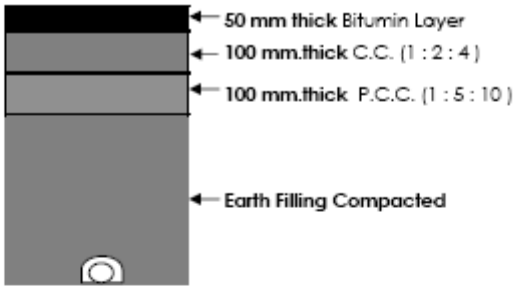
General drawing for cases other than roads.



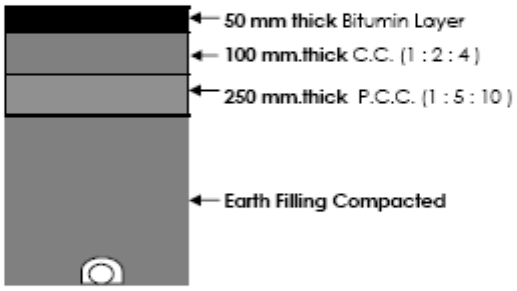
Details of Foot Path Along roads under PWD & MCD.

Annexure # 5 – Road Restoration Sectional Drawing

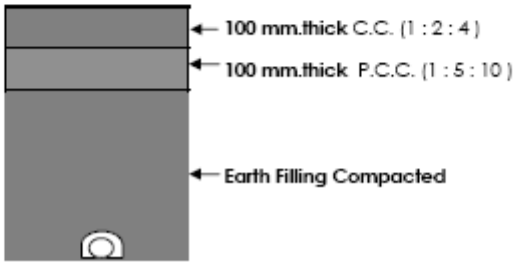
ROAD RESTORATION SECTIONAL DRAWINGS



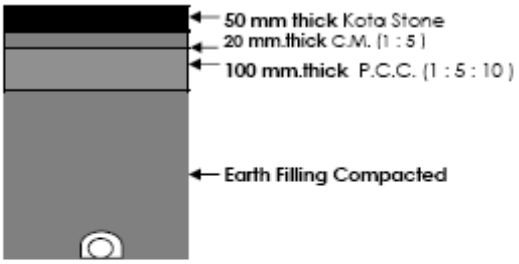
Bituminious Road Type - I (Category 1 & 2) Road width 20 to 30 feet and 30 to 40 feet.



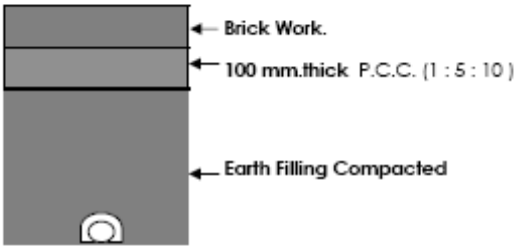
Bituminious Road Type - II (Category 3)



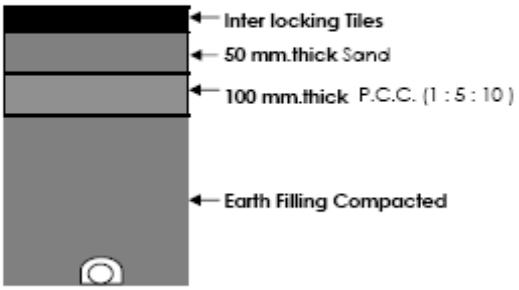
Cement Concrete Road



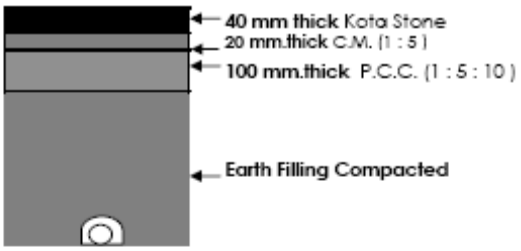
Kota / Rajasthan stone Road



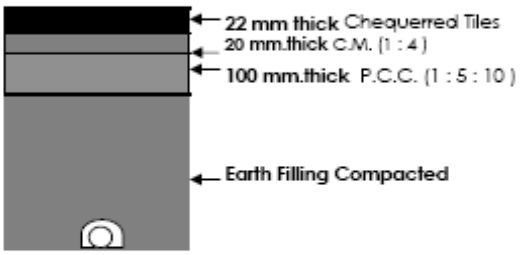
Brick Road



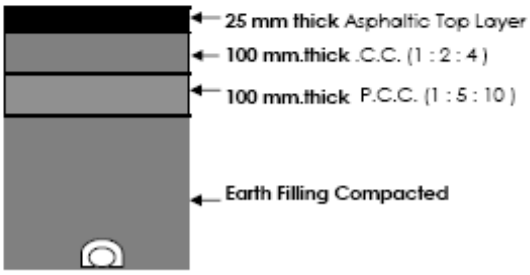
Interlocking Paving Tiles



Agra stone Road .



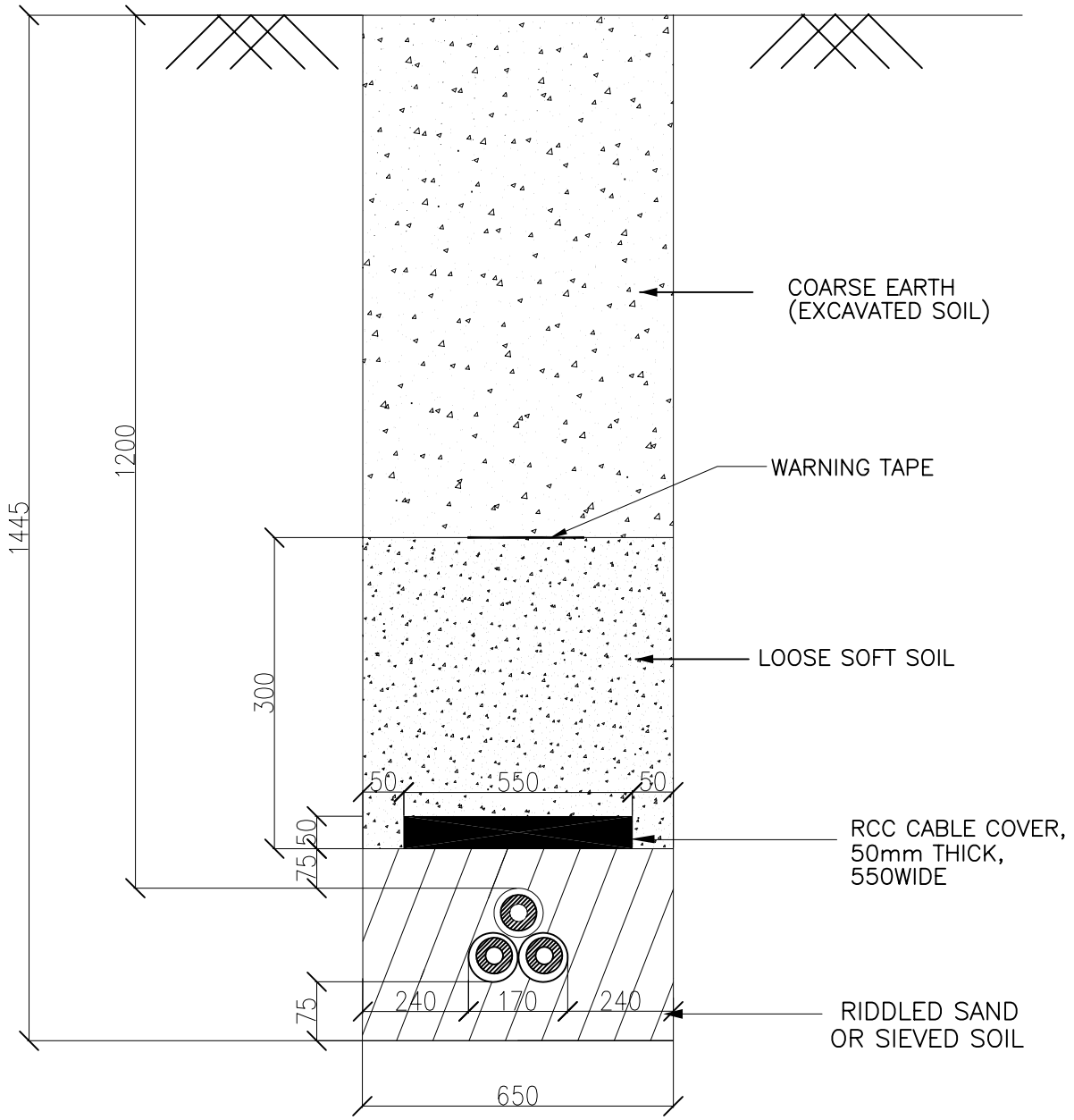
Chequerred Tiles .



Asphaltic Road .

Annexure # 6 – DRAWINGS (CABLE TRENCH AND RCC CABLE COVER)

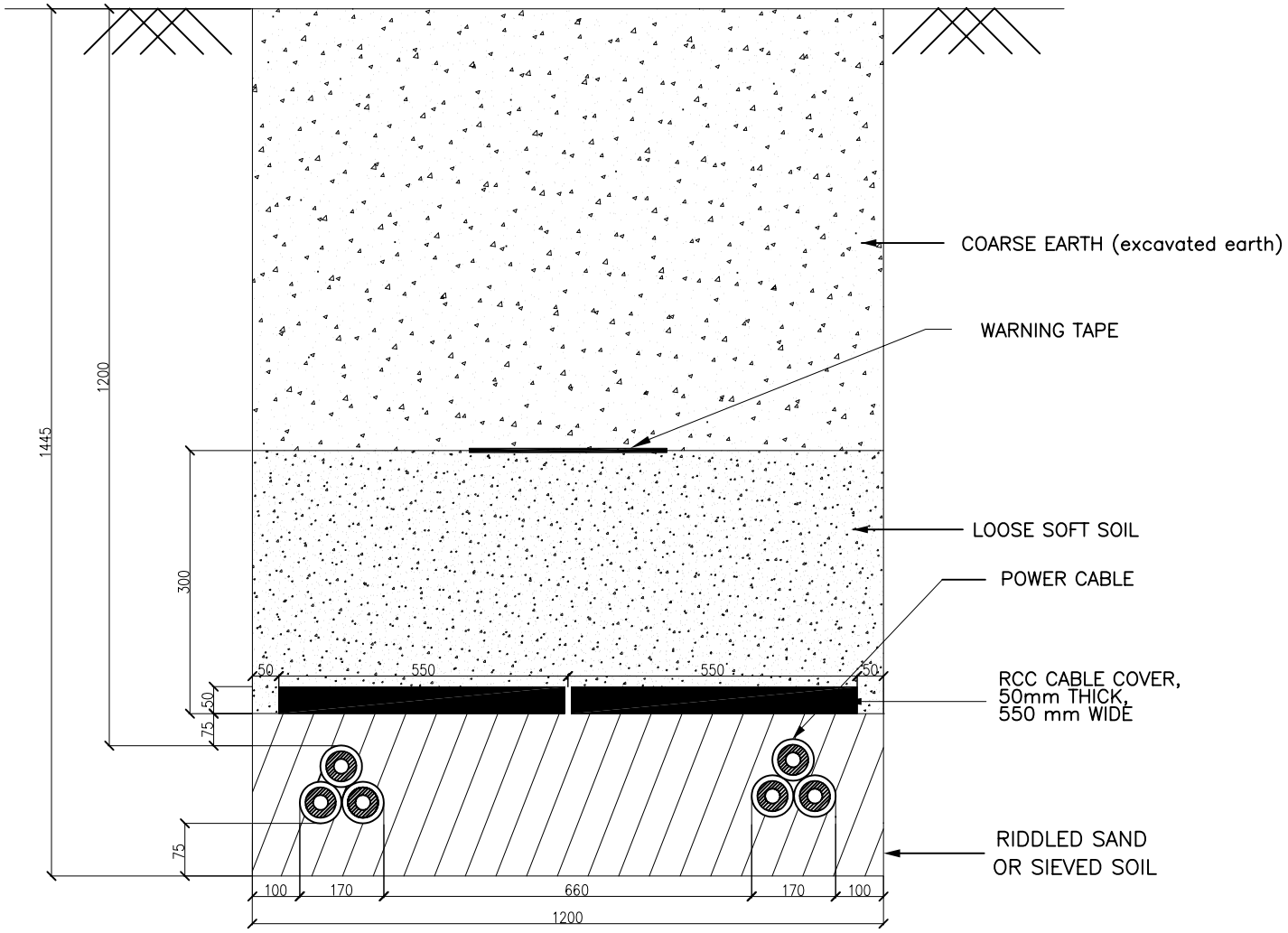
DRAWING # 1



TYPICAL DETAILS FOR 66KV BURRIED CABLE FOR SINGLE CIRCUIT
TYPE – B 4

DRAWN	DS	TITLE:– TRENCH DRAWING FOR 1C X 630 Sq. mm 66KV SINGLE CIRCUIT XLPE CABLE	BSES
CHECKED	SGD		
APPD.	D.GUHA		
DATE			REV. 00
SCALE			

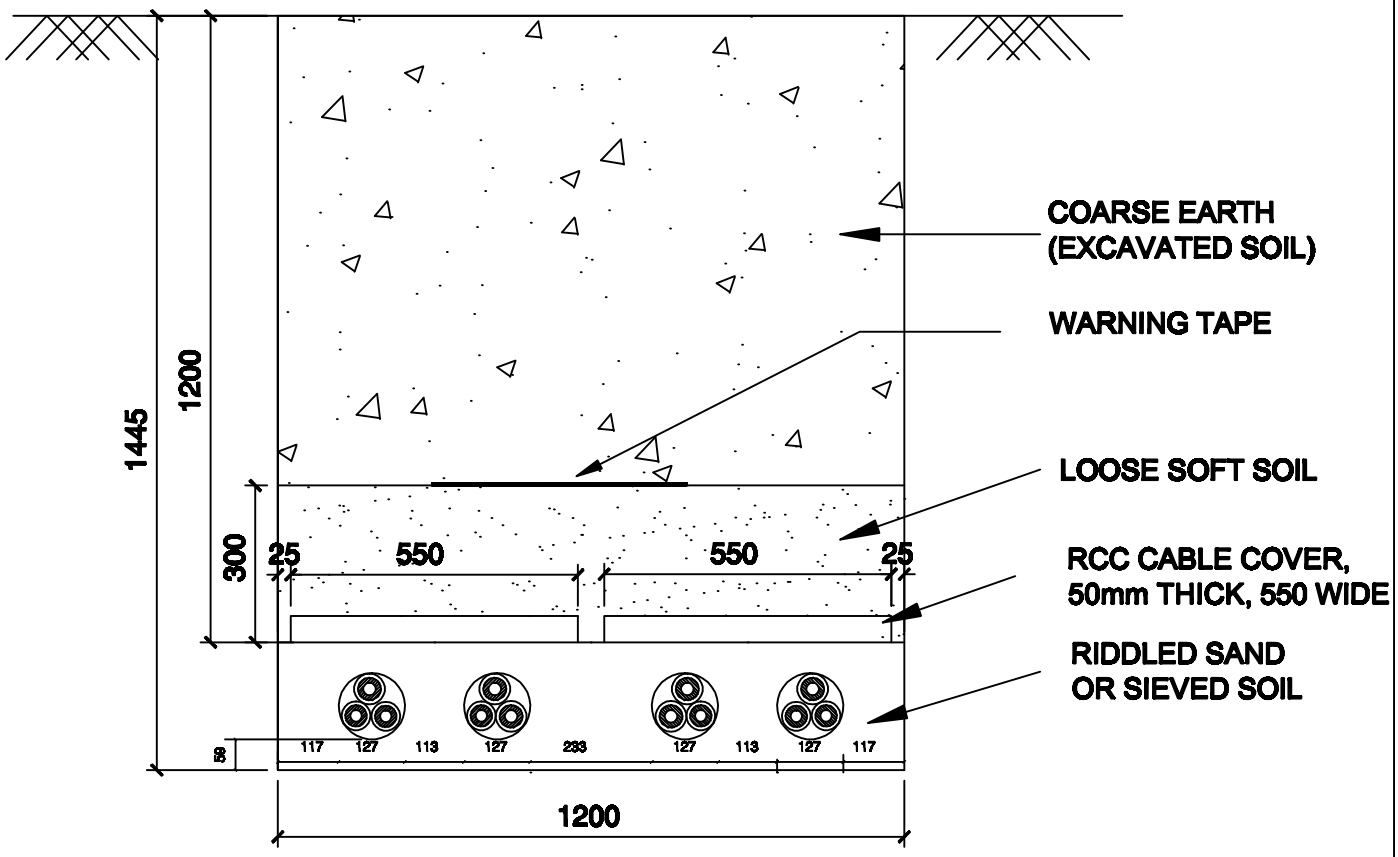
DRAWING # 2



TYPICAL DETAILS FOR 66KV BURRIED CABLE FOR TWO CIRCUIT
TYPE – C 2

DRAWN	DS	TITLE:– TRENCH DRAWING FOR 1C X 630 Sq. mm 66KV DOUBLE CIRCUIT XLPE CABLE	BSES
CHECKED	SGD		
APPD.	D.GUHA		
DATE			REV. 00
SCALE			

DRAWING # 2 A

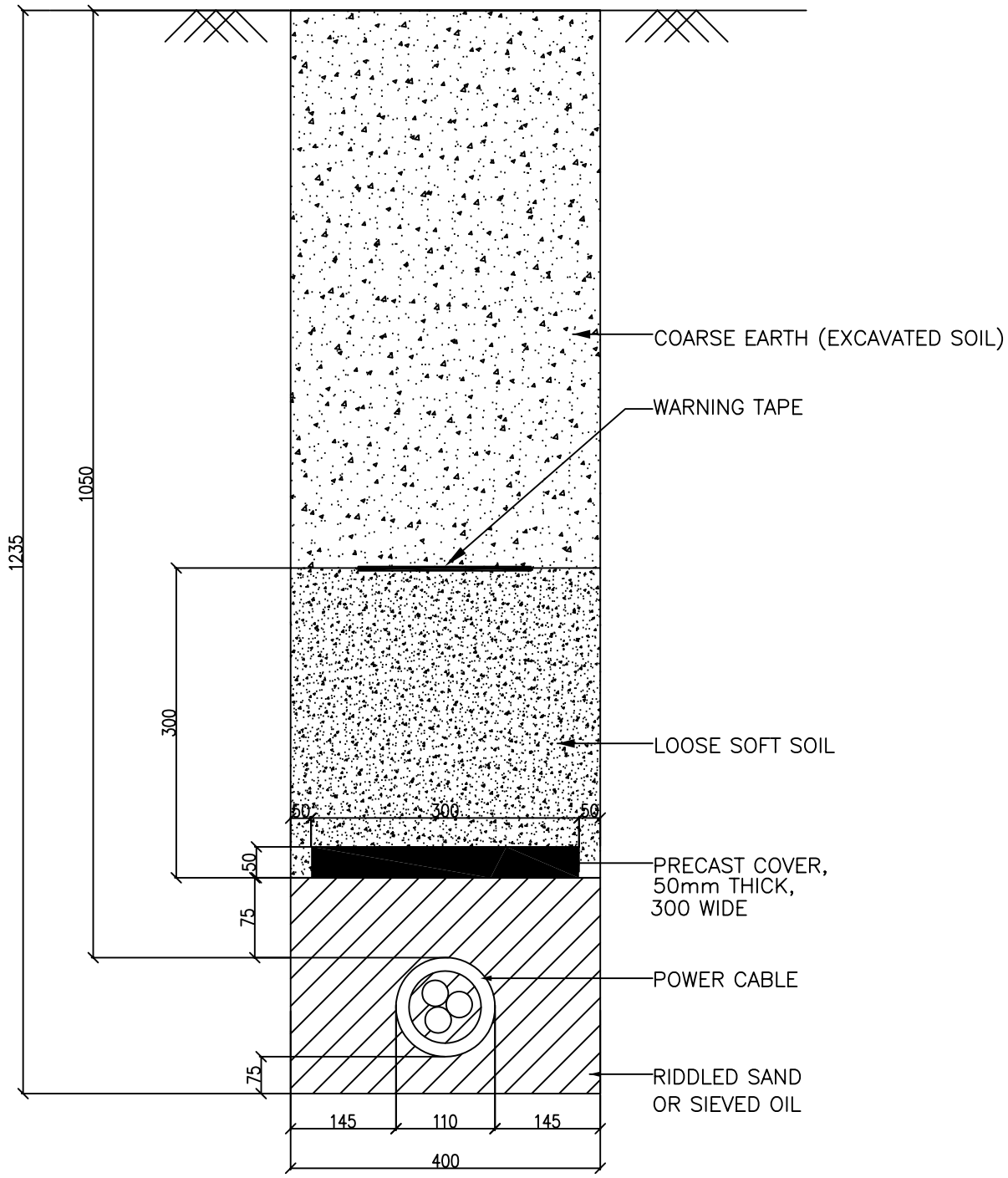


TYPICAL TRENCH SECTION DETAILS FOR 66KV SINGLE CORE 300 Sq. mm. BURRIED CABLE FOR DOUBLE CIRCUIT

TYPE - C 2

DRAWN	SAURABH	TITLE:–	BSES Rajdhani Power Limited
CHECKED	A.S	TYPICAL TRENCH SECTION DETAILS FOR 66KV SINGLE CORE 300 mm BURRIED CABLE FOR DOUBLE CIRCUIT	
APPD.	K.S		
DATE	09.01.15		REV. 00
SCALE			

DRAWING # 3

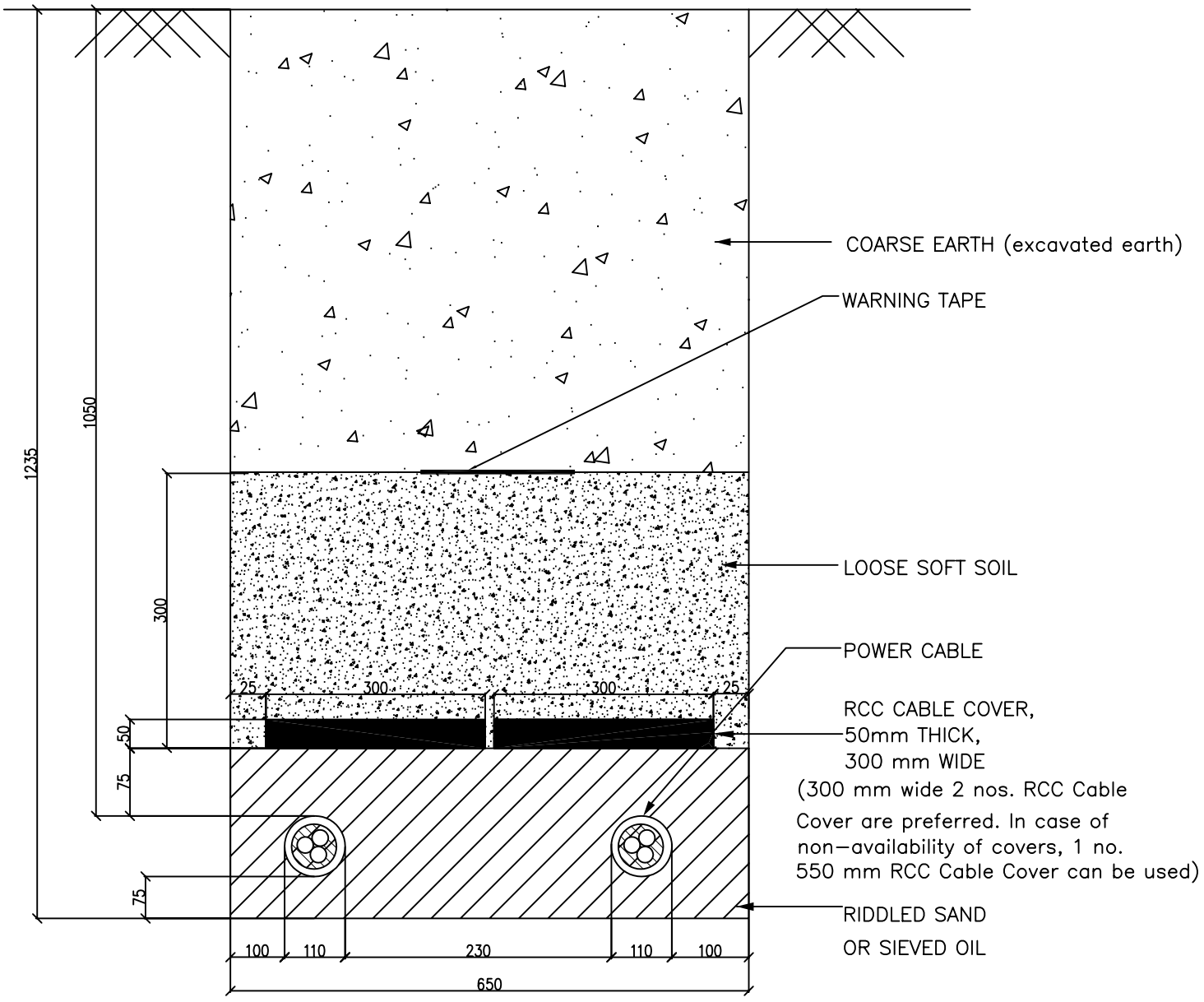


TYPICAL DETAILS FOR 33KV BURRIED CABLE FOR SINGLE CIRCUIT

TYPE – A 3

DRAWN	DS	TITLE:–	BSES
CHECKED	SGD	TRENCH DRAWING FOR	
APPD.	D.GUHA	33KV 3CX 400 mm sq.	
DATE		SINGLE CIRCUIT	REV. 00
SCALE		XLPE CABLE	

DRAWING # 4

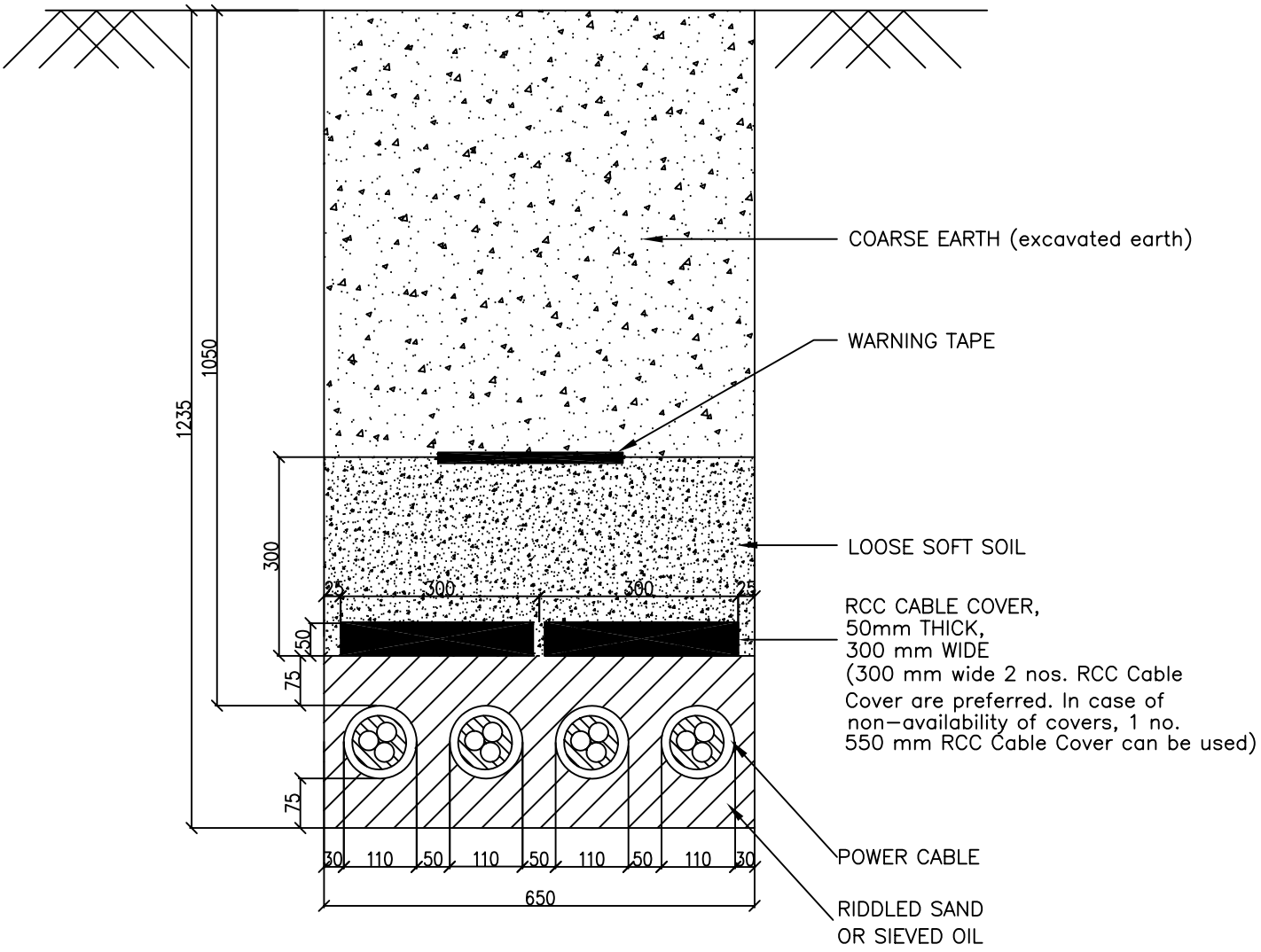


TYPICAL DETAILS FOR 33KV BURRIED CABLE FOR TWO CIRCUIT

TYPE – B–2

DRAWN	DS	TITLE:– TRENCH DRAWING FOR 3C X 400MM2, 33KV DOUBLE CIRCUIT XLPE CABLE	BSES
CHECKED	SGD		
APPD.	D.GUHA		
DATE			REV. 00
SCALE			

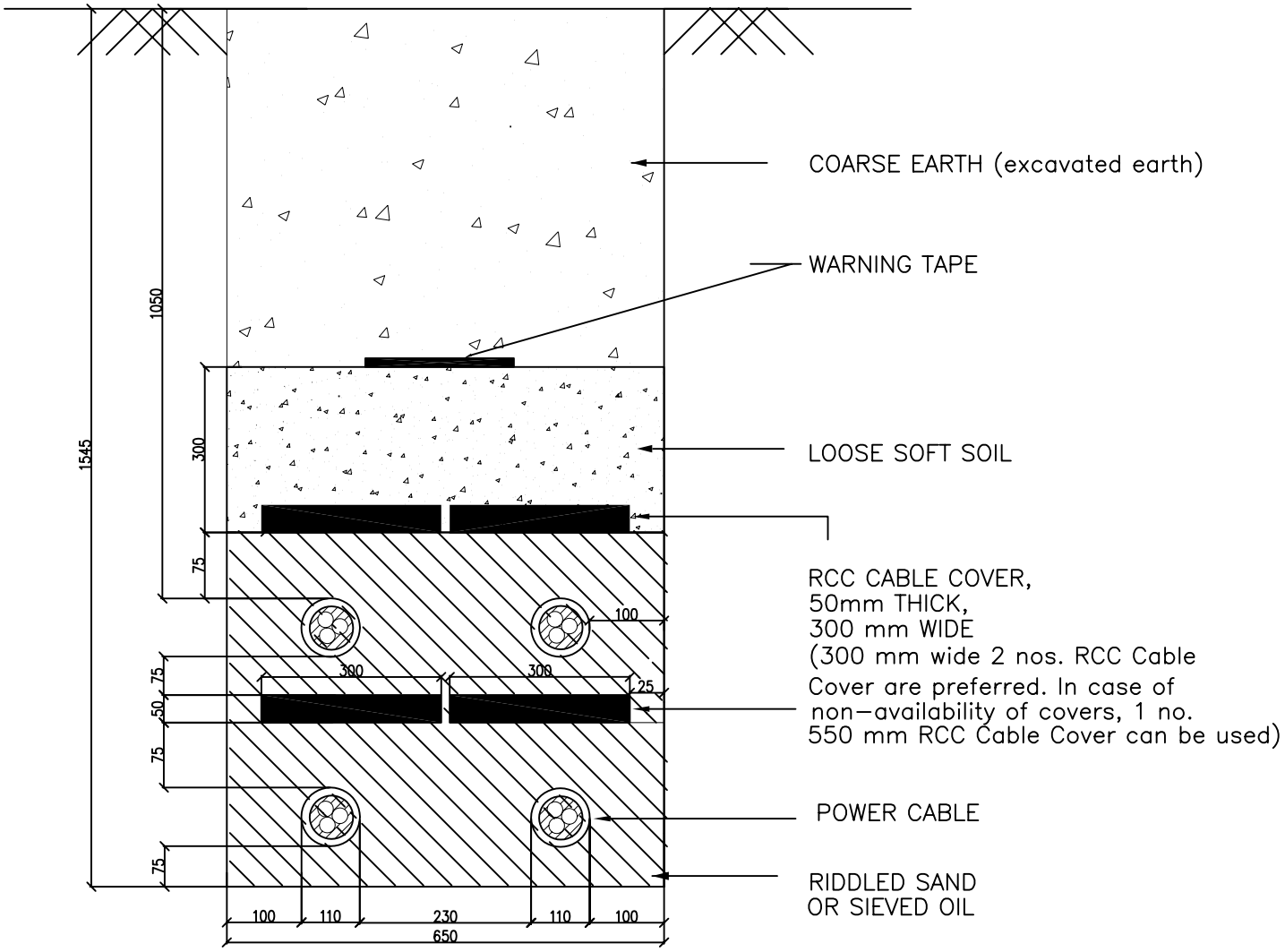
DRAWING # 5 A



TYPICAL DETAILS FOR 33KV BURRIED CABLE FOR FOUR CIRCUIT
TYPE – B 2

DRAWN	DS	TITLE:–	BSES
CHECKED	SGD	TRENCH DRAWING FOR	
APPD.	D.GUHA	3C X 400MM2, 33KV	
DATE		FOUR CIRCUIT	REV. 00
SCALE		XLPE CABLE	

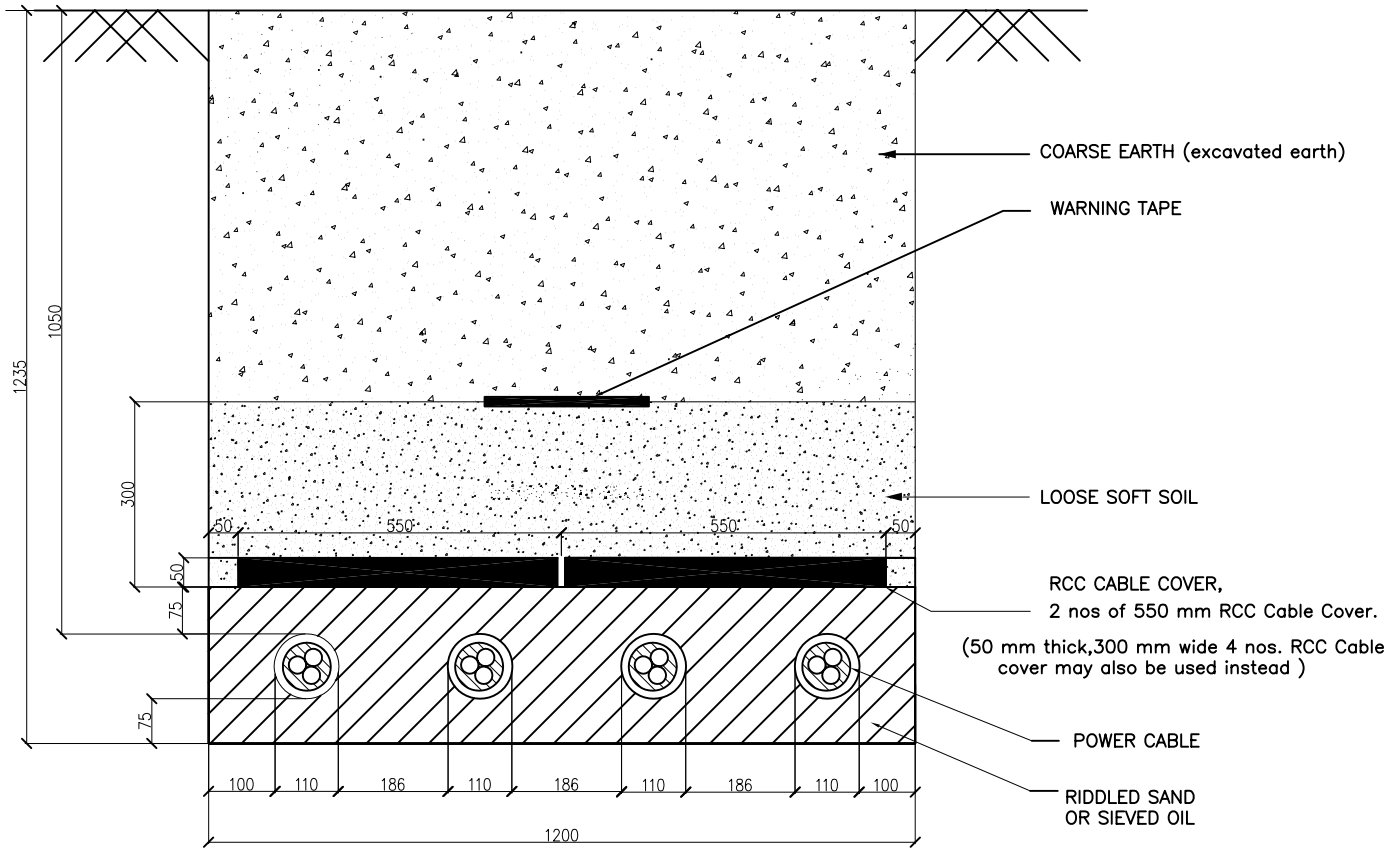
DRAWING # 5 B



TYPICAL DETAILS FOR 33KV BURRIED CABLE FOR FOUR CIRCUIT
TYPE – B 3

DRAWN	DS	TITLE:–	BSES
CHECKED	SGD	TRENCH DRAWING FOR	
APPD.	D.GUHA	3C X 400MM2, 33KV	
DATE		FOUR CIRCUIT	REV. 00
SCALE		XLPE CABLE	

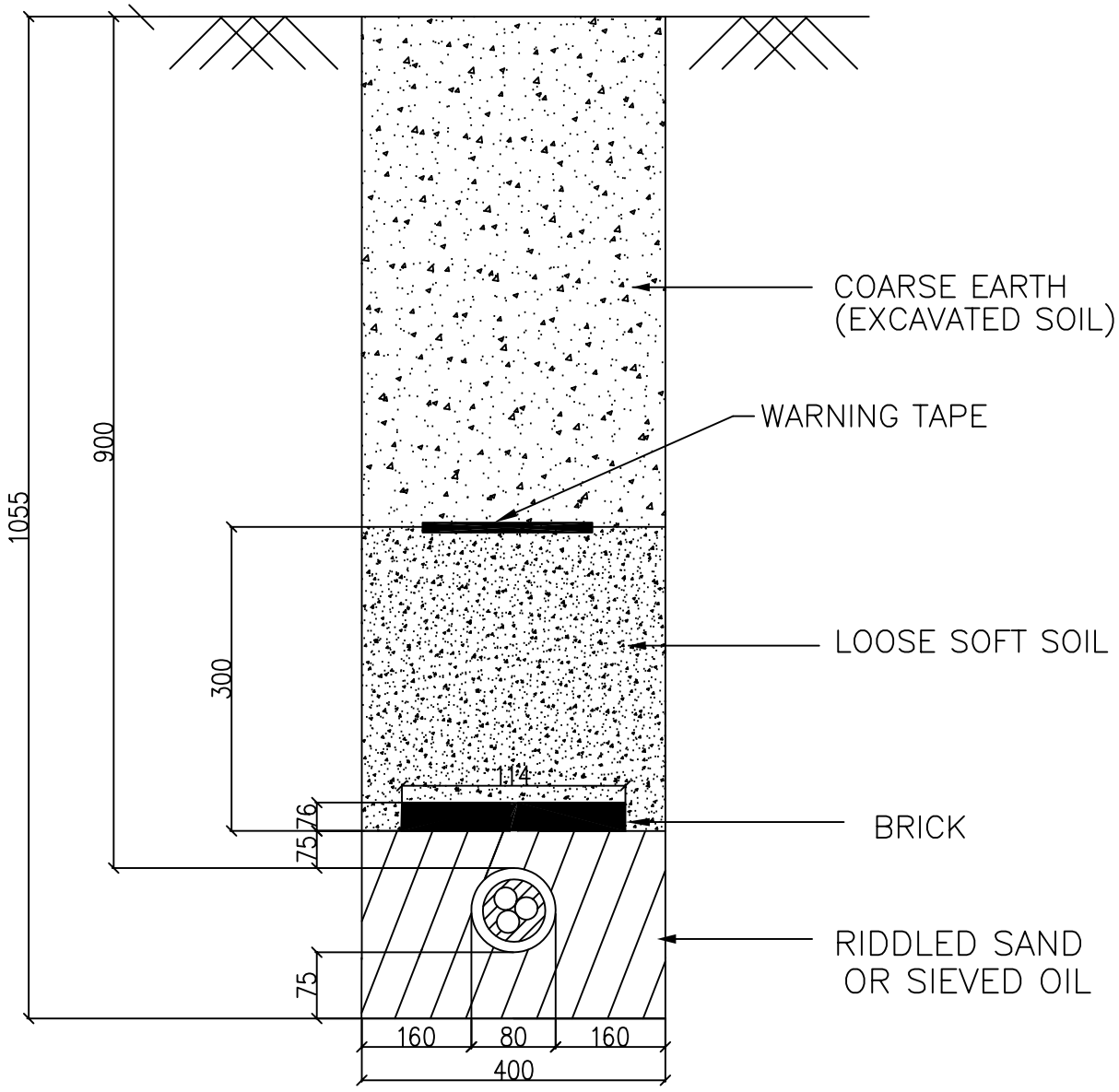
DRAWING # 5 C



TYPICAL DETAILS FOR 33KV BURRIED CABLE FOR FOUR CIRCUIT
TYPE – C 1

DRAWN	DS	TITLE:–	BSES
CHECKED	SGD	TRENCH DRAWING FOR	
APPD.	D.GUHA	3C X 400MM2, 33KV	
DATE		FOUR CIRCUIT	REV. 00
SCALE		XLPE CABLE	

DRAWING # 6

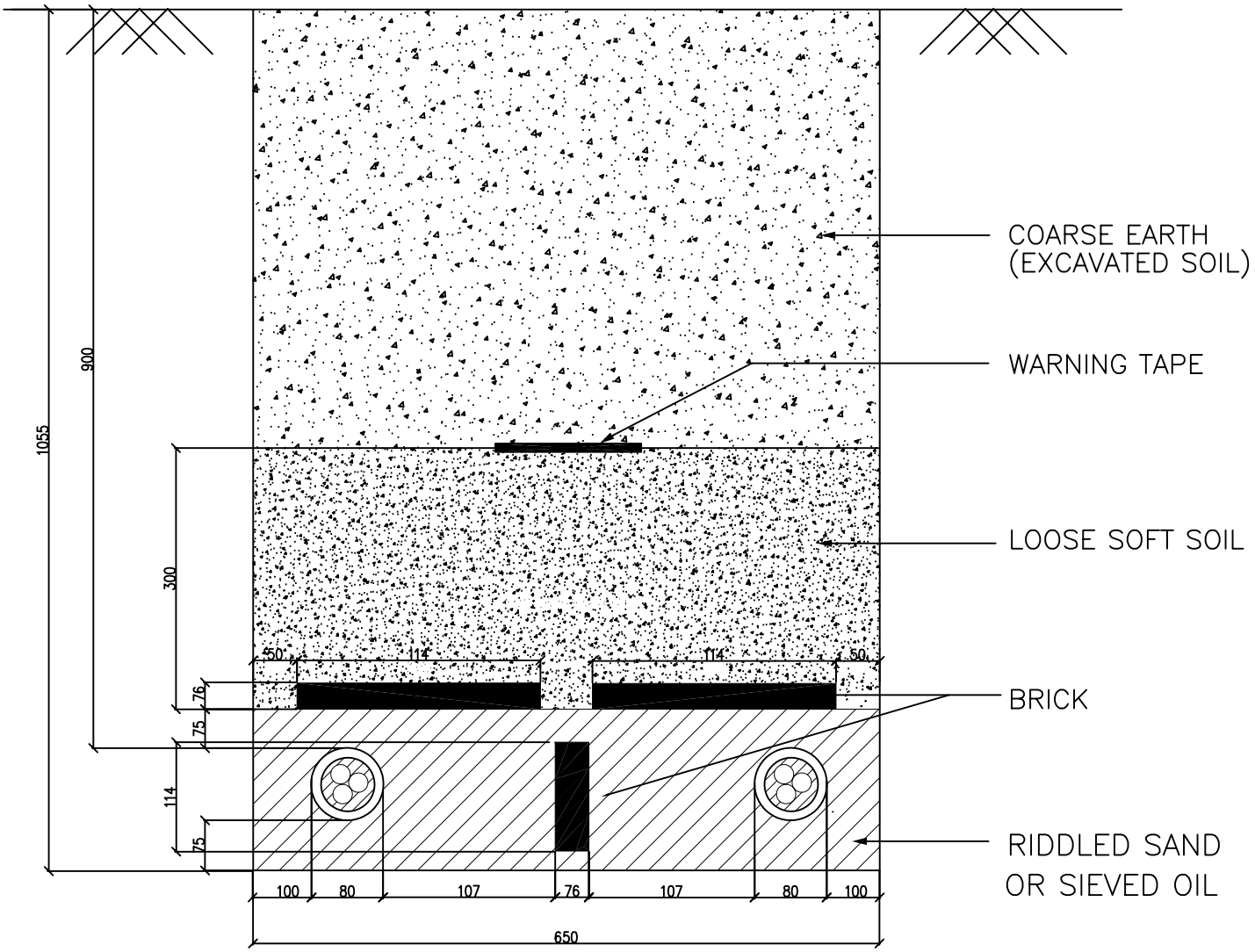


TYPICAL DETAILS FOR 11KV BURRIED CABLE FOR SINGLE CIRCUIT

TYPE – A 2

DRAWN	DS	TITLE:–	BSES
CHECKED	SGD	TRENCH DRAWING FOR	
APPD.	D.GUHA	3C X 300 Sq. mm	
DATE		11KV SINGLE CIRCUIT	REV. 00
SCALE		XLPE CABLE	

DRAWING # 7

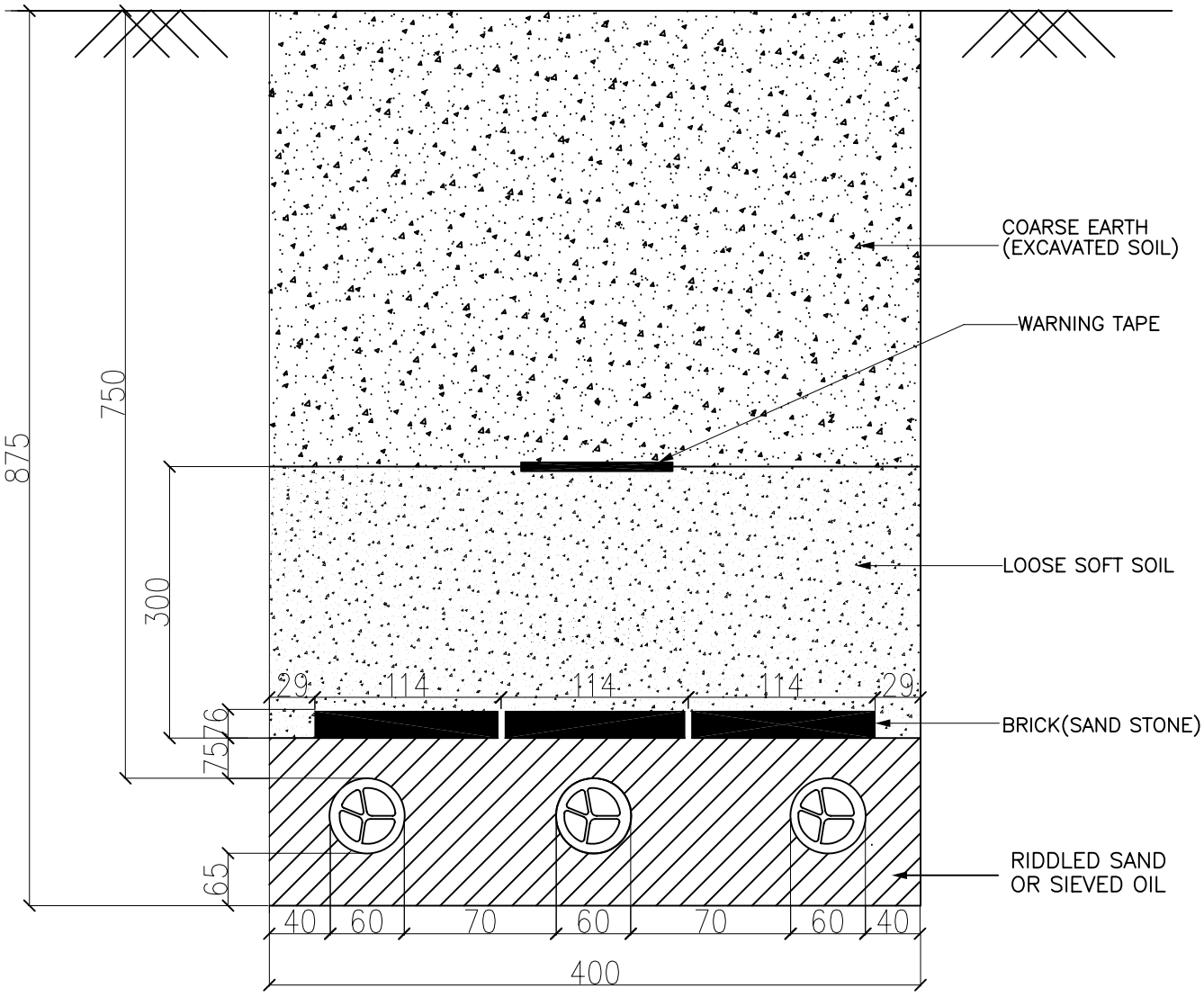


TYPICAL DETAILS FOR 11KV BURRIED CABLE FOR TWO CIRCUIT

TYPE – B 1

DRAWN	DS	TITLE:– TRENCH DRAWING FOR 3C X 300 mm Sq. or 3C X 150 mm sq II KV DOUBLE CIRCUIT XLPE CABLE	BSES
CHECKED	SGD		
APPD.	D.GUHA		
DATE			REV. 00
SCALE			

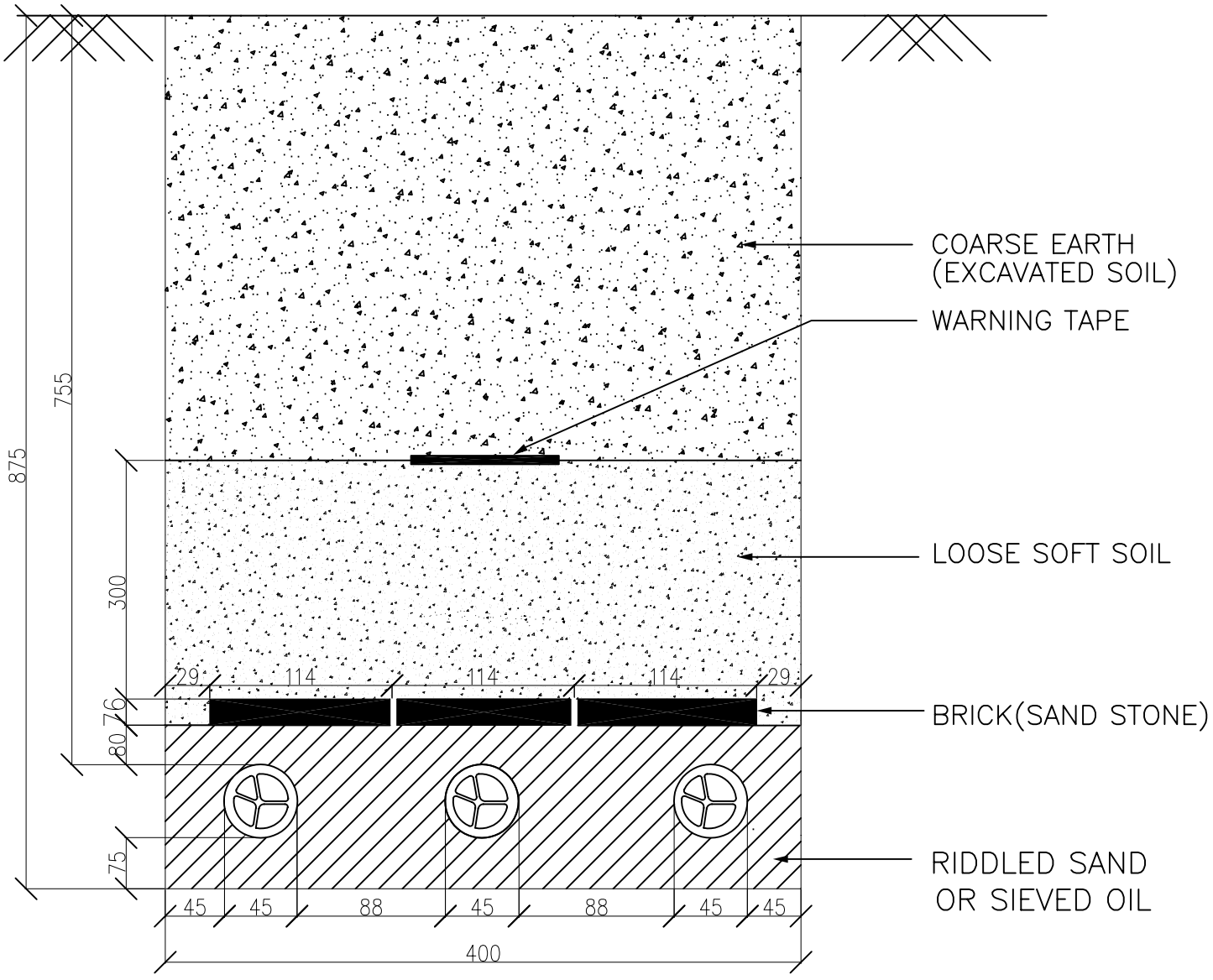
DRAWING # 8



TYPICAL DETAILS FOR 1.1KV BURRIED CABLE
TYPE – A 1

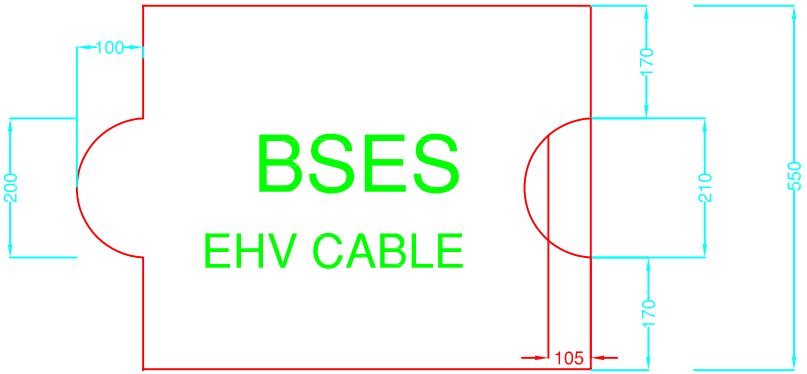
DRAWN	DS	TITLE:– TRENCH DRAWING FOR 3.5Cx300Sqmm 1.1 KV XLPE CABLE	BSES
CHECKED	SGD		
APPD.	D.GUHA		
DATE			REV. 00
SCALE			

DRAWING # 9



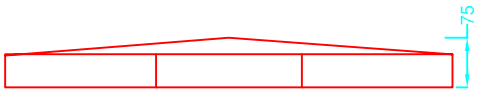
TYPICAL DETAILS FOR 1.1KV BURRIED CABLE
TYPE – A 1

DRAWN	DS	TITLE:–	BSES
CHECKED	SGD	TRENCH DRAWING FOR	
APPD.	D.GUHA	3.5Cx150Sqmm 1.1 KV	
DATE		XLPE CABLE	REV. 00
SCALE			

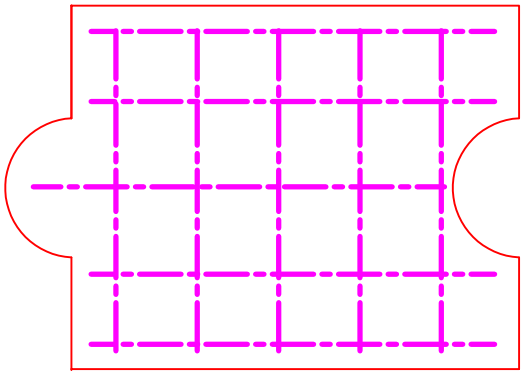


PLAN

ELEVATION



SIDE VIEW



NOTE -

(i) All dimensions are in MM.

(ii) Concrete Mix 1 : 2 : 4

(iii) MS rod - 6 MM Ø

CABLE COVER FOR EHV CABLES TYPE - A.

1. STEEL ROD - AS PER IS 432/1139

2. CONCRETE MIX SHALL BE NOT LESS THAN M200 GRADE AS PER IS 456.

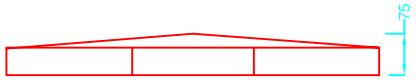
3. MOULDING SHALL BE WITH COMPACTION NOT LESS THAN 7 MN/Sq.m.(70 kgf/Sqcm)

DRAWN		TITLE:– CABLE COVER FOR EHV CABLE TYPE – A	BSES
CHECKED			
APPD.			
DATE			REV. 00
SCALE			

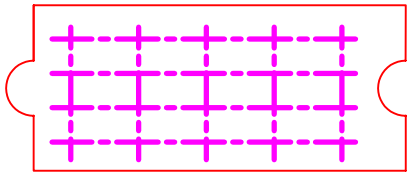
PLAN

1. STEEL ROD - AS PER IS 432/1139
2. CONCRETE MIX SHALL BE NOT LESS THAN M200 GRADE AS PER IS 456.
3. MOULDING SHALL BE WITH COMPACTION NOT LESS THAN 7 MN/Sq.m.(70 kgf/Sqcm)

ELEVATION



SIDE VIEW



NOTE -

(i) All dimensions are in MM.

(ii) Concrete Mix 1 : 2 : 4

(iii) MS rod - 6 MM Ø

CABLE COVER FOR EHV CABLES TYPE B.

DRAWN		TITLE:– CABLE COVER FOR EHV CABLES TYPE – B	BSES
CHECKED			
APPD.			
DATE			REV. 00
SCALE			

Annexure-7: Barricading and Safety

1. Dimensions of barricading- Height- 2 mtr, Length- 1.5 mtr. Refer drawing enclosed with tech spec for more details.
2. There shall not have any gap in between two barricades. Edge to edge shall be intact.
3. LED Bacon light shall be placed at 1st and 4th barricade and same shall be continue
4. Name, painting, colour, clean ness etc. shall be done on regular basis.
5. Vendor to ensure that traffic management shall not be excuse of work execution. The contactor shall not undertake loading and unloading at carriageways obstructing the free flow of vehicular traffic and encroachment of existing roads by the contactor applying the excuse of work execution.
6. Full height fence, barriers, barricades etc. shall be erected around the site in order to prevent the working area from the risk of accidents due to speedy vehicular movement. Same the way barricades protect the road users from the danger due to construction equipment and temporary structures.
7. The structure dimensions of the barricades , material and composition, its colour scheme, BSES logo and details shall be in accordance with specification and drawing laid down in the tender documents.
8. All the barricades shall be erected as per the design requirements of employer, numbered painted and maintained in good condition and also barricade in charge maintain a barricade register at site
9. All barricades shall be conspicuously seen in the dark/night time by the road users so that no vehicle hits the barricades. Conspicuity shall be ensured by affixing retro reflective strips of required size and shape at appropriate angle at bottom and middle portion of the barricades at a minimum gap of 1000 mm. In addition minimum one red light /red blinker and red beacon light should be placed at the top of each barricade.
10. No dust deposit at the front side of barricades.
11. Cable drum shall be returnable and vendor shall take it back (by bye back process) from site at their own risk and cost.
12. Once cable lying complete of a drum, within two days empty drum shall be removed from site by bye back process.
13. Trained traffic marshal with all PPE and traffic control light (Red and Green) shall be placed at site for 24x7.
14. No excuse of theft (beyond 6 hrs. of FIR) shall be acceptable.
15. During execution of job, any damage to other agency's properties shall be counted in vendor account and necessary action shall be taken by vendor to recover, repair etc.
16. Excess earth shall be removed from site after back filling. Site to be cleared to avoid flowing of dust. Barricades to be removed from site with in 24 hrs. after completion of job.
17. During non working hrs. vendor to ensure presence of supervisor for controlling any event from locals.
18. PPEs

    - Helmets

- Mask
- Jacket
- Shoes
- First Aid Box etc.

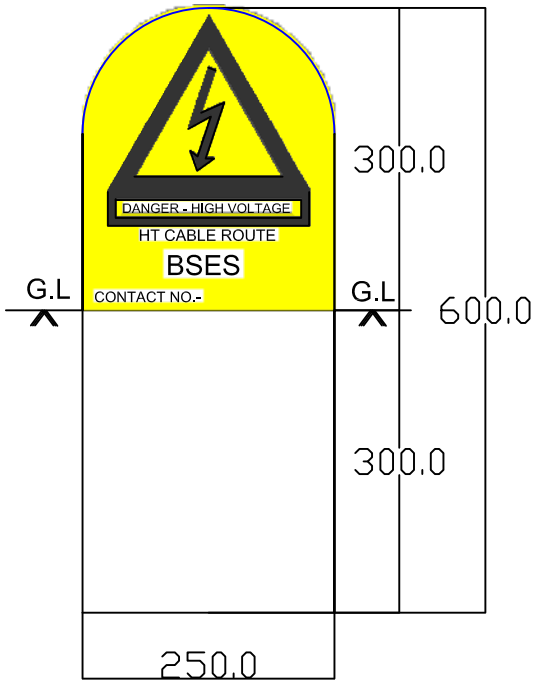
Shall be available at site 24x7. Zero tolerance on absence of PPEs to the working personnel. No excuse shall be acceptable in this regards.

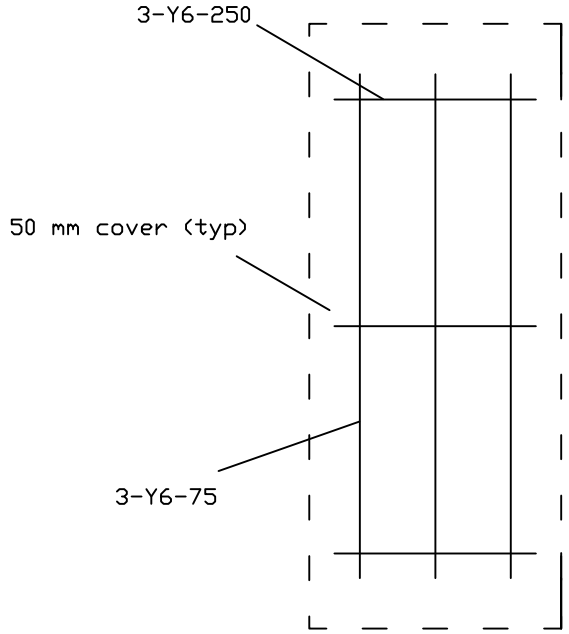
19. GPR/Scanning shall be done by vendor of whole the route and same shall be submitted to BRPL. This work shall be done by vendor before execution of job.
20. Jointing TAT- Jointing to start within 48 hrs. and shall be completed by 96 hrs.+1 day.
21. Lifting of cable drums with hydraulic machine, pulling of cable from top end of drum with pulling machine (hydraulic winch) is mandatory.
22. Violation on barricading guideline and safety norms, a fine of Rs.5000 /day shall be imposed. BRPL inspector/engineer in-charge shall be empowered to impose the above penalty.

Annexure # 8 – ROUTE MARKER AND BARRICADING DRAWING

Reinforcement Detail

DETAIL OF HT CABLE ROUTE MARKER (RCC) - BSES





Notes:-

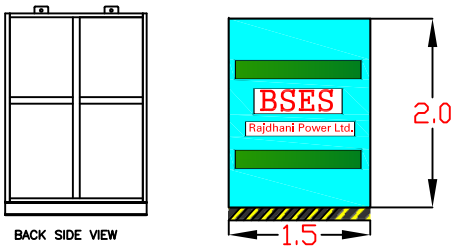
1	RCC Cable route marker with 6 mm Dia. Road and M25 concrete grade.
2	The litter/number shall be engraved on both the side route marker.
3	All dimentions are in mm unless specified.
4	Thickness of RCC shall be 75mm.
5	Yellow colour shall be visible above ground level.
6	Each route marker to be placed at an internal 50 mtr. and at every turn of route.
7	All kind of paint on route marker shall be in the scope of manufacturer.

DRAWN	R.K.JANA	TITLE:-	BSES Rajdhani Power Ltd.
CHECKED	P.B	DETAIL OF HT CABLE ROUTE MAKER (RCC).	
REVIEWED	M.B		
APPO.	K.A		DWG. NO.
DATE	16.08.16		BSES-RM-RCC-01, R0

BARRICADING FOR CABLE LAYING WORK

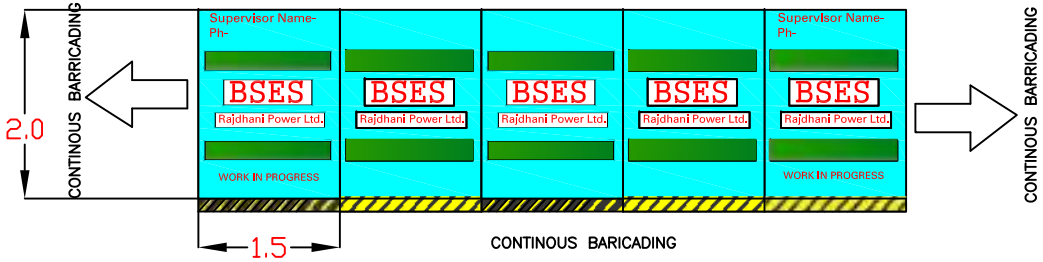
NOTE:

1. Barricading shall provided through out the route length as well as project location.
2. Plate shall be MS
3. Supervisour name, ph no, work in progress, shall be mentioned at every 1st and 4th plate of barricading through out the route.
4. Becon Light shall be provided through out the length.
5. Traffic marshal shall be Provided for traffic control by vendor.
6. Violation of safety norms and barricading shall be reviewed by BRPL and shall impose fine of Rs.5000/day as well as termination of work and short close of award.
7. After finishing of job vendor shall take return all the plate at their own risk and cost.
8. PPE's like Helmet, Mask, Jacket, safety boot etc. shall be provided vendor to all worker.



BACK SIDE VIEW

FRONT SIDE VIEW



DRAWN	R.K.JANA	TITLE:– DRAWING–BARRICADING FOR CABLE LAYING WORK	BSES Rajdhani Power Limited
CHECKED	P.B.		
REVIEWED	A.S.		
APPD.	V.P.		
DATE	29.06.17		

Annexure#9-Note for HDPE Pipe Diameter in Cable Laying

1) Primarily our intent for laying cable will be through open trench only.
2) Trench dimensions shall be as per the standards which mentioned as below table

Sl. no.	Cable	Trench Details (mm)		
		Depth (single and double run)	Width (Single Run)	Width (Double Run)
1	LT Cable	875	400	400
2	11 kv	1055	400	650
3	33 kv	1235	400	650
4	66 Kv	1445	650	1200

3) QC team will do stage inspection after completion of digging to validate the depth of trench and will give approval for issuing of cable.
4) Execution in charge to ensure the cable laying work.
5) QC team will also inspection the laying work to validate the laying as per standards before back filling.
6) In case of site constraints, trench less cable laying shall be allowed as per the followings-
   a) Cable laying up to 50 mtr through trenchless will be allowed with approval of circle head (O&M) for road crossing or site constraints. Site photos of constraints shall be reviewed before approval by circle head.
   b) Absence of permission for digging- written disapproval by road owing agency and appropriate approval by circle head (for O&M Jobs), by O&M head (for 11kV, P&C job) and by EHV head (for EHV Jobs)
   c) The size of HDPE (PN6, PE80) pipe shall be as per the guidelines of IS-1255, 1983, clause no-6.3.4.3. Details mentioned below in below table-

Sl. No	Cable	Recommended Dia of HDPE pipe (mm)
1	66kV, 3CX300	225
2	66kV, 1CX630	180
3	66kV, 1CX1000	180
4	33kV, 3CX400	180
5	11kV, 3CX300	160
6	11kV, 3CX150	160

d) In-case of using lower size of HDPE pipe due to site conditions, the deviation for using lower HDPE pipe from above table, written approval must be taken through technical committee. Photos of the challenges while apparently the same will be reviewed by technical committee.

(However, HDPE pipe size with less than 1.5XOD of cable shall not be allowed at any stage)

TECHNICAL SPECIFICATIONS

OF

INSULATING MAT

BSES RAJDHANI POWER LTD.				
Prepared by	Naved Ahmad	Naved Ahmad 15/5/18	Date:	15.05.2018
Reviewed by	Amit Tomar		Revision	R0
Approved by	K. Sheshadri	15/05/18	No of Pages:	8

Contents

1.0 Scope of Supply

1.1 The specification covers the design, manufacturing, inspection, testing & supply of safety helmet with sensor

1.2 Design, Engineering, Manufacturer, Assembly, Inspection, testing at manufacturer works before dispatch Packing, delivery of material to BRPL stores and submission of documents to purchaser.

2.0 Service Condition

The Insulating Mat to be supplied against this specification shall be suitable for satisfactory continuous operation under outdoor environment. Following are the climatic condition:

Sl.no	Parameters	Requirements
i.	Peak ambient temp.	55°C
ii.	Min ambient temp. in shade	45°C
iii.	Max. average ambient temp in 24 hours period in shade	40°C
iv	Min ambient temp.	(-)5°C
v	Max temp attainable by an object exposed to sun	70°C
vi	Max. relative humidity	95%
vii	Average number of thunder storm days per annum	40
viii	Average number of rainy storm days per annum	120
ix	Average annual rainfall	1250mm
x	No of months of tropical monsoon condition	4 months
xi	Max. wind pressure	150kg/m2
xii	Altitudes	Not exceeding 1000mtrs

The Insulating Mat shall also be for use in moderately hot and humid tropical climate, conducive to rust and fungus growth.

3.0 Applicable Standards

Following Indian/International Standards, which shall mean latest revision, with amendments/changes adopted and published, unless specifically stated otherwise in the Specification, shall be referred while accessing conformity of Lineman safety helmets with sensor

In the event of supply of insulating mat confirming to Standards other then specified, the bidder shall confirm in his bid that these standards are equivalent or better to those specified. In case of award, sallent features of comperison between the standards proposed by the bidder and those specified in this document will be provided by the supplier to establish equivalence.

Sl. no.	Product name	Standard	Title
1	Insulating Mat	IS 15652 : 2006	Synthetic Insulating Mat- Confirming
2		IS 5424 (cold standard)	superseded the rubber mat
3		IS 8002/IEC 61111	
4		IEC 479	

4.0 Requirements

ANNEXURE A-TECHNICAL COMPARISON DATA SHEET FOR INSULATION Mat-11 kV

Annexure A-Technical Comparison Data Sheet For Insulation Mat-11 Kv			
Sl No.	Descriptions	BRPL Requirement	Vendor Data
1	Purchase Req. No		
2	Guarantee Period (Min)	5 years	
3	Applicable IS/IEC Standard to be followed by Vendor	IS 15652:2006, IS 8002/IEC 61111, IEC 479	

Annexure A-Technical Comparison Data Sheet For Insulation Mat-11 Kv			
Sl. No.	Descriptions	BRPL Requirement	Vendor Data
4	Make	Vendor Name	
5	Material	Dielectric Elastomer	
6	Colour	Blue/Black	
7	Type	Pastable Type, gas welding with filler material type (IS:8002)	
8	Surface	Abrasions to be provided on upper surface to mat to make surface Anti-skid	
9	Voltage Grade	3.3 KV, 11 KV, 33 KV	
10	Suitable for AC/DC	AC/DC	
11	Thickness	3 mm for 11KV & 33 KV	
12	Width	1 mtr. (min)	
13	Length	5 mtrs for 11/33 KV	
14	Tensile Strength (N/Sqmm)	15 N/Sqmm upto 33 KV	
15	Elongation (%)	250 (min) upto 33 KV	
16	Insulation Resistance with Water at 500 V	1,000,000 M ohm up to 33 KV	
17	Leakage Current at 11 KV (mAmp)	10 (max)	
18	AC Di Electric Strength	45 KV (min) for 11KV	
19	Flame Retardance	Fire Retardant, fire self-extinguish within 5 seconds	
20	Working Temparature	-10°C to +60°C.	

Annexure-A-Technical Comparison Data Sheet For Insulation Mat-11 Kv			
Sl No.	Descriptions	BRPL Requirement	Vendor Data.
21	Low Temperature Resistance	No Tear, Break or Crack is Observed in Mats Under Force of 100 N for 1 Hrs. at -10+- 3°C	
22	Effect to Various Medium		
a	Acid		
i	Tensile Strength (N/Sqmm)	Not Less than 80% of Changes from Original Value	
ii	Elongation (%)	Not Less than 80% of Changes from Original Value	
b	Alkali		
i	Tensile Strength (N/Sqmm)	Not Less than 80% of Changes from Original Value	
ii	Elongation (%)	Not Less than 80% of Changes from Original Value	
c	Diesel		
i	Tensile Strength (N/Sqmm)	Not Less than 80% of Changes from Original Value	
ii	Elongation (%)	Not Less than 80% of Changes from Original Value	
d	Transformer Oil		
i	Tensile Strength (N/Sqmm)	Not Less than 80% of Changes from Original Value	
ii	Elongation (%)	Not Less than 80% of Changes from Original Value	
e	Ageing Properties at 70+-1 °C for 168 Hrs		
i	Tensile Strength (N/Sqmm) after Ageing	Not Less than 75%of Changes from Original Value	
ii	Elongation (%) after Ageing	Not Less than 75% of Changes from Original Value	

Annexure A-Technical Comparison Data Sheet For Insulation Mat-11 Kv			
Sl No.	Descriptions	BRPL Requirement	Vendor Data
23	Class-C for 3 mm thickness		
i	Working Voltege	11 KV	
ii	Proof Voltage (for 180 sec)	36 KV max	
ii	Break Down Votage	65 KV (max) AC RMS	
24	Embossing	Anti-Skid without metallic derivatives with Chips/without Chips.	
25	Marking	Every meter of mat should be marked with respective Class symbol, Lot No. or Batch number and Manufacturer's Identity or Brand name, Mat Tested & Stamped to IS:15652-06 and ISI mark, BSES Mark, PO no, date of manufacturing, Length of Mat.	
26	Packing	Packed in Gunny bags of Jute/Hessian cloth to avoid mechanical damage to the material in transit.	

5.0 Workmanship And Finish:

One side plain and other side pattern.

6. Inspection:

Manufacturer shall intimate the manufacturing schedule in advance. The manufacturer shall give minimum 15 days advance notice about readiness of material at their works. The material shall be inspected for conformity with BRPL specification before the same is accepted.

8.1 Certificates required
8.2 Manufacturing certificates
8.3 Test certificates
8.3 Authorization of dealership/ distribution ship

7. Deviation

Deviation from this specification is only acceptable in cases where the bidder has submitted deviation list along with the technical bid. It may also be noted that the deviation can only be accepted by BRPL in case it does not hamper the basic purpose of safety helmets with sensor

In the absence of a list of deviations, it will be assumed by Buyer that the seller complies fully with this specification.

BSES

Specification of
11 kV Ring Main Unit

Specification no – BSES-TS-18-MRMU-R0

Rev		0
Date:		13/04/2022
Pages		70
Prepared by	Vaibhav Valsh	
	Abhishek Harsh	
Reviewed by	Srinivas Gopu	
	Anil Bohara	
Approved by	Gaurav Sharma	
	Gopal Nariya	

Index

Record of Revision

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

1.0 Scope of work

1.1 11kV Motorized RMU with FRTU & Modem shall be supplied as per the specification.

1.2 Metering Cubicle (Only with Outdoor RMU, if specified with purchase requisite)

1.3 Design, construction, Complete Installation Testing & commissioning of all Motorized RMUs with FRTU at site along with interconnection of all components, DI/DO/AI signals, status monitoring signals to FRTU. Integration of FRTU with SCADA.

1.4 FRTU, Modem and Relay Licensed software for programming, configuration, troubleshooting and diagnosis shall be provided.

1.5 For scope of supply, refer annexure – A

1.6 Mandatory spares shall be supplied along with the RMU as per the list mentioned in Annexure D

2.0 Codes & standards

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

S No.	Title
Indian Electricity Rules	With latest amendments
Indian electricity act	IE act 2003
IS 3427	A.C. Metal Enclosed Switchgear and Control gear for Rated Voltages Above 1 kV
IS 9920 part 1,3 & 4	High voltage switches above rated voltage 1kv
IS 13118	General requirements of circuit breakers above rated voltage 1kv
IS 3231	Electric Relays for Power System Protection
IEC 60265 part 1	High voltage switches
IEC 60056	High voltage alternating current circuit breakers
IEC 60059	Preferred current ratings of high voltage switchgear
IS 16227/IEC 61869	Current transformers
IS 3156	Voltage Transformer
IEC 60694	Specification for high voltage switchgear
IEC 60298	AC metal enclosed switchgear
IEC 60129	Ac disconnector and earth switches
IEC 60529	Classification of degrees of protection provided by enclosures
IEC 60255	Electrical relays
IEC 62271	HV Switchgear and Control gear
IEC 62271 – 103	HV Switchgear and Control gear - Switches for rated voltages above 1

	kV up to and including 52 kV
IEC 62271 – 1	HV Switchgear and Control gear – Common Specifications
IEC 62271 – 201	HV Switchgear and Control gear - AC insulation-enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 52 Kv
IEC 60044	Instrument Transformers – Current Transformers
IEC 62271 – 102	HV Switchgear and Control gear – Alternating Current Disconnector and Earthing Switches

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

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

3.0 Electrical Distribution System Data

3.1	Supply	3 phase AC, 3 wire
3.2	Voltage	11000 volt ±10%
3.3	Frequency	50 Hz ± 5%
3.4	System neutral	Earthed at upstream 11kv source

4.0 11kv RMU System layout

4.1	RMU Configuration	As per scheme given in Annexure E & type as per Purchase requisition
4.1.1	1 Way RMU (Transformer feeder)	Motorized VCB with manual operation facility. Self power relay with protection CTs to be provided. The extension panel DI/DO/AI/Modbus communication signals are to be at single point at RMU for SCADA communication using existing FRTU panel.
4.1.2	3 Way RMU, all are VCB modules.	
4.1.2.1	Cable feeder 1	Motorized VCB with manual operation facility. FPI and CBCT/Phase Sensors to be provided.
4.1.2.2	Cable feeder 2	Motorized VCB with manual operation facility. FPI and CBCT/Phase Sensors to be provided.
4.1.2.3	Transformer feeder	Motorized VCB with manual operation facility. Self power relay with protection CTs to be provided.

4.1.3	4 Way RMU, all are VCB modules.	
4.1.3.1	Cable feeder 1	Motorized VCB with manual operation facility. FPI and CBCT/Phase Sensors to be provided.
4.1.3.2	Cable feeder 2	Motorized VCB with manual operation facility. FPI and CBCT/Phase Sensors to be provided.
4.1.3.3	Transformer feeder 1	Motorized VCB with manual operation facility. Self power relay with protection CTs to be provided.
4.1.3.4	Transformer feeder 2	Motorized VCB with manual operation facility. Self power relay with protection CTs to be provided.
4.2	Extensibility	Both side extensible for 1Way RMU One side extensible for 3Way and 4 Way RMU
4.3	Circuit breaker, disconnector & earth switch in RMU panel	All shall be non draw out type, fixed position
4.4.1	Insulation medium for panel	SF6 gas in sealed metallic tank
4.4.2	Breakers	Vacuum type (with disconnector & earth switch)
4.5	Arc interruption chamber for breaker	i) Separate for each breaker ii) Arc interruption chamber of breakers shall be separate from the main insulated tank. (Desirable feature)
4.6	Maximum dimensions for a 3 way panel (3 CBs)	
4.6.1	Width (measured from front)	1250 mm
4.6.2	Depth	800 mm
4.6.3	height	2000 mm
4.7	FRTU	FRTU shall be provided and integrated with RMU and LV compartment with completely wired along with Modem suitable for communicating over 4G/5G (If available during detail engineering, without any price implication) GSM network. Bidder shall demonstrate the data communication of FRTU modem with MCC/BCC for the proposed modem for approval of owner in the Pre Order technical evaluation stage. For detailed specification of FRTU, I/O requirements , refer standard specification of Annexure H
4.8	Modem	Modem should be dual sim 4G/5G (If available during detail engineering, without any price implication) and shall also have compatibility of 3G/2G network. For detailed technical specification of modem, please refer Annexure G
4.9	Auxiliary transformer	Resin cast

		To be provided as per tender requirement
4.9.1	Rating	11kV/230V
4.9.2	burden	500VA
4.9.3	Primary Fuses	To be provided
4.9.4	2 pole MCB	To be provided for secondary side of the Aux Transformer
4.9.5	Compartment	Separate compartment with padlocking arrangement to be provided.

5.0 RMU panel construction

5.1	Panel type	Metal enclosed, framed, Compartmentalized panel construction.
5.2	Service Location	Indoor, non air conditioned environment / Outdoor with continuous ambient temperature of 50 deg C and shall be suitable for external climatic condition Resistant to water ultraviolet radiation (Canopy shall be provided for outdoor application)
5.3	Mounting	Free Standing
5.4	Overall Enclosure Protection	IP 4X minimum, vermin proof IP 54 minimum (For outdoor duty).
5.5	Doors	Front access with anti theft hinge arrangement, Minimum three hinges. Hinges arrangement shall ensure that door cannot be removed.
5.6	Covers	Bolted for rear access, with handles. Support for handle shall be provided at suitable place on RMU body. All the accessible bolts / screws shall be vandal proof. One set of required Special tools per RMU (if any) shall be in the scope of supply. All kind of nuts and bolts must be stainless steel
5.7	Construction	Indoor RMU: Sheet metal 2.5mm thick CRCA. Outdoor RMU: Pre Galvanized sheet 2.5mm thick with 275GSM
		Stainless steel tank. 3.0 mm thickness shall be based on validated type tests for 21kA 1sec IAC test and 20kA, 3sec short ckt tests.)
5.8	Base frame	**For Panel type design:-** Common Base frame shall be made with 75mm ISMC/ISA channel for both Indoor and Outdoor type RMU for holding the both RMU with FRTU compartment. Proper Bolted fixing arrangement shall be provided for erection on RCC foundation. Also, base frame shall be painted with 2 coats of anti rust red oxide and 2 coats of bitumen paint shall be provided.

		For T-type design:- 300 mm - 450 mm height (made with ISA / ISMC) for Indoor & Min. 500 mm for outdoor. Height of the base frame shall be enough to ensure height to suit the operator's convenience.
		Frame shall be completely covered from all the four sides by MS plate / sheet. Cable box compartment should be extended up-to base-frame bottom to have metallic separation between each of the feeders at base frame level too. Painting should match with RMU shade
		With fixing bolt for RMU & frame (in case the frame is supplied loose) & foundation bolts.
5.9	Power Cable Clamping Arrangement	Shall be provided for each power cable along with HDPE cable clamps (to suit the cable size from 150 to 400 sq mm PILC / XLPE cable. Exact size shall be provided during drawing approval stage), also cleat shall be adjustable vertically.
5.10	Lifting lugs	Four numbers
5.11	Cable Entry	Bottom
		3mm metallic gland plate, removable type & split type in two parts, with 1no. 90 mm diameter knocks out punch/hole in the centre (For double cable boxes, Un-drilled gland plate to be supplied. Approval should be taken for the same during drawing submission)
5.12	Cable type & size	3c x 150 / 240 / 300 /400 sq mm Aluminum conductor XLPE/ PILC with armor & PVC outer sheath
5.13	Terminals for 11kv cable termination	Suitable for Ring Type Bimetallic lug as per annexure F
5.13.1	Terminals	M16 size Set of required size of stud suitable for M 16 size Ring type lug & bimetallic washers.
5.13.2	Bimetallic washers	Required (Not applicable for silver quoted bushing)
5.13.3	Right angled boots	Single piece cold shrink type. Minimum 20mm spacing between boots preferred. Type test reports, maintenance replacement plan shall be submitted.
5.13.4		
5.13.5	Cable Test Plug	Preferred with cable test plug facility, without opening of cable compartment
5.13.6	Termination type	suitable for heat shrinkable type
5.13.7	Termination height	For Indoor / Outdoor : Min. height from gland plate shall be 900mm

5.14	Bus bar	Copper (Sizing Calculation to be submitted in support of its Guaranteed S.C. rating / Capability)
5.14.1	Bus bar continuous rated current	630amp (at designed 40 deg.C ambient)
5.14.2	Bus bar short time withstand capacity	20 KA for 3 sec
5.14.3	Bus bar support insulator material	SMC / DMC resin
5.14.4	Maximum temperature rise above reference ambient 40 deg C	In line with Table 3 of IEC62271-1
5.15	Earth bus bar	Aluminium/Tinned Copper flat sized for rated fault duty for 3 sec
5.16	Earth bus internal connection to all non current carrying metal parts	By 2.5 sq mm copper flexible wire, Earth connection point maximum 1 meter away from cable test facility
5.17	Earth bus external connection to owners earth	Studs on both sides with holes for M10 bolt + hardware to readily receive purchaser earth connection
5.18	Cooling arrangement	By natural air without fan
5.19	Panel internal wiring	a) Multi strand flexible color coded PVC insulated Cu wire 1 sq mm (SCADA) b) 1.1KV , PVC insulated 2.5 sq mm cu cable for CT connection. c) Colour of wire (R phase - Red, Y phase – Yellow, B phase – Blue, AC- black, DC – grey, Earth – green) with ferrules at both ends.
5.20	Hardware (Nut, bolts & handle)	Stainless steel (Except termination nut-bolts which are Brass / Tinned Copper)
5.21	Gasket	Neoprene rubber
5.22	Marshalling terminal blocks	1 Sq mm, Nylon 66 material, screw type + 20% spare in each row of TB. Disconnecting type Terminal block to be provided for CT connections
5.23	Panel cover fixing bolts	Allen head 6mm with hexagonal slot. Seals shall be provided between the Panel and removable covers to avoid theft. The seals shall be opened/broken by using specific equipment.

5.24	Padlock facility	Required for all earth switches & all handles
5.25	Bushings for future extensions of RMU	RHS extensible. Should be duly insulated & covered with metallic covers in unused condition, In addition a removable boot cover shall be provided on the extensible bushings.
5.26	Internal Arc classification	
5.26.1	Explosion vents	To ensure operator's safety, design should ensure that gases / flames generated during flash over / blast in any of the compartment, must not come out from the front of RMU as well shall not go to adjacent cable compartment. Internal arc test report (for Cable compartment & other compartments) must be submitted to support above, along with RMU GA drawing indicating these vents. There shall not be any type of holes, gaps etc on the walls of cable termination compartment.
5.26.2	Internal Arc rating	20 kA for 1s
5.26.3	Internal arc classification	Shall comply to the requirements of IEC 62271-200, Accessibility type AFLR. Operators of equipment shall be protected against the effects of an arcing fault in any of the MV compartment at all times , including while carrying out the maintenance works on other compartments
5.27	SF6 Gas Annual Loss	< 0.1% of total mass. Pressure of SF6 gas shall be above the operating limit throughout the life of the equipment.
5.28	VPIS	VPIS shall be provided with terminals facility for phasing purpose. VPIS sensor shall be installed on screened bushing NO/NC Contact shall be provided with VPIS for taking the Live line indication status to remote SCADA through FRTU.
5.29	Push Buttons	On/Off PBS shall be shrouded / covered to prevent accidental operation.

6.0 Circuit breaker (TCB / FCB)

6.1	Type	Three pole, operated simultaneously by a common shaft
6.2	Arc interruption in dielectric medium	Vacuum Bottle
6.3.1	Operating mechanism	Manual and Motorized spring charged stored energy type, remote electrical close / open operation possible.
6.3.2	Manual operation	Possible without removal of motor
6.3.3	Addition / removal of motor	Without overhaul of operating mechanism

6.3.4	Motor rated voltage	24V DC
6.4	ON/OFF push button	On panel front with Protective flap/shrouded to prevent any accidental tripping of breaker.
6.5.1	Continuous rating at design 40 deg C ambient	630amp
6.5.2	Short time withstand capacity	20 KA for 3 sec
6.6	Minimum number of operations at rated current (as per IEC 62271-100)	Mechanical Endurance – Class M1 (2000 operations) Electrical Endurance – Class E2
6.7	Fault making capacity	50 KA peak
6.8	Fault breaking capacity	20 KA Minimum
6.9	Maximum number of operations at rated Fault current (as per IEC 62271-100)	Electrical Endurance – Class E2. To be guaranteed by manufacturer with authorized lab test reports
6.10	Breaker status auxiliary contact	2NO + 2NC wired to terminal block
6.11	For Cable feeder circuit breaker module	
6.11.1	Self powered relay	Not required
6.11.2	CTs	Not required
6.11.3	Fault passage indicator (FPI)	To be provided cable feeders
6.11.4	Fault passage indicator (FPI) (Earth fault and over current protection type)	a) To be provided on each and every cable feeder for RMU. FPI shall be earth fault and over current protection type and shall be suitable for remote load monitoring at SCADA for cable feeders. b) CBCT – Split open type suitable for mounting without disconnection of cable for EF. c) Phase sensor – 3 Nos. split open type for short ckt. purpose with mounting arrangement
6.11.5	Connection of CBCT with FPI	Cable connection of FPI with CBCT shall be of pre moulded type on the CBCT side. Cable shall be 2.5 sq.mm cu cable or fiber cable.
6.11.6	Fault Passage Indicator	a) Digital type and shall operate as the current exceeds the set value. Flash indication for identifying faults with red LED with one flash for every one sec. Test & reset button 1 NO + 1 NC potential free contact for remote indication FPI power supply unit shall use lithium battery with minimum life of 1000 blinking hours , so that FPI shall continue to function even after main feeder has tripped. FPI shall be powered with 24V DC in all motorized RMU. b) FPI shall be suitable for remote load monitoring at SCADA for Cable feeder. FPI shall be provided with Remote communication capability with SCADA on

		Modbus Protocol. The Load current as measured by FPI shall be communicated to SCADA.
6.11.6.1	**Earth Fault Indicator**	
6.11.6.1.1	Sensing Current	50 to 400A
6.11.6.1.2	Sensing Time	30 to 100 ms in steps of 10ms.
6.11.6.1.3	Reset Time	0.5 -1-2-3-4 hr
6.11.6.1.4	Resetting Facility	a) Self reset after reset time b) Self reset after restoration of voltage c) Manual d) Remote resetting
6.11.6.1.5	Contact Rating	1A at 230 V
6.11.6.1.6	Degree of Protection	IP 54
6.11.6.1.7	Mounting Arrangement	Surface or Flush Mounting
6.11.6.1.8	Ambient Temperature	-20 to 55 Deg C
6.11.6.2	**Short Ckt indicator**	
6.11.6.2.1	Sensing Current	200 to 1200 A
6.11.6.2.2	Sensing Time	30 to 100 ms in steps of 10 ms
6.11.6.2.3	Reset time	0.5-1-2-3-4 hr
6.11.6.8	Data by Purchaser	
6.11.6.8.1	System Fault Level	2kA – 8.75kA
6.11.6.8.2	Type of Grounding	Solidly Grounded
6.11.6.8.3	Fault clearing time	100ms
6.11.6.8.4	Cable Type	XLPE , 70 sq.mm to 400 sq.mm
6.12	For Transformer feeder breaker module	
6.12.1	Current transformer	a) 75-150-400 / 1 amp b) Resin Cast Ring type c) Considering three core cable terminations, mounting flexibility shall be provided for CT's (in horizontal & vertical direction both). Additionally, CAUTION marking (by sticker/ paint) shall be provided to avoid CT's installation above the screen of cable. (i.e. earth potential point.) d) Disconnecting type terminal block shall be provided for CT Circuit. e) Change in CT ratio shall be possible from the disconnecting type TB. Any change in CT ratio from CT secondary will not be acceptable.
6.12.2	CT accuracy class	5P10 minimum
6.12.3	CT burden	CT burden should be 20% higher than the connected relay burden.
6.12.4	Protection relay	a) Self powered, Microprocessor based Numerical relay (with backlit LCD display), IDMT over current / earth fault protection with high set element, manual reset type, flush mounted on panel front

		b) Relay Setting 10 % to 250% In insteps of 1% c) The relay should record atleast 10 fault events on FIFO basis d) Relay auxiliary supply shall be 24V DC for all motorized RMU. For non Motorized RMU relay shall be with 240V AC auxiliary for remote tripping e) RS-485 Port to be provided on the Relay for remote communication of the parameters to the SCADA through FRTU over IEC103 Protocol. Necessary internal wiring also shall be done between Relay and FRTU. f) Licensed software shall be provided for Relay communication with Laptop along with necessary cables for interconnection between Laptop and Relay (Based on requirement). g) Appropriate wiring to be done to connect all the relays to the FRTU.
6.12.5	Relay auxiliary contacts for remote indication	Potential free contact 1NO + 1NC wired to terminal block
6.12.6	Shunt trip 24V DC (for WTI trip & door limit switch & for remote trip from SCADA.)	To be wired to terminal blocks
6.12.7	Breaking Timing	40 to 60 ms
6.13	FRTU and Associated equipment battery, BHMU and battery charger	
6.13.1	Battery	
6.13.1.1	Battery type	Li-Ion/SMF lead acid battery
6.13.1.2	Rating	a) **Li-ion battery(LIB)/SMF Lead Acid Battery (as per tender requirement)** b) 24VDC, 26Ah(Min) c) Battery provided in enclosure shall be rated for 10 close & 10 open operations of CB as well as 3 hrs backup for all equipment installed inside FRTU Cabinet (mini FRTU load shall be consider as 50W) d) However the actual battery and battery charger sizing shall be finalized by owner during detail engineering and bidder has to supply the finalized size of battery and battery charger without any price implication.
6.13.1.3	Location	Battery shall be kept in shielded compartment in FRTU panel and fixed with rivet and nut bolt. Individual battery terminal shall be wired upto terminal blocks mounted in FRTU cabinet.
6.13.2	Battery Health Monitoring Unit (BHMU)	1. BHMU will have Auto / Manual test facility. In Auto Mode it ensures battery automatic discharge at preset set period with 100W discharge resistor along with

		suitable algorithm to check the healthiness based on rate of discharge. 2. In manual Mode PB provided for battery testing. 3. Provision for Bypass mode of BHMU shall also be provided. 4. Output contacts :230V/24V DC -5A a. Battery Fail: 1 CO b. Test In process 5. Indications: a. BHMU healthy. b. Battery Fail c. Battery Low d. Test On.
6.13.3	Battery charger	2 no's chargers with auto change over using 10A diodes.
6.13.3.1	MCBs at charger input & output supply	Required 2 nos DP MCB for AC Incoming supply All the MCBs shall be easily accessible for operation, with proper labeling. MCB location shall be preferably away from Battery charger location.
6.13.3.2	Charger temperature rise at heat sink at full load for 2 hours	Maximum 55 deg C above ambient of 40 deg C
6.13.3.3	Battery charger cooling method	Natural without any fans
16.13.3.4	Individual CBs DC control	Required with MCB
16.13.3.5	DC power supply for FRTU	24v DC +/- 1 volt thru 2 Amp MCB. FRTU functionality should not effect during DC voltage supply range 18 to 30V DC.
6.13.4	FRTU	FRTU shall be provided and integrated with RMU and LV compartment with completely wired along with Modem suitable for communicating over GSM network. Bidder shall demonstrate the data communication of FRTU modem with MCC/BCC for the proposed modem for approval of owner in the Pre Order technical evaluation stage. For detailed specification of FRTU, I/O requirements , refer standard specification of Annexure H
6.13.5	Modem	Modem should be dual sim 4G/5G (If available during detail engineering, without any price implication) and shall also have compatibility of 3G/2G network. For detailed technical specification of modem, please refer Annexure G
6.13.6	Transducer	DC voltage transducer (4-20mA) for monitoring of DC battery bus voltage.

7.0 Earth switch (ES)

7.1	Type	Three Pole, operated simultaneously by a common shaft, for each Circuit breaker & Load break switch.
7.2	Switching in dielectric	Dry Air in sealed medium or SF6 gas

	medium	
7.3	Operating mechanism for close & open	Manual
7.4	Fault making capacity	50 kA (Desirable)
7.5	Auxiliary contacts	1NO+1NC wired to terminal block
7.6	Disconnect switch (if provided in series with vacuum bottle)	Desirable to be located on purchaser cable connection side of vacuum bottle
7.7	Minimum number of operations at no load (as per IEC 62271-102)	Mechanical Endurance – Class M0(1000 operations)
7.8	Making capacity endurance of earth switch (as per IEC IEC 62271-102)	Class E2 (Min 10 operations)

8.0 Requirements of sealed housing live parts

8.1	Enclosure	Stainless steel enclosure ensure Degree of protection IP67. Non ferrite & Non magnetic grade 304 stainless steel of minimum 3mm thickness. Stainless steel enclosure welding shall be robotic welding type.
8.2	SF6 gas pressure low alarm	To be given along with NO and NC Contracts
8.3	Provision for SF6 gas filling	NRV
8.4	Provision for SF6 gas pressure indication	Analog Manometer with non return valve Manometer with integrated pressure density switch and temperature compensation required
8.5	Arc interruption method for Vacuum circuit breaker	Puffer type / rotating arc type vacuum interrupter
8.6	Potential free contacts for SF6 gas pressure low	1NO +1NC (Desirable) Two distinct SF6 pressure low Potential Free contacts to be provided.

9.0 Operational interlocks

9.1.1	Interlock type	Mechanical. All interlocks shall be preferably guarded by flap, so as to prevent insertion of handle for wrong operation.
9.1.2	Circuit breaker & respective earth switch	Only one in ‘close’ condition at a time
9.3	Prevent the removal of respective cable covers if circuit breaker is ‘ON’	Electrical / Mechanical

9.3	Prevent the closure of circuit breaker if respective cable cover is open	Electrical / Mechanical
9.4	Cable test plug for CB accessible only if Earth switch connected to earth	Mechanical
	For motorized RMUs	
9.5	Prevent motorized operation of CB during manual operation	Electrical / Mechanical Electrical signal shall cut-off completely during manual operation. If CB fail to operate, the supply to motor shall be disconnected after certain time period to prevent burning of motor due to continuous supply.
9.6	Prevent motorized operation of more than one CB at a time	Necessary feature (Electrical)

10.0 Indication & signals (for SCADA / Local)

10.1	Operation counter on front / Inside the RMU LT chamber	To be provided for each Circuit breaker, with minimum four digits & non resettable type
10.2	Cable charge status indication for all CB	Capacitor type voltage indicators with LED on all the phases (Shall be clearly visible in day light)
10.3	Spring charge status indication	On front for breaker
10.4	Earth switch closed indication (For Each CB)	On front
10.5	Circuit breaker On/OFF indication	Green for OFF / Red for ON
10.6	Circuit breaker protection relay operated on fault	Flag
10.7	Fault passage indication on CB	Flag
10.8	Status signals to SCADA-to be wired to marshalling terminal block	2NO + 2NC
10.8.1	CB close / open	potential free contacts
10.8.2	CB Disconnector Close/Open	Potential free contacts
10.8.3	CB Earth Switch close /open	potential free contacts
10.8.4	Auto trip	potential free contacts

10.8.5	Battery charger Fail	potential free contacts
10.8.6	Protection relay operated	potential free contacts
10.8.7	FPI operated (both E/F and S/C)	potential free contacts
10.8.8	SF6 gas pressure low	potential free contacts (Desirable)
	Spring Charge Status	Potential free contacts
10.8.9	Ready to close signal to control centre to indicate all interlocks are OK	Potential free contacts. Signal to indicate Ready for remote operation from Scada required for entire closing and entire tripping ckt. with all interlocks accounted for (Make : Gogate with P Card / Eqvt after approvals)
10.8.10	Local / Remote Switch (Motorized RMU only)	1. L/R switch is lockable type 2. A manual Local / Remote selector switch shall be provided for each breaker to disable all control outputs by breaking the power supply connection to the control outputs. 3. When in the "Local" position, the Local/ remote switch shall allow testing of all the control outputs of breaker without activating the control outputs to field devices. A status input indication shall be provided for the Local/ Remote switch to allow the SCADA system to monitor the position of the switch. 4. The status of Local/ Remote switch should be wired and configured in FRTU.
10.8.11	Battery charger 1 and 2	Potential Free contacts
10.8.12	Battery	Potential Free contacts
10.8.13	Battery Health Monitoring Unit	Required
10.8.14	Auxiliary Circuit Healthy	Potential free contacts
10.8.15	FRTU Door open	Potential Free Contacts
10.8.16	Interlock Card Operation fail	Potential Free Contacts
10.8.17	Command Acknowledgement	Potential free Contacts
10.9	Commands from SCADA- to be wired to marshalling terminal block	Cable feeder close / open
		Transformer feeder close / open
		FPI Reset
		Interlocking card reset
10.9	RS 485 MODBUS output of Protection relay/FPI	Required

11.0 Mimic diagram, labels & finish

11.1	Mimic	1. Mimic diagram (Shall not be accepted with Stickers) 2. On panel front with description of function & direction of operation of handles/buttons 3. The paint of Mimic shall be same as RMU external paint
11.2	Operating Instructions	Operating instruction chart and Do's & Don'ts in Hindi / local language to be displayed on left / front side of panel enclosure on anodized Al Sheet 16SWG, duly affixed on panel.
11.3	Name plate on panel front	Fixing by rivet only
11.3.1	Material	Anodized aluminum 16SWG / SS
11.3.2	Background	SATIN SILVER
11.3.3	Letters, diagram & border	Black
11.3.4	Process	Etching
11.3.5	Name plate details	1. Purchaser Name 2. Order no and Date 3. Month & year of manufacture, 4. Equipment type, input & output rating, 5. Guarantee period 6. SLD 7. CT rating 8. Aux PT rating 9. Manufacturer serial no. 10. Breaker operation at rated load, making operation and no load operation
11.4	Labels for meters & indications	The label shall be riveted and not pasted on the panel compartment door. Preferable the labels shall be engraved on the plate. Anodized aluminum with white character on black background OR 3 ply lamicoid
11.5	Danger plate on front & rear side	Anodized aluminum 16 SWG with white letters on red background
11.6	Painting surface preparation	Shot blasting or chemical 7 tank process for CRCA sheet
11.7	Painting external finish	Powder coated epoxy polyester base grade A, shade -RAL 7032, uniform thickness 60 micron minimum
11.8	Painting internal finish	Powder coated epoxy polyester base grade A, shade -white, uniform thickness 60 micron minimum

12.0 Approved makes

12.1	FRTU	ABB / Schneider/ Siemens/Phoenix
12.2	FPI(E/F & S/C)	EMG/Schneider/SIEMENS/C&S

12.3	Self Powered O/C & E/F Relay	Ashida ADR241S -761
12.4	Battery Charger	Allan/Gogate
12.5	Boots	3M/Raychem/KD joshi/Shine
12.6	Vacuum Interrupter	CG/ABB/Schneider/BEL
12.7	Modem (GSM 4G+)	Niseva/Lantronix/Pheonix
12.8	Terminals block	Connectwell/Wago/Phoenix/Elmex
12.9	CT and Aux PT	Narayan Power Tech (NPT)/Gilbert Maxwell, Pragati, Nortex
12.10	Interposing relay with freewheeling diode	ABB/Tyco/OEN
12.11	CBCT (Both for Earth fault and Over current protection)	EMG/Schneider/SIEMENS/C&S
12.12	Battery	HBL/Exide
12.13	Wire	Polycab/Havells/Finolex/KEI
12.14	AC & DC MCB	SIEMENS/Havells/C&S/ Schneider
12.15	Disconnecting type fuses	Connectwell/Wago/Phoenix/Elmex
12.16	Protocol converter	ABB/Tyco/OEN
12.17	DC power connector	Wago/Havells/Connectwell
12.18	Battery Health Monitoring Unit	GOGATE/Allan
12.19	Surge protector	Phoenix

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

13.0 Quality assurance

13.1	Vendor quality plan	To be submitted for purchaser approval
13.2	Inspection points in quality plan	To be mutually identified & agreed
13.3	Quality – Process Audits	BSES shall carryout vendor process audits.
13.4	Field quality plan	Bidder to submit field quality plan along with the bid
13.5	Maintenance manual	Bidder to submit maintenance manual along with the bid

14.0 Inspection & testing

14.1	Type test	1. Equipment of type tested quality only, including internal arc test on various compartments like cable

		chamber, SF6 gas tank etc.
		2. Type test certificate to be submitted along with offer for scrutiny.
		3. For motorized RMUs – Bidder to submit following test report for DC charger. a) temperature rise test b) voltage regulation test
		4. FRTU type tests as detailed in specification attached in Annexure H
14.2	Routine test	As per relevant Indian standard
14.3	Acceptance test	To be performed in presence of purchaser at manufacturer works. BSES may carry out integration of the FRTU/Modem and BSES SCADA during Inspection stage. OEM to carry out the configuration of both Modem and FRTU in this case to establish connection between FRTU and SCADA.SIM shall be provided by BSES
		1. Physical inspection & BOM, wiring check
		2. Insulation resistance test (Before & after HV test)
		3. HV test for one minute,
		4. Operation & interlock check
		5. Measurement of resistance of main circuit
		6. Voltage Indication check
		7. Functional testing of Fault passage Indicator for Alarm
		8. Primary current injection test for each circuit breaker feeder with relay
		9. Breaker closing & opening time measurement
		10. Functional test of FRTU
		11. Motor Operation
		12. Raw material docs verification

15.0 Shipping, Handling and Site support

15.1	Packing Protection	Against corrosion, dampness, heavy rains, breakage and vibration
15.2	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection & identification Label
15.3	Packing Identification Label (Anodized Aluminum Plate)	On each packing case, following details are required:
		1. Individual serial number
		2. Purchaser's name
		3. PO number (along with SAP item code, if any) & date
		4. Equipment Tag no. (if any)
		5. Destination

		6. Manufacturer / Supplier's name
		7. Address of Manufacturer / Supplier / it's agent
		8. Description (Configuration of RMU; e.g. 2CCB + 1 FCB, Motorized / Non Motorized, Extensible / Non Extensible) and Quantity must be prominently displayed at least 3 sides of packing box & on top.
		9. Country of origin
		10. Month & year of Manufacturing
		11. Case measurements
		12. Gross and net weights in kilograms
		13. All necessary slinging and stacking instructions
15.4	Shipping	The seller shall be responsible for all transit damage due to improper packing.
15.5	Handling and Storage	1. Manufacturer instruction shall be followed. 2. Detail handling & storage instruction sheet / manual to be furnished before commencement of supply.

16.0 Deviations

16.1	a) Deviations from this specification shall be listed separately by bidder clause wise (as mentioned in below) along with optional offer and has to submit the list along with bid./quotation. BSES will review the deviations and if BSES is agreed with the deviation, seller has to take written confirmation from BSES on deviation during tender evaluation. b) In the absence of any separate list of deviations from the bidder with bid as well as written confirmation from BSES on deviations, it will be assumed by the Buyer that the Seller complies with the Specification fully. c) Any deviations mentioned in any other submitted bid documents (i.e.in filled GTP, Catalog, BSES old approval, buyer's/seller's standards etc) by seller without separate deviation sheets will not consider as a deviation from this tech spec at any stage of contract.

Sl. No.	Document Name	Clause No.	Deviation	Reason	Merit to BSES

17.0 Drawings Submission

S.no	Documents to be submitted	With the bid	After Award	
			For Approval	Dispatch
1	Copy of specification along with company seal & signature on each page.	✓		
2	Detailed reference list of customers using the offered product during the last 5 years with similar design and rating	✓		
3	GA / cross sectional drawing of product showing all the views / sections	✓	✓	
4	Manufacturer's quality assurance plan and certification for quality standards	✓	✓	
5	Type test reports for the type, size & rating of product / equipment offered	✓	✓	
6	Complete product catalogue and Manual.	✓	✓	
7	Recommended spare parts and consumable items for five years of operation and spare parts catalogue with price list	✓	✓	
8	BOM	✓	✓	
9	Schematic and wiring drawings for all components		✓	
10	Terminal arrangement & cable box details including gland plate arrangement etc		✓	
11	Quality Assurance plan	✓	✓	
12	Recommended spare parts and consumable items for five years of operation and spare parts catalogue with price list	✓	✓	
13	Detailed installation and commissioning instructions			✓
14	Battery and battery charger sizing calculations			✓
15	Detailed loading drawing to enable the buyer to design and construct foundations		✓	
16	Transport / Shipping dimensions with weights, wheel base details, un tanking height		✓	

S.no	Documents to be submitted	With the bid	After Award	
			For Approval	Dispatch
17	Deviation Sheet (if any)	✓	✓	
18	Inspection and test reports, carried out in manufacturer's works			✓
19	Test certificates of all bought out items			✓
20	Operation and maintenance Instruction as well as trouble shooting charts/ manuals			✓
21	As built Drawings (one set) along with each RMU hard copy			✓
22	As built Drawings soft copy			✓
23	IO termination chart shall be provided along with the schematic drawing for approval. IO Termination chart shall be provided on the inside of FRTU Compartment door.			✓
24	The FRTU and modem Configuration file for every FRTU shall be shared with BSES after successful on-site integration with SCADA			✓
25	FRTU and modem licensed software to be provided to BSES. Any future software upgrades and support to be provided to BSES without any cost implication till warranty period.			✓

18.0 Equipment ID

13.1	Equipment ID	a) A Slot shall be provided on the Compartment door at a clearly readable height from the base level of FRTU compartment. This slot shall be provided with a Fibre card which shall be accessible from inside only but shall be visible outside. Equipment ID shall be painted/printed on the Fibre Cardand b) Equipment ID shall be painted on any appropriate face of RMU at a clearly readable height from the base level. Front recommended type face for the signage is True type or Post script c) Font Size: All painting should be in UPPERCASE. Recommended height of 50 mm with spacing between alphabets of 3 mm.

		d) Total No's of Character: 18 e) Height of Font: 50 mm f) Height of Base: 100 mm g) Spacing between alphabets: : 3 mm h) Paint: Base coat – Dense Yellow. Letters – Black Quick Drying paint 2 coats. i) Equipment ID shall be separately provided by BSES j) Equipment ID painting shall complete at factory by seller on each and every motorized RMU before dispatch.

Annexure A Scope of supply

1.0 The scope of supply shall include following

1.1 Design, manufacture, testing at manufacturer works before dispatch, packing, delivery and submission of all documentation the 11kV Ring Main Unit (RMU).

1.2 11kV RMU shall be as per scheme enclosed as Annexure E.

1.3 FRTU along with necessary software's and hardware shall be provided as per detailed specification in Annexure H

1.4 Supply of dual SIM Modem (Auto change over, 4G/5G and GSM) for FRTU communication with MCC/BCC as per specification in Annexure G. SIM card shall be provided by BSES.

1.5 Battery, Battery Charger and BHMU

1.6 Configuration of 11kV RMU shall be as per Purchase Requisition.

1.7 Testing & commissioning supervision of all motorized RMUs at site included in the scope of vendor including all operational checks, LV wiring checks, battery / charger checks, VPI , FPI, self powered relay. Supervision of testing & commissioning of all the panels at site. Vendor shall depute the service team with 2 days prior notice from owner.

1.8 FRTU customization, parameterization along with integration of FRTU with Control centre has to be carried out at all sites by bidder and OEM engineer.

1.9 Guarantee Period for RMU along with all hardware installed inside the FRTU cabinet: 66 months from the date of supply or 60 months from date of commissioning, whichever is earlier.

1.10 Service Performance Requirements During Guarantee Period:

a) RMU including battery charger: Complaint to be attended on urgent basis and to be resolved within 24 hrs, 1 day from intimation. Adequate quantity of necessary spare should be maintain by bidder service team at Delhi till completion of guarantee period.

b) FRTU: After reporting of FRTU modules compliant / failure, within 24 hours FRTU modules shall be replaced by vendor at site. Adequate quantity of necessary spare should be maintain by bidder service team at Delhi till completion of guarantee period.

c) Modem: After reporting of Modem compliant / failure, within 24 hours Modem should be rectified / replaced by bidder service team at site. Adequate

quantity of necessary spare should be maintain by bidder service team at Delhi till completion of guarantee period.

1.11 Each RMU shall be supplied with 2 sets of Operating Handle.

1.12 All the accessories mentioned above shall be supplied along with RMU's as a composite unit. Inside the composite unit, battery and battery charger shall be inbuilt inside RMU compartment and FRTU, modem shall be inbuilt inside LV compartment.

1.13 Supplier scope includes training of BSES team – 4 batches (each batch with 4-6 engineers or team member as per BSES requirement.) for minimum 3 days each at factory as well as at BSES site for erection, testing commissioning and maintenance trouble shooting mechanism of Motorized RMU including Automation part. This shall be carried out 1 week from date of 1st shipment/ dispatch. Supplier shall also provide training for Self Powered relay & FRTU at respective manufacturer' factory as well as at BSES site for minimum 3 days for BSES team – 4 batches (each batch with 4-6 engineers or team member as per BSES requirement.) . This is applicable for each and every P.O. of Motorized RMU's.

1.14 Unit price for Conversion kit should be offered separately for converting the RMU from single cable termination design to double cable termination design, at site.

1.15 BOQ as following –

Sr No	Purchaser Equipment Tag No / SAP code	RMU standard configuration Type	Unit	Quantity
1		*Example – Type A2*	No	*e.g. 1*
2		*Example – Type R5*		
3				
4				

2.0 Submission of documents

	Along with offer	For Approval after award of contract	Final after approval
Documents as given in clause no 17 of specification	3 copies + 1 soft copy in USB	4 copies + 1soft copy in USB	6 copies + 1 soft copy in USB for all type of documents

3.0 Delivery schedule

3.1	Delivery period start date	-	from date of purchase order
3.2	Delivery period end date	-	as agreed with supplier
3.3	Material dispatch clearance	-	after inspection by purchaser

Annexure B Technical particulars (Data by purchaser)

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

Annexure C Guaranteed Technical Particulars (Data by Supplier)

a. Bidder shall furnish the GTP format with all details against each clause.
b. Bidder shall not change the format of GTP or clause description.
c. Deviation sheets shall be submitted separately along with company seal and sign. Deviation mentioned in submitted GTP or any other documents except deviation sheet shall not be considered as a deviation.

Sr. No.	Description	Data to be filled by Manufacturer
1	11kv RMU (as per scope of supply annexure A)	Separate GTP to be filled for each type of RMU
2	Equipment make	
	Equipment type / brand name	
3	Conformance to design standards as per specification clause no 2.0 –	Yes/No
4	Conformance to specification clause no 3.0 to 17.0 –	Yes/No
5	If NO for pt 3 or pt 4 above, Submission of deviation sheet for each specification clause no –	Yes/No
6	Panel overall dimensions in mm	
6.1	Width (measured from front)	
6.2	Depth	
6.3	height	
7	Panel weight in kg	
8	Panel extensible on both sides – Yes / No	
9	Panel enclosure protection offered	
10	Panel tested for internal arc (Cable & other compartments) –Yes / No	
11	Heat generated by the panel in Kw	
12	Insulation level for complete panel	
12.1	Impulse withstand (Kv peak) -70kvp min	
12.2	Power frequency withstand (Kv rms) – 28kv min	
13	Bus bar	
13.1	Material & grade	
13.2	Bus bar cross section area in sq mm	
13.3	Bus bar rated current in amp i) at designed 40 deg.C ambient	

Sr. No.	Description	Data to be filled by Manufacturer
	ii) at 50 deg.C ambient	
13.4	Max temperature rise above reference ambient of 50 deg C	
13.5	Short time current withstand capacity for 3 seconds (in KA)	
13.6	Bus bar clearances in mm P-P / P-E	
13.7	Bus bar with insulation sleeve / barriers	
13.8	Bus bar support insulator type	
13.9	Bus bar support insulator voltage class	
13.10	Bus bar support insulator minimum creepage distance / mm	
13.11	Earth bus bar material	
13.12	Earth bus bar size	
13.13	**Cable compartment**	
13.13.1	C-C distance between bushings	
13.13.2	Phase to Phase Clearance (Min)	
13.13.3	Phase to Earth (Min) Clearance	
13.13.4	Impulse Withstand Voltage of design tested	
13.13.5	IAC level – Cable compartment / RMU Tank	
14	**Circuit breaker type – VCB**	
14.1	Rated voltage & frequency	
14.2	Rated current in amp	
14.3	Rated breaking current – KA rms symmetrical	
14.4	Short time withstand capacity in KA for 3 sec	
14.5	Rated making current - KA peak	
14.6	Breaker total opening time at rated breaking capacity (in milliseconds)	
14.7	Number of breaks per pole	
14.8	Total length of contact travel in mm	
14.9	No of circuit breaker operation cycles (close & open) guaranteed at rated current, Electrical endurance class	25% rated current -
		50% rated current -
		75% rated current -
		100% rated current -

Sr. No.	Description	Data to be filled by Manufacturer
14.10	No of breaker opening operations guaranteed at rated fault current, Electrical Endurance Class	
14.11	No of breaker mechanical operation cycles (close & open) guaranteed at zero current , Mechanical endurance class	
14.12	Contact material	
14.13	Operating mechanism – trip free	
14.14	Motorized/Manual Spring charge type	
14.14.1	Spring charging motor rating - Watt	
14.14.2	Spring charging motor rated DC voltage	
14.14.3	Closing coil wattage & rated DC voltage	
14.14.4	Trip coil wattage & rated DC voltage	
14.14.5	Operating motor voltage with acceptable % variation	
14.15	Minimum permissible SF6 gas pressure (For SF6 type RMU only)	
14.16.1	Capacitor type cable voltage indication provided?	Yes / No
14.16.2	Voltage Presence Indicator- Make / Model	
14.17	Operation counter provided	Yes/ No
15.1	Disconnect switch continuous rating (Amp)	
15.2	Disconnect switch Short time withstand rating -20kA for 3 sec minimum	Yes / No
16	Earth Switch	
16.1	Minimum number of operations at no load- Mechanical Endurance class	
16.2	Making capacity endurance of earth switch – Electrical endurance class	
17	Self Powered Relay – Make / Model	
17.1	CT Input	
17.2	IDMT Setting Range 4 element – Over Current & Earth fault & steps	Overcurrent- Earth Fault- Instantaneous O/C- Instantaneous E/F-
17.3	Operating Time	Over Current – Curves Instantaneous

Sr. No.	Description	Data to be filled by Manufacturer
17.4	Pick up Current	
17.5	Resetting Current	
17.6	Relay Burden	
17.7	Time Accuracy	
17.8	Tripping Coil O/P – type & duration	
17.9	Fault Current Display	
17.10	No of Fault Current Latching with time stamping	
17.11	Display Facility / Type	
17.12	Operational Indicators	
17.13	Potential Free Output Contacts	
17.14	Thermal Withstand Capacity of Relay	
18	Current Transformer- Make	
18.1	Ratio	
18.2	Burden	
18.3	Accuracy Class	
19	Fault Passage Indicator (shall be for both earth fault and over current protection)	
19.1	CBCT	
19.1.1	Type	
19.1.2	Mounting Arrangement	
19.1.3	CT to indicator connection	
19.1.4	ID of sensor	
19.2	Earth Fault/Short Circuit Indicator make	Make / Model
19.2.1	Sensing Current (i) Earth Fault (ii) Short Ckt Indicator	
19.2.2	Sensing Time (i) Earth Fault (ii) Short Ckt Indicator	
19.2.3	Indication	
19.2.4	Reset Time (i) Earth Fault (ii) Short Ckt Indicator	
19.2.5	Resetting Facility	
19.2.6	Output Contact	

Sr. No.	Description	Data to be filled by Manufacturer
19.2.7	Contact Rating	
19.2.8	Aux Power Supply	
19.2.9	Degree of Protection	
19.2.10	Mounting Arrangement	
19.2.11	Ambient Temperature	
20	**DC charger rating in amps – min 10 Amp Dual**	Yes/No
20.1	MCB rating at 230V AC input of charger	Amp
20.2	MCB rating at 24V DC output of charger	Amp
20.3	Charger heat sink temperature rise (max 55 deg C above ambient 40 deg C)	
20.4	Voltage variation in 24V Dc output for FRTU	(Max +/-1 V)
20.4.5	Charger with natural cooling (no cooling fans)	Yes/No
20.4.6	Charger tested for input supply voltage regulation test (input variation 150V-250V, output Dc voltage variation +/- 1 volt max)	Yes/No
20.4.7	Charger temperature rise test certificate submitted	Yes/No
20.5	DC battery rating in Ah – 26Ah (mini) OR as approved battery sizing during detail engineering, whichever is higher.	Yes/No
20.6	DC charger changeover – Diode rating 10A min OR as approved during detail engineering whichever is higher.	Yes/No
21.1	Cable termination – Height of power terminal from gland plate	mm
21.2	Torque required for tightening terminal lug	
22	Mimic diagram, labels & finish as per cl no 11	Yes / No
23	Submission of RMU / component catalogue	Yes/No
24	Unit price for Conversion kit offered separately for converting the RMU from single cable termination design to double cable termination design	Yes / No
25	**FRTU**	
25.1	Make & Model No	
25.2	No of DI Modules	

Sr. No.	Description	Data to be filled by Manufacturer
25.3	No of DO Modules	
25.4	No of AI Modules	
25.5	Make of Protocol converter	
25.6	Modem	Ethernet Type
25.6.1	Type – Dual SIM 4G/5G and compatible to 3G & 2G Refer Modem Specifications	Yes / No
25.6.2	Make	
25.6.3	Serial port Isolator provided	Yes / No
25.7	Interposing Relay with freewheeling diode	
25.7.1	Make	
25.7.2	Rating	
25.7.3	Model No	
25.8	Terminal Blocks, Disconnecting type	
25.9	MCB make	
26	Surge Protection devices required for	
26.1	Each Serial Ports	
26.1.1	Quantity	
26.1.2	Make and Model	
26.2	Each RJ pot	
26.2.1	Quantity	
26.2.2	Make and Model	
26.3	Charger Output	
26.3.1	Quantity	
26.3.2	Make and Model	

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

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

Annexure D Mandatory Spares and Recommended spares

1.0 Mandatory Spares (To be supplied with RMU supply)

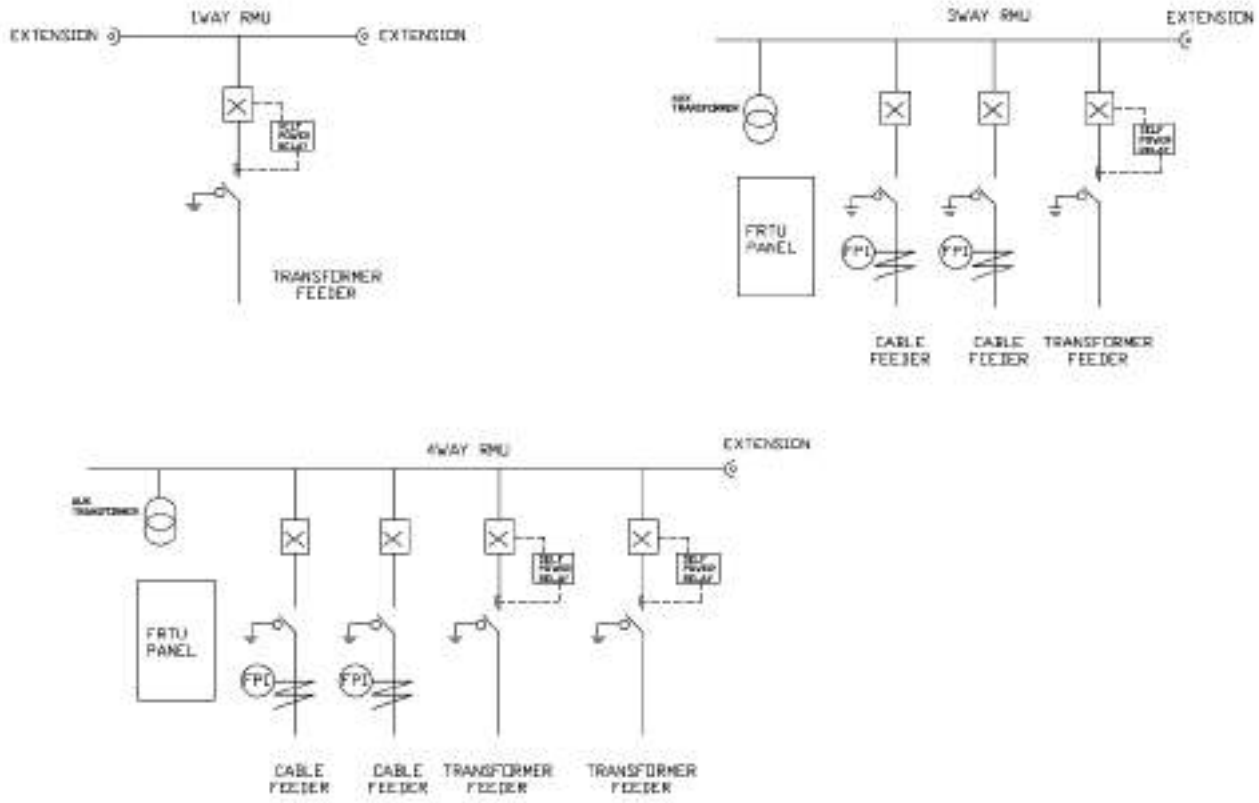
Sr No	Description of spare part	Unit	Quantity
1	FRTU (with DI/DO/AI cards)	Nos	Minimum 2 no's of Each type or 5% whichever is higher
2	Modem	Nos	Minimum 2 no's or 5% whichever is higher
3	High gain Antenna	Nos	5
4	Single Phase Transformer as per tender requirement	Nos	1
5	HRC Fuses for Aux Transformer	Nos	20
6	Auxiliary relays	Nos	Minimum 10 no's or 5% whichever is higher
7	Interlock card	Nos	Minimum 2 no's or 5% whichever is higher
8	Motor kit of each type	Nos	Minimum 2 no's or 5% whichever is higher
9	Battery Charger	Nos	Minimum 2 no's or 5% whichever is higher
10	SPD (each type)	Nos	Minimum 2 no's or 10% whichever is higher
11	BHMU Module	Nos	Minimum 2 no's or 5% whichever is higher

2.0 List of recommended spares as following

Sr No	Description of spare part	Unit	Quantity
1	FPI	Nos	limited to 10% of order quantity of RMU
2	VPIS	Nos	limited to 10% of order quantity of RMU
3	Manometer with pressure indicator switch	Nos	limited to 10% of order quantity of RMU
4	Self Powered Relay	Nos	limited to 10% of order quantity of RMU
5	Aux Switches	Nos	limited to 10% of order quantity of RMU
6	CPU with Power Supply Card, I/O Adapter Board, rack,relay board etc	Nos	limited to 10% of order quantity of RMU
7	Battery	Nos	limited to 10% of order quantity of RMU

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

Annexure E Typical scheme of RMU



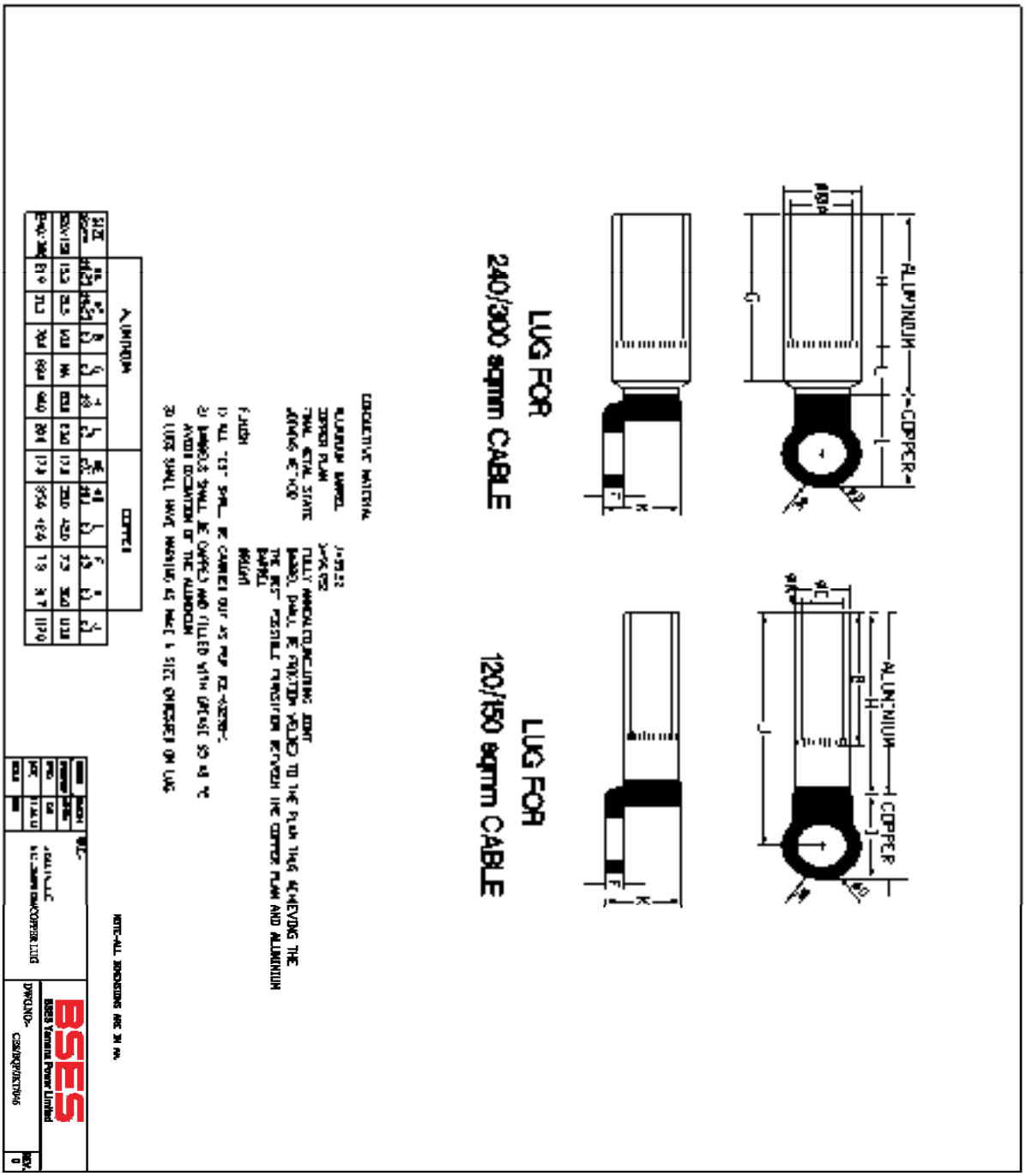
a) 11kV RMU shall have Feeder Circuit breaker (FCB) and Transformer circuit breakers (TCB) all are motorized

c) 1Way RMU is extensible on both sides and 3Way 4Way RMU shall be suitable for extension on one sides for addition of TCB or FCB.

d) Self Power relay is provided for transformer circuit breaker feeder.

e) Fault passage indicator (FPI) including associated CT & connecting cable is shown by letter 'FPI'.

Annexure F Drawing of Bimetallic Ring Type Lug



Annexure G Specification of 4G Ethernet Modem for FRTU

1. **Module:** 4G Dual SIM with compatible 3G /GSM GPRS
   a) FDD LTE: B1 (1920-1980/2110-2170) / B3 (1710-1785/1805-1880) / B8 (880-915/925-960) / B20 (800) MHz
   b) TDD LTE: B38 (2570-2620) / B39 (1880-1920) / B40 (2300-2400) / B41 (2496-2690)
   c) HSPA / UMTS: B1 (2100) / B8 (900) /800/850/1900 MHz
   d) GSM: 900/1800/ MHZ Class 10

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

3. Modem shall be compatible with IPv4 & IPv6 scheme

4. Console Interface: RS232 on RJ45 connector.

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

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

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

8. Support for NAT and Port forwarding.

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

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

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

12. SIM Interface: External with locking provision.

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

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

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

16. Connectors: RJ45 Ethernet Port, SIM Card Holder, DC power connector, SMA Antenna connector

17. Power Supply: 24V DC (with reverse current protection) with 2 numbers Terminal Block without adapter. Modem functionality shall not affect during DC voltage supply range of 18 to 30V DC.

18. Enclosure: Metallic Extrusion

19. Mounting: DIN Rail Mounting

20. Temperature: Operating (-10 to 70 Degree Centigrade), 95% Humidity

21. Antenna: 12dB High Gain Antenna with SMA connector. 15mtr wire length to be provided with the High Gain Antenna.

22. Accessories:

    a) 1 Meter cable for connecting to external DC power source (24 V)
    b) 1 Meter Standard Ethernet (Straight) data cable
    c) Standard Console cable for diagnostic port of Modem
    d) 1 Meter serial cable for dialing modem from FRTU

23. Certification:

    a) Conducted Immunity : IEC61000-4-6
    Measure emission of the device (referenced to earth) on power mains and to compare them with specified limits to ascertain that the device will not disturb other equipments
    Frequency : 0.15MHz to 80MHz
    Modulation : 80% AM at 1 KHz
    Test Voltage : 3V

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

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

24. Warranty period: 5 years

Annexure H Specification For Feeder Remote Terminal Unit For RMU

1.0.0 Scope of Supply & Work

This document defines the scope of supply, including spares and scope of work of installation, testing & commissioning including interfacing/ integration with RMU and owners SCADA system for acquisition of real time status and control functions associated with the same.

1.0.1 Scope of Supply

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

1.0.2 Scope of Work

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

1.1.0 Applicable Standards

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

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

1.2.0 Technical Requirements

1.2.1 FRTU Functionalities:

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

a) It should be capable of handling minimum 250 DP(data point) respectively.
b) FRTU shall have serial port, configurable RS485/RS232 for MODBUS serial and IEC 103 protocol communication.
c) FRTU shall have TCP/IP port for Modbus TCP/IP and IEC 61850 communication.
d) Ethernet ports for interfacing with IEC 60870-5-104 protocol to communicate with MCC and BCC.
e) Ethernet port should be configured for IEC 60870-5-104 protocol as a slave.
f) Built in optical couplers to isolate the field signals and field communication channels.
g) FRTU shall support event storage capacity as measured events (500), system events (50), alarms (50) and normal events (250). Events should be stored on the basis of FIFO.
h) Local viewing of all events shall be possible.
i) FRTU DI/ DO and AI communication channel capacity should be such that it can fulfill automation of complete substation system.
j) FRTU shall support web based monitoring from remote as well as local.
k) All DI/ DO and AI communication channels should have individual LED indications.
l) FRTU shall support feature of remote configuration as well as diagnosis.
m) FRTU system shall support communication with 4 Nos. master stations simultaneously.
n) All DI/DO/AI communication card installed in FRTU shall support HOT swap feature.
o) As the SCADA/ DMS system will use public domain such as RF/ GPRS etc., therefore it is mandatory to guard the data/ equipment from intrusion/ damage/ breach of security & shall have SSL VPN based security.
p) FRTU shall support SNMP (Simple Network Management Protocol).
q) Capability of time synchronization with GPS receiver and SCADA MCC/ BCC.
r) FRTU system should be modular and expandable.
s) FRTU should be capable to store the configuration program in detachable flash memory card.
t) FRTU shall have console port with console cable.

1.2.2 CPU Module:

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

1.2.3 Communication Ports:

a) FRTU shall have the following port for communications

S. No	Communication With	Communication Protocol	Physical Layer		Connecting Cable	Required Qty
			Interface	Physical		

				Port		
1	Master station(s)	IEC 60870-5-104	Ethernet	RJ45	CAT VI	1
2	LT panel/ Transformer	IEC 61850	Ethernet	RJ45	CAT VI	1
3	Local Configuration	_	RS232	USB/DB9	Console Cable	1
4	Protection relays	IEC 103	RS485	Terminal Block	Shielded RS485 Twisted Copper Cable	1
5	MFM/FPI	MODBUS	RS485	Terminal Block	Shielded RS485 Twisted Copper Cable	1
6	LT panel/Transformer	MODBUS	RS485	Terminal Block	Shielded RS485 Twisted Copper Cable	1
Total						6

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

1.2.4 MCC/ BCC Communication Protocol:

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

1.2.5 Communication between FRTU, MFMs and Protection Relays:

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

1.2.7 Digital Input Module:

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

1.2.8 Digital Output Module:

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

1.2.9 Analog Module:

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

1.2.10 Interfacing of FRTU system with RMU

a) RMU signal connections should be terminated in RMU bay wise and extension of the signals from the each equipment TB (Terminal Block) to FRTU TB through cable connectors, bay wise.

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

1.2.11 Troubleshooting:

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

1.2.12 Programmable Logic Control (PLC):

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

1.2.13 Cyber Security:

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

FRTU should have following features:
a) User level configuration
b) User wise authentication like system admin, configuration admin, control, operator.
c) Disabling the DNS
d) Disabling, enabling & configuration of TCP/ IP and UDP ports.
e) Door lock alarm integration with FRTU.

1.3.0 General Construction of Enclosure:

a) FRTU system housed in suitably sized panel, fabricate steel plate with mini 2mm thick frame and 2.0 mm thick CRCA sheet with seven tank process for indoor and for outdoor of protection mini IP 54 with safety lock of good quality. The cabinet

shall have adequate space for installation of other hardware's like modem, battery charger and battery as well as shall have at least 10% spare space.

b) It is suitable class of IP 54 protection as per indoor and outdoor applications.
c) Enclosure fabricated with double door, swing frame type with proper pad lock arrangement to avert the theft of the equipment fitted inside.
d) The component and accessories to be mounted on mounting plate of FRTU.
e) Enclosure should have proper illumination, universal type socket and laptop stand and Drawing pocket.

1.4.0 FRTU Power Supply

a) Power supply for FRTU shall be on 24V DC system which would be made wired from Battery Charger/batteries housed in FRTU cabinet.
b) The main DC circuits shall be protected by incoming circuit breakers. Each circuit shall be tapped through single pole MCBs so as to provide an individual DC feed to each of the I/O modules, modems and protocol converters. Contractor shall provide maximum power consumption data of each of the type of FRTU. To protect the batteries from the theft the battery in RMU compartment should have separate pad lock arrangement.
c) Power supply system should have redundant battery charger to provide the supply to FRTU system as well as to charge the battery.
d) Type 3 Pluggable Surge Protection Device in accordance with IEC 61643 with KEMA & UL approval must be installed at the incoming power supply of FRTU. DIN Rail Mounted Suitable Surge Protection must be installed on all communication lines (i.e on Ethernet/RS 485 lines)

1.5.0 FRTU Type and Routine Tests

1.5.1 Type Tests

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

a) Dielectric test
b) Impulse voltage withstand test
c) High frequency disturbance test
d) Thermal requirement test
e) Mechanical requirement test
f) Limiting dynamic value test
g) Contact performance test
h) Electromagnetic radiation susceptibility test
i) Electrostatic discharge susceptibility test

1.5.2 Routine Tests

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

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

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

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

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

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

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

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

1.5.3 SAT

This document exclusively covers the SAT for FRTU system.

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

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

SAT will include the validation of the following:

1. Network
2. FRTU availability and operational efficacy
3. Validation of SOE
4. Indication, Command and Measured data

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

1.6.0 Spares, Accessories & Tools:

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

1.7.0 Software / Firmware

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

1.7.1 General

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

1.7.2 Diagnostic Software

Software shall be provided to continuously monitor operation of the FRTU and report FRTU hardware errors to the SCADA/DMS. The software shall check for memory, processor, and input/output errors and failures. It is desirable that internal diagnostics be sufficiently detailed to detect malfunctions to the level of the smallest replaceable component.
The FRTU shall facilitate isolation and correction of all failures and shall include features that promote rapid fault isolation and component replacement. All functional module nodes shall

be designed with integrated on-line diagnostic functions. The results of these diagnostics shall be reported to the central processing module. The central module shall store this information and report it to the SCADA/DMS as permitted by the protocol. FRTU shall be able to access from remote (BCC/MCC) for down loading configuration.

1.8.0 Service Life and Warranty Support

Service Life:

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

The supplier shall provide a service support letter containing:

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

1.9.0 Trainings & Hands-on

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

1.9.1 FRTU System Hardware Course

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

a) System hardware design architecture overview: Configuration of the system hardware.

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

1.9.2 FRTU System Software Course

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

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

1.9.3 FRTU Application Software Course

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

a) Overview: Block diagrams of the application software and data flows. Programming standards and program Interface conventions.
b) Application Functions: Functional capabilities, design and major algorithm. Associated maintenance and expansion techniques.

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

1.9.4 Requirement of Training

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

Name of Course:

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

1.10.0 Drawings & Documents

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

a) FRTU function design document
b) FRTU hardware description document & all the documents referred there in to meet all the clauses of the specification.
c) FRTU Test equipment user documents
d) FRTU user guide
e) FRTU Operation & Maintenance document
f) FRTU training documentation
g) FRTU database document
h) FRTU I/O list (as build) after the execution
i) FRTU Test procedures
j) Data Requirement Sheet (DRS) of all items
k) Protocol documentation including implementation profile etc.
l) FRTU installation and layout, GA, BOQ, schematics and internal wiring drawings for each FRTU site

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

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

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

1.11.0 FRTU DI/DO/AI list

RMU configuration	FRTU DI/DO/AI requirement		
	Digital Input Channels	Digital Output Channels	Analogue Channels
3Way & 4Way RMU	48	16	6
5Way	64	32	6
6Way	80	40	6

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

Signals List for Motorized RMU						
Digital Inputs	Equipments	Signals	DI for 3Way		DI for 4Way	
	Cable Circuit Breaker	CBON	DI1, DI2	2	DI1, DI2	2
		CBOFF	DI3, DI4	2	DI3, DI4	2
		Disconnector Open	DI5, DI6	2	DI5, DI6	2
		Disconnector Close	DI7, DI8	2	DI7, DI8	2
		Earth Status	DI9, DI10	2	DI9, DI10	2
		FPI operated (E/F)	DI11, DI12	2	DI11, DI12	2

		FPI Operated (S/C)	DI13,DI14	2	DI13, DI14	2
		Local/Remote	DI15, DI16	2	DI15, DI16	2
		VPIS Status	DI17, DI18	2	DI17, DI18	2
	Circuit Breaker	CB ON	DI19	1	DI19, DI20	2
		CB OFF	DI20	1	DI21, DI22	2
		Disconnector Open	DI21	1	DI23, DI24	2
		Disconnector Close	DI22	1	DI25, DI26	2
		Earth Status	DI23	1	DI27, DI28	2
		Ready to Close Signal to control centre to indicate all interlocks are OK (including spring charge and trip ckt healthy)	DI24	1	DI29, DI30	2
		Auto Trip	DI25	1	DI31, DI32	2
		Local/Remote	DI26	1	DI33, DI34	2
		SF6 Low	DI27	1	DI35	1
		VPIS Status	DI28	1	DI36, DI37	2
	Common Signals	AC Fail	DI29	1	DI38	1
		Battery Charger-1 Fail	DI30	1	DI39	1
		Battery Charger-2 Fail	DI31	1	DI40	1
		Command Acknowledgement	DI32	1	DI41	1
		Battery Health Monitoring Unit/Battery in Trouble	DI33	1	DI42	1
		FRTU Door Open	DI34	1	DI43	1
		Interlock Card operation Fail	---	0	---	0
		Auxiliary Circuit Healthy (Control Ckt healthy)	DI35	1	DI44	1
		MOG Alarm from field	DI36	1	DI45	1
		WTI Alarm from field	DI37	1	DI46	1
	APFC	APFC Incomer MCCB Trip	DI38	1	DI47	1
		APFC Fan MCCB Trip+Other common alarm	DI39	1	DI48	1
			Total	39	Total	48
	Spare DI			**9**		**0**
	TOTAL			**48**		**48**

Signals List for Motorized RMU

	Signals	DO for 3 way		DO for 4Way	
Digital Outputs	Cable CBON	DO1, DO2	2	DO1, DO2	2
	Cable CBOFF	DO3, DO4	2	DO3, DO4	2
	FPI Reset	DO5, DO6	2	DO5, DO6	2

	Transformer CB ON	DO7	1	DO7, DO8	2
	Transformer CB OFF	DO8	1	DO9, DO10	2
	Interlock card remote reset	DO9	1	DO11	1
	Modem interlock card remote reset	DO10	1	DO12	1
	Modem Remote Reboot	DO11	1	DO13	1
	FRTU Remote Reboot	DO12	1	DO14	1
	Auto Trip Reset	DO13	1	DO15, DO16	2
		total	**13**	total	**16**
Spare DO		DO14-DO16	3	DO16	0

Analog Inputs	LT Palm Temp	AI1
	Oil Temp of Trf.	AI2
	Oil Level	AI3
	Spare	AI4 to AI6

Serial Port	DT Energy Meter Data	SP1
	Relay and FPIs of RMU (Both relays and FPIs to be connected to FRTU through daisy chain)	SP2
	LT ACB/field Data	SP3

1.12.0 Guaranteed Technical Documents

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

Sr. No.	Description	Buyer's Requirement	Vendors Data
1	Vendors Name		
2	Guarantee period	5 yrs	
3	Make of FRTU base module		
4	No. of DI modules	3 x 16	
5	No. of DO modules	2 x 8	
6	No. of AI modules	1x 6	
7	Dimensions & Weight of FRTU	Vendor shall provide	
8	Dimensions of FRTU panel	Vendor shall Provide	
9	Make of protocol converter	Vendor shall provide	

10	Interposing relay with freewheeling diode		
10.1	Make	ABB / SCHNEIDER/SIEMENS	
10.2	Capacity	>8 A	
10.3	Model	CR-P with 2C/O contacts / Eqv	
11	AC & DC MCB	Merlin & Gerin / Protec / Indokopp	
12	Terminal Blocks	Elmex / Connectwell / Phoenix	
13	Disconnecting type fuses	Elmex / Connectwell / Phoenix	
14	Enclosure		
14.1	Indoor		
14.1.1	Sheet steel thickness	Mini 2 mm	
14.1.2	Painting process	7 tank	
14.2	Outdoor		
14.2.1	Galvanized sheet (120GSM min)	Mini 2 mm	
14.2.2	Powder Coating	80 Microns	
14.3	Construction of steel according to IEC 529 , index of protection	IP55	
14.4	Shade	RAL-7035	
14.5	Louvers with filters	2 Nos	

Annexure 'I' 11 kV Metering Cubicle

1.0 General Requirement

1	Panel Type	Outdoor, Metal enclosed, framed, Compartmentalized panel construction
2	Service Location	Outdoor
3	Mounting	Free Standing
4	Overall Enclosure Protection	IP 54 Minimum (Complete unit i.e. RMU coupled to Metering unit shall be IP54)
5	Panel Fabrication	The metering cubicle shall be fabricated with 2.0mm CRC sheet. Load bearing members and high voltage compartments shall be 3.0 mm. The panel shall be vermin proof and totally enclosed. CT/PT compartment shall be fabricated after bending the M.S. Sheets on three sides and fourth side shall be welded to make the complete assembly tamper proof. Pressure release device/ explosion vent should be provided on the CT PT compartment at the rear side.
6	Compartmentalized panel construction	The panel shall have four separate compartments. All the compartments shall be completely segregated from each other. 1. Meter Compartment 2. CT- PT compartment 3. Incoming 4. Outgoing
7	Meter Compartment	The Upper compartment i.e. the "meter compartment" shall be suitable for housing 3 phase 4 wire Energy Meter (energy meter not in bidder's scope of supply) and associated wiring.
7.1	Double door	1. Double door arrangement as front and back door to meet IP54 requirement. Both the doors should have 02 no's concealed type (Anti Theft) hinges. 2. Front door should have at least 01 no's padlocking and 02 no's sealing arrangements.

7.2	Meter reading Window	Provided on front and back door to enable the meter reader to perform inspection of meter compartment and note down the reading of meter. 1. Front Door: window of size 350 (W) X 300 (H) mm approximately with colour-less transparent acrylic sheet and wire mesh welded from inside. 2. Back door: window of size 350 (W) X 300 (H) mm approximately with colour-less transparent acrylic sheet.			
7.3	Data Downloading slot	Slot to facilitate installation of data downloading cable with DB9 serial connector. 1. Front door: Slot of size 25mm X10 mm (+/- 2 mm) should be provided on front door with sealable cover. 2. Back door: Slot of size 30 mm X 50 mm shall be provided to facilitate installation of data downloading cable.			
7.4	Meter hanging arrangement	The meter compartment shall contain hanger arrangement of slotted angle for mounting meter so that meter can be adjusted vertically and horizontally. Two horizontal and two vertical slotted channels should be provided for the same.			
8	CT PT Compartment	The CT/PT compartment shall be completed welded type and house the 11 KV dry type current transformers (3 no's) and 3 phase dry type potential transformer.			
8.1	Current Transformers	The metering current transformers shall be suitable for 11 KV; 50Hz effectively earthed neutral system. The CT shall be single core, epoxy resin cast, copper wound primary type with rated burden 5VA and accuracy class 0.5s or better conforming to IS:2705 (Part-I&II). Instrument security factor shall be less than or equal to 10. CTs should have solid copper bus bar type primary terminals for connection with main busbar/bushing terminal. Secondary terminals of CTs should be made of copper or brass.			
8.2	STC of CT	SL	CT ratio	Short time rating	Size of main Bus bar
		1	15 / 5 A	6 KA for 1 sec.	30 x 4 sqmm
		2	30 / 5 A	6 KA for 1 sec.	30 x 4 sqmm
		3	60 / 5 A	18KA for 1 seconds	30 x 4 sqmm
		4	100 / 5A	18KA for 1 seconds	30 x 4 sqmm
		5	150 / 5 A	18KA for 1 seconds	30 x 4 sqmm

		6	300 / 5 A	18KA for 1 seconds	40 x 6 sqmm
		7	400 / 5 A	21KA for 1 seconds	40 x 6 sqmm
8.3	Potential Transformer	The Potential Transformer shall be dry type Epoxy resin cast, Copper wound suitable for 3 phase 11KV, 50Hz effectively earthed neutral system. The PT shall be connected in star to have ratio 11KV/√3 / 110/√3 V with rated burden of 10VA per phase and accuracy class 0.5 or better conforming to IS:3156 (Part I & II). Primary terminal of PT should be of copper. Secondary terminals of PT should be made of copper or brass.			
8.4	Pressure release device	Pressure release device/ explosion vent should be provided on the CT PT compartment at the rear side.			
9	Incoming	1. Coupled to the breaker module of RMU. 2. Coupling arrangement should meet the IP54 requirement.			
10	Outgoing	Cable compartment with cover/ door.			
10.1	Cable type & size	3C x 400 sq mm Aluminum conductor XLPE with armor & PVC outer sheath			
10.1	Cable Entry	1. Bottom 2. Gland plate - 3mm metallic, removable & split type in two parts, with 1no. 90 mm diameter knocks out punch/hole in the centre. Approval should be taken for the same during drawing submission			
10.2	Cable support	'HDPE' cleat(s) shall be provided.			
10.3	Termination Type	Suitable for heat shrinkable type			
10.4	Terminals for 11kV cable termination	1. Suitable for Ring Type Bimetallic lug. 2. Material of Nut, bolts and spring washer- Brass 3. Size of Nut bolt- M16			
10.5	Termination height	From gland plate 900 mm minimum			
10.6	Right angled boots	Single piece cold shrink type (make – 3M or Raychem)			
11	Panel Wiring	1. Secondary wiring of CTs and PTs shall be done with 2.5 sq. mm PVC insulated cables with stranded copper conductor. 2. CT and PT wiring should run in independent rigid steel conduit pipes of appropriate size from CT/PT compartment			

		to meter compartment. 3. Conduit pipes shall be clamped with the inner wall of the panel and shall be so laid that none of the wires can be tampered from outside. 4. Current transformer and Potential transformer secondary wiring shall be colour coded as per IS and shall be suitably ferruled for identification. 5. No link or test terminals shall be provided in wire from CT/PT to meter terminals.
12	Earthing	1. The assembly comprising of the chassis, framework and the fixed parts of the metal casing shall be provided with two separate earthing terminals of M10 or above. 2. These terminals shall be provided over and above all other means provided for securing and earthing metallic enclosures (armour or other metallic coverage) or current-carrying cables. 3. The earthing terminals shall be readily accessible and so placed that the earth connection of the CT/ PT chamber is maintained when the cover or any other movable part is removed. 4. The earthing terminals shall be protected against corrosion and shall be metallically clean. 5. Earth continuitity shall be provided to all Gesketted joints by copper braid suitable for rated fault current. 6. Under no circumstances shall a movable metal part of the enclosure be insulated from the part carrying the earthing terminals when the movable part is in place. 7. The earthing terminals shall be identified by means of the symbol marked in a legible and indelible manner on or adjacent to the terminals.
13	Bushing	Bushing should be made of homogeneous epoxy / polymeric material free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality. Bushings shall be designed to have ample insulation level, mechanical strength and rigidity for the conditions under which they will be used. The hollow porcelain bushings shall conform to IS-5621. Bushing clamping accessories, bolts, studs etc shall be hot dip galvanized. All the nuts and washer shall be SS-304. All iron parts shall be hot tin galvanized and all points shall be airtight. All current carrying contact surfaces shall be silver

		plated. The creepage distance of the bushing shall not be less than 31 mm/KV. Bushing shall be tested in accordance with IS-2099. Routine as well as type tests reports in conformity with IS-2099 shall be furnished to the purchaser.
14	Connections	1. No joint in the primary winding of CT shall be acceptable. 2. Connection between CT terminal and bushing terminals shall be done with solid copper busbar of adequate size. 3. Flexible copper strip / rope are not acceptable for primary connection. 4. PT should be connected to primary busbar through bus bar of appropriate size (connections using flexible conductor are not acceptable). 5. All bus bars/ connections in the CT/PT compartment shall be encapsulated in epoxy.
15	Lifting Lug	1. 04 No's lifting lugs shall be provided at the top of the metering cubicle for transportation. 2. All nuts, bolts, flat and spring washers shall be SS only.
16	Height of the Base frame	The total height including base channel shall not be more than 2000 mm. Width and depth should be minimum possible and may be increased suitably to accommodate CT's/PT's.
17	Provision for Sealing	Welded Stud with nut must be provided for the purpose of sealing on the following compartments/ locations. 1. Meter compartment 2. Coupling arrangement of RMU and metering cubicle. 3. Outgoing cable compartment

2.0 Labels & painting

1	Name plate	The metering cubicles shall be provided with a non detachable type nameplate with legible and indelible marking fixed on the enclosure sheet with welded arrangement so that in case name plate is removed no passage holes are left. (separate name plate should be provided for RMU & metering cubicle)
2.1	Location	Name plate having complete data shall be provided outside as well as inside the metering cubicle at a suitable place where it can be easily read.
2.2	Material	Anodized aluminum 16SWG / SS

2.3	Background	SATIN SILVER
2.4	Letters, diagram & border	Black
2.5	Process	Etching
2.6	Name plate details	1. BSES Property 2. Supplier's name 3. P.O. No. & Year of manufacturing 4. Sr. No. of metering cubicle 5. Particulars of CT's such as ratio, VA burden, accuracy class, SC rating, BIL. 6. Particulars of PT's such as ratio, accuracy class, VA burden, BIL. 7. Standard connection diagram 8. Consumer account no 9. Sanctioned load. 10. Date of release of connection.
2.7	Labels for CT Ratio	On CT PT compartment by anodized aluminum with white character on black background OR 3 ply lamicoid
2.8	Danger plates	1. On CT PT compartment and each cable compartment 2. Anodized aluminum 16 SWG with white letters on red background
2.9	BSES Insignia	a) 01 no's b) Shall be etched on anodized aluminium 16SWG / SS plate. c) Details shall be finalized during drawing approval.
2.10	Enclosure painting surface preparation	Shot blasting or 7 tank chemical process
2.11	Enclosure painting internal/ external finish Powder coated epoxy polyester base	Hot dip galvanizing – 80 micron thick grade A, shade - RAL 7032, uniform thickness 60 micron minimum.

3.0 Technical requirement of CT and PT

SL	Description	Requirement for CT	Requirement for PT
1	Nominal System Voltage (KV rms)	11KV	11KV
2	Highest System Voltage (KV rms)	12KV	12KV
3	Type	Single phase Indoor CT's	Three phase Star/Star PT.
4	Ration	As specified in purchase enquiry	
5	Accuracy Class	0.5s	0.5
6	Primary fuses		3A
7	Rated frequency	50Hz	50Hz
8	Rated Secondary Current Amp.	5 Amp	N / A
9	Rated continuous thermal current	1.2 times of rated primary current,	NA
10	Max Ratio error	As per IS 2705	As per IS 3156
11	Max Phase angle error	As per IS 2705	As per IS 3156
12	Rated burden	5VA at 0.8 pf (Lag)	10VA/ phase at 0.8 pf (Lag)
13	Rated voltage factor	N / A	1.2 times continuous and 1.5 times for 30 seconds
14	Short time current rating		
14.1	Thermal rating	As provided in section 3.2	N / A
14.2	Dynamic rating	2.55 times of short time thermal current rating	N / A
15	One minute high voltage power frequency withstand voltage		
15.1	On primary winding KV rms On secondary winding KV rms	28KV (rms) for 1 minute for 11 KV class 3KV (rms) for 1 minute	28KV (rms) for 1 minute for 11 KV class 3KV (rms) for 1 minute

15.2	1.2 / 50 impulse withstand voltage	75 KV (peak) for 11 KV class	75 KV (peak) for 11 KV class
16	Winding materials	Copper	Copper
17	Insulation class	Class B	Class B
18	Insulation security factor	< 10	N / A

4.0 Inspection & testing

1	Type test	1. Metering cubicle shall be type tested as per IS 3427 2. CT and PTs shall be type tested as per IS2705 and IS3156 respectively. 3. Bushings shall be type tested in accordance with IS2099. 4. Type tests should not pertain to period earlier than five Years.
2	Routine test	1. Metering cubicle shall be tested as per IS 3427 2. CT and PTs will be tested in accordance with IS2705 and IS3156 respectively. 3. Temperature rise test will have to be carried out during Inspection. 4. During inspection, all routine and acceptance tests shall be carried out in presence of purchaser's representative.
3	Physical Inspection	1. Checks of all mounting plates / fasteners. 2. Checking of components as per drawing. 3. Electrical circuit's fasteners tightness / surface area contacts. 4. Labels / identification / nameplates. 5. All doors checks – safety and accessibility. 6. Panel surface finish / smoothness.
4	Right to waive off tests	Reserved by Purchaser

5.0 Guaranteed Technical Particulars (Data by Supplier)

SL	Description	Requirement	Data By Supplier
1	Name of Manufacturer		
2	Type and Designation	Outdoor type with resin cast CT and PT	
3	Normal system voltage	11KV	
4	Highest system voltage	12KV	
5	Frequency	50Hz	
6	Insulation Class		
7	Impulse Withstand Voltage (On assembled CT-PT set)	75 KV peak	
7.1	One minute power frequency dry withstand voltage (On assembled CT-PT set Primary)	28KV rms	
7.2	Secondary	3KV rms	
8	Current Transformers:	(3 nos. total, 01 no. per phase)	
8.1	Type	Resin cast wound type	
8.2	Transformation ratio (CT Ratio)	As per requirement	
8.3	Rated Output (VA Burden)	5VA	
8.4	Class of accuracy	0.5s	
8.5	Rated continuous thermal current	1.2 times of rated primary current	
8.6	Short time thermal current rating for one second	As per CT ratio and specification	
8.7	Rated Dynamic current	2.55 times of short time thermal current rating	
8.8	Security factor	Less than 10	
8.9	Insulation level	28KV for 1 min	

SL	Description	Requirement	Data By Supplier
8.10	No. of cores	One	
8.11	Max Ratio error	As per IS:2705/1992	
8.12	Max phase angle error	As per IS:2705/1992	
8.13	Max. temp rise over max ambient temp of 50 deg C at rated continuous thermal current at rated frequency & withstand burden	As per IS:2705/1992	
8.14	Make and Grade of epoxy resin		
9	Potential Transformers	(3 Phase 4 wire unit)	
9.1	Burden in VA/Phase	10 VA/phase	
9.2	Transformation ratio	11KV/110V (L-L)	
9.3	Primary Fuse	3A	
9.4	Class of accuracy	0.5	
9.5	Winding connection	Star/Star	
9.6	Insulation level	28KV for 1 min	
9.7	Rated voltage factor and time	1.2 continuous and 1.5 for 30 seconds	
9.8	Temp rise over max ambient temp	Within limits of IS-3156/1992	
9.9	Max phase angle error	Within limits of IS-3156/1992	
9.10	Max Ratio error	Within limits of IS-3156/1992	
9.11	Make and Grade of epoxy resin		
10	Size of main busbar		
10.1	For CT ratio less than and equal to 150/5	30 x 4mm (minimum)	
10.2	For CT ratio of 300/5 and	40 x 6mm (minimum)	

SL	Description	Requirement	Data By Supplier
	400/5		
11	Core material	CRGO (Virgin grade)	
12	Minimum creepage for HT Bushing	31mm/kV	
13	Clearances a. Phase to phase clearance b. Phase to earth clearance		
14	No. of Paint coats a. Primer b. Enameled RAL 7032	2 coats 2 coats	
15	Weight of complete unit		
16	Gauge of a. Meter box b. HT compartments	2mm (min) 3 mm (min)	
17	Dimensions of complete Metering cubicle a. Height (mm) b. Breadth (mm) c. Length (mm)		
18	Meter compartment		
18.1	Dimensions of meter compartment with double door (minimum sheet thickness 2mm) a. Height (mm) b. Breadth (mm) c. Length (mm)		
18.2	Protection class	IP 5X	
18.3	Provision of Acrylic window		
18.4	Provision of slotted channel (40*12mm) suitable for 6mm bolts (4 Nos)	Required	
18.5	Provision of Pad locking & sealing arrangement of door		
18.6	Provision of mounting metering reading port on door.		
19	Metering cubicle mounting	Floor mounting	

Annexure J Service and Warranty requirement

INDEX

1. Purpose

This document is prepared to specify the servicing requirement and Warranty / Guarantee handling procedure in case of difficulty that arises in the supplied equipment within the useful service life of the equipment being procured by BSES Rajdhani Power Limited/ BSES Yamuna Power Limited.

2. Applicability

It is applicable to any equipment supplied directly or indirectly for installation / use in BSES Rajdhani Power Limited/ BSES Yamuna Power Limited.

3. Priority

This document which include service, warranty / guarantees management / handling procedures shall be considered a final in case of any contradiction with other contractual document.

4. Liability

i) Supplier shall be liable to arrange OEM qualified service engineers as and when required by BSES Rajdhani Power Limited/ BSES Yamuna Power Limited to attend defects, trouble shooting to restore equipment health to ensure 100 % capacity availability.

ii) OEM shall be liable to provide essential spares at reasonable price for entire lifespan of the equipment.

iii) Service call shall be attended within reasonable time frame as mentioned in this document.

iv) Service cannot be denied by supplier/OEM till completion of useful life of the equipment.

v) The commercial liability shall be restricted to supply/service contract provision.

It will be liability of manufacturer /vendor tie up with accessories / component manufacturer to full fill requirement stipulated this document.

5. Warranty Requirements

i) The equipment failed / malfunctioned within stipulated warranty period shall be attended free of cost for the reasons not attributed to BSES.

ii) The cost incurred for service, spares, transportation, consumable and manpower / labour shall be borne by supplier.

iii) OEM is bound to send service engineer to site on request for troubleshooting promptly.

iv) There is no cap on number of visit or spare replacement required to repair / trouble soot the problem in the equipment during warranty period.

v) Each break down / problem reported shall be analysed scientifically to establish the root cause of breakdown.

vi) In case it is established that any component or accessories is not performing satisfactorily or causing repeated failure due to poor performance, manufacturing mistakes, design mistakes or not suitable to our environment condition applicable to NCR region, the OEM shall be liable to rectify or replace the same in all equipment supplied to BSES irrespective of warranty period.

vii) In case if RMU supplier is not OEM of the equipment / accessories, the supplier will be liable to tie up with OEM to provide service / spares to meet warranty / servicing requirement stipulated in this documents.

viii) Irrespective of onsite or workshop repairing, it will be responsibility of OEM to maintain work quality to ensure no compromise on performance and useful life of the equipment.

6. Process requirements

6.1 Complain Registration.

i) Supplier to provide communication details for complaint registration in O&M Manual, on website as well as shall be printed on the equipment. In case of changes, same shall be communicated to BSES.

ii) BSES will register complain through a e-mail / telephonic call to the call centre / service centre

6.2 Confirmation and Service time Schedule.

i) All timing will be counted from date of call registration by BSES till restoration of equipment health at respective site in operation condition satisfactory of BSES engineer.

ii) Service call confirmation & service engineer visit schedule shall be provided within two hour for working hour call (09:00AM to 06:00PM, Monday to Saturday) and before 10 AM next working day for off working hour calls.

iii) Emergency trouble shooting calls - within 12 Hrs including spare arrangements.

iv) Normal trouble shooting call - within 48 Hrs.

v) On site repairing / component replacement - within 7 days.

vi) OEM workshop repairing - within 30 days including returning to BSES stores.

vii) Replacement of complete RMU - within 45 days including delivery to BSES Stores

viii) The service engineer shall intimate necessary requirement to attend call along with confirmations

ix) Site visit & Investigation.

x) The OEM shall depute qualified and experienced engineer to carryout trouble shoot as well as testing and collecting necessary data / details essential for root cause analysis.

xi) The service engineer shall collect preliminary details to understand and estimate the spare requirement, shutdown time requirement from our respective area engineer whose details will be provided along with service call.

xii) The necessary tools shall be carried by service engineer attending calls.

xiii) Service engineer to get call attendance certificate from respective area BSES engineers.

xiv) Service engineer to intimate necessary precaution required to prevent repetition of problem to respective area BSES engineer as well as CES Team.

xv) Detailed technical report (root cause analysis) to be submitted to CES Team for records and analysis against each call.

6.3 Recommendation.

i) Shall be based on scientific study / test results only.

ii) Shall cover root cause analysis for failure.

iii) Shall cover spares / component list for repairing.

iv) Shall cover time requirement.

v) Shall cover site preparation / condition requirement.

vi) Other critical measures essential for quality work.

6.4 On Site Repairing.

i) All site repairing shall be under supervision of OEM engineer and shall meet all OEM recommendation to ensure quality of work.

ii) All spares arrangement shall be carried out well in advance to minimize outage time. The list must be shared with CES team

iii) Necessary repairing process to be intimated to CES team in advance. It shall include in process & final quality and performance checks / test.

iv) The repairing process shall be certified by OEM design / quality expert.

v) Detailed time schedule and spares arrangement details shall be submitted to CES team for necessary planning.

vi) The repairing work shall be witness by BSES CES engineer, who may insist in process / performance checks / test in addition to above if felt essential.

vii) If BSES engineer observed any quality problem / skill problem, may insist for repairing at OEM facility.

6.6 Repairing at OEM facility.

Following requirement shall be fulfilled during OEM workshop repairing work: -

i) During site inspection, if service engineer felt necessary to send equipment to OEM facility, the same shall be organized by OEM.

ii) In case if BSES felt that site repairing is not up to the required quality or felt necessary to analyze cause of failure, the same shall be organized by OEM.

iii) Equipment unpacking, testing and opening for analysis inspection shall be carried out in presence of BSES engineer. It shall be intimated to BSES at least 3 days in advance for necessary travel arrangement.

iv) If cause of failure observed due to design mistake / manufacturing mistakes, the same shall be rectified in all other similar design equipments without any cost to BSES.

v) OEM to intimate the final testing for inspection. BSES may depute engineer or third party representative to carryout inspection / testing before dispatch.

vi) Dispatch shall be carried out only after BSES clearance.

vii) Necessary lifting, shifting, loading / unloading & transportation arrangement shall be in the scope of OEM / supplier.

viii) A document required essential for lifting and shifting of equipment will be intimated at least two days in advance.

6.5 Witness / Inspection stages.

Even though OEM is liable for overall quality of work, BSES may witness / Inspection following activity:-

i) On site inspection, repairing/replacement work.

ii) Testing / inspection equipments / any accessories / component to establish the cause of failure.

iii) Opening of equipment for internal part inspection.

iv) Final testing/inspection before despatch.

i) Testing / checking of the evidence causing failure / problem.

Note: It will be responsibility of OEM / Supplier to establish with facts, figure, photographs, and evidence to prove that cause of failure not attributed to design.

7. Documents / records / report submission

The following be recorded and provided to BSES by OEM against each call / repairing / rectification works for BSES clearance and future reference:-

i) Root cause analysis report.

ii) All test report.

iii) Minutes of meeting.

iv) Spares / accessories test report / calibration certificates.

v) Proof of expenditure for cost incurred to BSES.

vi) Copy of transportation documents.

vii) All technical details of parts / accessories being replaced.

8. Qualification requirements for service engineers

i) All work must be carried out by only qualified, experience engineer certified by OEM. BSES may request qualification and experience details if felt necessary.

9. Safety.

i) All necessary personal protective equipments requirement for the personal and labour will be in the scope of OEM / supplier.

ii) It will be liability of OEM / Supplier to meet the necessary safety norms , standards, rules & regulation .

iii) BSES may audit the same during on site work.

10. Communications.

For better coordination, single channel communication must be followed. BSES and OEM / Supplied to communicate to each other their team for communication time to time in case of any changes.

At present, all warranty related communication is to be done with CES team.

11. Changes / revision management.

Necessary approval of O&M analytic cell is essential for changes in this document.
In case if any stack holders do not agree or wish to amend its content may send request to BSES O&M analytic cell for approval. The request will be in effect only on consideration and authorized release of revision in document by O&M analytic cell

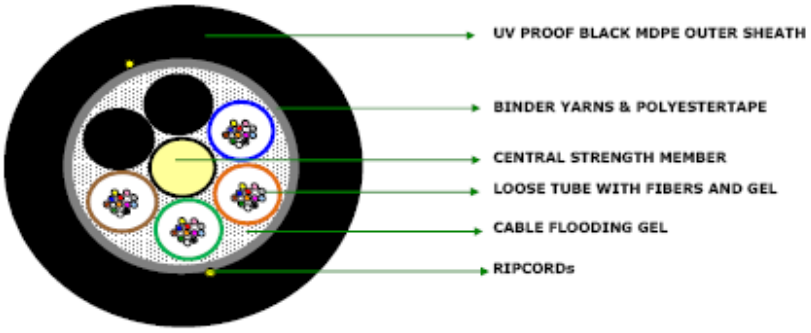
Annexure I:
Details of Optical Fiber Cable

48F Composite Fiber Multitube (MDPE) Single Sheath Duct Lite Optical Fiber Cable

PRODUCT INFORMATION

Fiber		
Single Mode Optical Fiber	**36 Nos.**	**Fiber ITU.T - G.657A1**
Maximum Cabled Fiber Attenuation dB/Km		1310nm : 0.36 & 1550nm : 0.23 & 1625nm : 0.26
Multi Mode Optical Fiber	**12 Nos.**	**Fiber OM2 : 50/125**
Maximum Cabled Fiber Attenuation dB/Km		8500nm : 3.5 & 1300nm : 1.5
Loose Tube		
Filling Gel		Thixotropic gel to prevent water ingress in loose tube (ITCO T 250)
Fiber Per Tube	12 Nos.	
Tube	4 Nos.	Thermoplastic Material (PBT)
Core		
Central Strength Member		Fibre Reinforced Plastic (FRP) to provide tensile strength and antibuckling properties.
Filler	2 Nos.	Polyethylene Black
Water blocking elements		Cable flooding gel is added in interstices of core to prevent water ingress in the cable core (ITCO C 480)
Core Covering		Binder and Polyester Tape
Cable		
Rip Cord	2 Nos.	Polyester Based Twisted Yarn — Applied below Outer Sheath
Outer Sheathing		UV Proof Black MDPE (ME 6052/ME 6056) — 2.2 mm Nominal Thickness

CONSTRUCTIONAL DETAILS



Typical construction Diagram - Not to Scale

OPTICAL FIBER CABLE PERFORMANCE

MECHANICAL				ENVIRONMENTAL	
Max. Tensile strength	2500 N	**Crush Resistance**	2000 N / 100x100 mm	**Temp. Performance**	
Minimum Bend Radius	20 D	**Impact strength**	25 Nm.	**Installation**	-20°C to +80°C
Repeated Bending Test	20 D,30Cycle	**Torsion**	±180°	**Service**	-20°C to +80°C
				Storage	-20°C to +80°C
Water Penetration	1m head, 3m samples, 24 Hr			**Drip Test**	30 cm, 70°C, 24 hr

Tests shall be carried out as per IEC 60793 & IEC 60794-1-2/GR 20 Standards. Change in attenuations shall be ≤ 0.05 dB.

COLOR DETAILS

Optical Fibre Colour	Blue, Orange, Green, Brown, Slate, White, Red, Black, Yellow, Violet, Pink, Aqua.
Loose Tube Colour	For G657A1 : Blue, Orange, Green & For OM2 : Brown.
Outer Sheath Colour	Black

PHYSICAL PARAMETERS

Cable Diameter (mm)	11.75 ± 0.25	**Cable Wt. (Kg/Km)**	114 ± 10%	**Cable Length:**	2 Km ± 5%

PRINTING DETAILS

Cable Printing details (White - Hot Foil Emb.)	48F TELEPHONE SYMBOL LASER SYMBOL MONTH & YEAR OF MANUFACTURE LENGTH CODE METER MARKING

The accuracy of marking shall be ± 0.5%. Occasional loss of printing & remarking shall be as per Bell core GR 20 and this supercedes the earlier markings.

BSES

Technical Specification

For Heat Shrinkable & Cold Shrinkable Straight Through Jointing Kit

(11 KV, 33 KV, 66 KV XLPE Insulated Cables)

Specification no – BSES-TS-44-STTH-R0

Rev:		0
Pages:		28
Date:		19 Apr 2022
Prepared by	Abhishek Vashistha	
	Goutam Deka/Pronab Baiag	
Reviewed by	Puneet Duggal	
	Amit Tomar	
Approved by	Gaurav Sharma	
	Gopal Narya	

Index

1.0.0 Scope of work

A. Heat Shrinkable / Cold shrinkable Straight Joint Kits (hereinafter briefly referred to as "STJ Kits"), suitable for 11 kV, 33 & 66kV XLPE cables, shall be designed, manufactured, tested, packed and delivered by the Vendor, as per Purchaser's requirements.

B. Supervision, during installation of joints at site if mentioned in the order.

C. During post-installation period, if a joint fail at site, the vendor shall depute a technical team to site for a root-cause analysis of the failure of the joint, in the presence of BSES officials. An Analysis Report shall then be submitted for BSES's review and approval. If this report concludes the cause of failure as due to a design/manufacturing defect in a component, then vendor shall replace all such components in the entire stock available with BSES.

2.0.0 Codes & standards

2.1.0 National Standards:

S No.	Standard Number	Title
2.1.1	IS- 13573: 2011	Joints & Terminations of Polymeric Cables for working voltages from 6.6 kV up to and including 33 kV Performance Requirements and Type Tests
2.1.2	IS- 7098: Part 2:1985	Cross-linked Polyethylene (XLPE) Insulated PVC sheathed cables: Part 2 - For working voltages from 3.3 kV up to and including 33 kV
	IS- 7098: Part 3:1993	Cross-linked polyethylene insulated thermoplastic sheathed Cables specification: Part 3 - For working voltages from 66 kV up to and including 220 KV
2.1.3	IS- 10810: 1984	Methods of test for cables

2.1.1 International Standards:

S No.	Standard Number	Title
2.2.1	EA TS - 09-13	Electricity Association - Technical Specification – 09 – 13 Material component for use in Electric Power Cable Termination & Joints for System voltage above 1kV up to 36 kV
2.2.2	IEC - 60183	Guide to the selection of high voltage cables
2.2.3	IEC - 885 Part 1 to 3	Electric test methods for electric cables
2.2.4	IEC - 60502 - 4	Power Cable Accessories for XLPE Cables above 3kV & up to 30 kV Test methods
2.2.5	IEC - 60840	Power cable with extruded insulation and their accessories for rated voltage above 30 kV (Um=36 kV) up to 150 kV (Um=170 kV) - test methods and requirements.

3.0.0 Cable Construction

Normal sizes of XLPE cables used in BSES system, construction features and corresponding joint requirements of cables are indicated below:

a. 11kV, 3-core x 150 sq mm AL
b. 11kV, 3-core x 300 sq mm AL
c. 11kV, 3-core x 400 sq mm AL(Conventional)
d. 11kV, 3-core x 300/400 sq mm AL (Single and three core long barrel Repairing Joint)
e. 11kV, 3-core x 400 sq mm AL (OFC embedded)
f. 11kV, 1-core x 1000 sq mm AL
g. 11kV, 1-core x 150 sq mm AL HTAB
h. 11kV, 1-core x 95 sq mm AL HTAB
i. 33kV, 3-core x 400 sq mm AL
j. 33kV, 3-core x 400 sq mm AL (OFC embedded)
k. 33kV, 3-core x 400 sq mm AL (Single and three core long barrel Repairing Joint)
l. 66kV, 1-core x 630 sq mm AL
m. 66kV, 1 core x 1000 sq mm AL
n. 66kV, 1 core x 1000 sq mm AL (For Single core long barrel Repairing Joint)
o. 66kV, 3-core x 300 sq mm AL
p. 66kV, 3-core x 300 sq mm AL (OFC Embedded)

3.1.0	Conductor	a) Electrolytic Grade Stranded Aluminum Conductor b) Grade: H2 / H4 as per IS: 8130 / 1984 (For Al) c) Stranded, compacted and circular in shape d) Class 2 e) Longitudinal "Water-Blocking Arrangement" (or water-tight construction or water barrier protection)
3.1.1	Conductor Screen	Extruded Semi Conducting material
3.1.2	Insulation	Extruded XLPE Insulation for 11 kV and Extruded TR-XLPE Insulation for 33 kV and 66 kV
3.1.3	Insulation Screen	Freely strippable Semi Conducting (without application of heat) for 66kV firmly bonded.
3.1.4	Water Swell able Tape	Semi-conducting Water Swell-able Tape under the copper tape on each core.
3.1.5	Copper Tape	Copper Tape applied helically over the layer formed by application of insulation screen, water swell able tape and identification strip
3.1.6	Filler	All interstices, including center interstices filled by PP filler. In case of OFC embedded cable.48 no OFC (36 single mode and 12 no multi mode) as a filler in 11kV 3CX400 sqmm cable, 33kV 3CX400 and 66 kV 3CX300 sqmm cable
3.1.7	Over all three cores	Binder tape
3.1.8	Inner Sheath	Extruded Inner Sheath of Black PVC type ST-2.

3.1.9	Armour	a) For 11 kV 3-core Cables : Galvanized Steel flat strip armour b) For 1-core Cables : Non-Magnetic, Hard drawn Aluminium wire (flat/round) c) Corrugated aluminium or lead sheathed for 1core 66kV Cable d) For 33kV and 66 kV 3-core cable- Galvanized Steel Round wire
3.1.10	Binder Tape	Rubberized cotton tape
3.1.11	Outer Sheath	Extruded outer sheath of PVC (ST-2) for 11 kV and 33 kV cable. For 66 kV cable, HDPE ST 7 with termite- repellant and anti-rodent properties with extruded semicon/graphite layer over HDPE ST7.
3.1.12	HTAB Cable (1CX150 and 1CX95)	AB cable- conductor-conductor semicon screen- TR XPLE-insulation screen-- Water Swallowable tape -Round wire armour (in the place of copper tape), Water Swallowable tape-outer sheath+massenger wire
3.1.13	OFC	For OFC embedded cable of sizes 11kV 3CX400 sqmm cable, 33kV 3CX400 and 66 kV 3CX300 sqmm cable - Single Mode-36 Nos. Multi Mode- 12 nos. All the OFC cable is placed as filler inside the cable.

4.0.0 Straight-Through Joints (STJ)

General Technical Requirements for Straight-Through Joints (STJ) for XLPE cables are as follows:

Scope: Design, manufacture, testing and supply of Straight-Through Joint Kits for 11 kV, 33 kV & 66kV Power Cables.

Functional requirements for Heat Shrinkable / Cold Shrinkable STJ joints are given below:

4.1.0 Heat Shrinkable / Cold Shrinkable STJ joints		
4.1.1	Cable preparation	Cable preparation shall be as per installation instruction sheet. Manufacturer shall be provide Installation instruction sheet in every kit
Connector		
4.1.2	Conductor Screen	For 11kV a) Conductors to be jointed by crimping connectors b) Annular CSA (cross-sectional area) of the ferrule shall not be less than CSA of the conductor of the cable. Length of the ferrule shall be sufficient to allow adequate number of crimps, to limit temperature rise at the joint. (Vendor to furnish dimensional drawing for ferrule, indicating crimp marks.) c) For aluminium cable, the crimped ferrule shall be of aluminium d) Refer annexure F for GA drawing of crimping ferrule e) For single core repairing joint- long barrel mechanical connector/ferrule shall be provided (middle part of ferrule/connector shall be solid for better connectivity)

		For 33kV and 66kV a) Shear bolt type mechanical connector b) Approved make: • Tyco Electronics (BSM-185/400-U) • Pfisterer (332617010) • Nexans • Niled • Or equivalent type tested make (Manufacturer shall take prior approval from CES) d) Maintain smooth surface over connector after cut the shear head bolt e) Vendor to furnish drawing for the mechanical connector **Note:** In all voltage grade- For single core long barrel repairing joint, one long barrel connector/ferrule and for three core long barrel repairing joint, three long barrel connector/ferrule shall be provided along with all kind of accessories.
4.1.3	Void filling and stress relief over crimped connector and cut point of the insulation screen.	By means of High permittivity mastic tapes / Lubricant.
4.1.4	Metal screen continuity	By means of Tinned copper wire mesh, wrap individual core from cu screen with 50 % overlap and continue on other side cu screen. Bind the copper wire mesh on copper screen with copper binding wire/CFS
Armour / Earthing Continuity		
4.1.5	Armour bond	a) By means of a combination of steel (G.I.) support ring (for 3 - core Cable) or Aluminium support ring (for 1 - core Cable) and two nos. of stainless steel hose clips. b) GI Support Ring shall be 'zinc-sprayed with central bulge / bump'.
4.1.6	Minimum Armour Fault Current Carrying capacity	11 kV Cable – 11 kA for 1 sec 33 kV Cable – 31.5 kA for 1 sec 66 kV Cable – 31.5 kA for 1 sec
4.1.7	Provision of Armour continuity	By means of tinned copper braided conductor as per following 11 kV cables – 11 kV Cable – Three No's of 25 sq mm each 33 kV Cable – Four No's of 50 sq mm each 66 kV Cable – Four No's of 50 sq mm each

Accessories		
4.1.8	Suppression of electrical discharges over XLPE insulation	Cleaning solvent /equivalent, for manual application.
4.1.9	Installation Instruction	Shall be provided in English and Hindi and shall be inside every kit.
4.1.10	Sheet paper Tap	Paper tape, required for measurements during jointing, shall be provided inside every kit.
4.1.11	Identification Tag (for traceability)	1. An aluminum pouch with paper tag & sealing arrangement at one end shall be provided.This tag is required to be tied over the cable at one side of the joint. The paper tag shall give following information 1) Vendor kit designation 2) Cable section/Division 3) Type of joint 4) Size of Joint 5) Make of joint 6) Voltage class 7) Serial no. of kit 8) Vendor lot & batch no 9) Month & year of manufacturing 10) Date of installation 11) Name of jointer 12) Name of vendor supervisor 13) Name of BSES supervisor 14) Remarks 2. In addition to above Stainless Steel Tag shall be provided with following details for straight through joint a. Manufacturing month and year (MM/YY format) b. Manufacturer name i.e Comp c. Manufacturer own sl no for future tracing
4.1.12	Printing on each Heat/cold shrinkable or Moulded component	Month and year of manufacturing, batch no. /lot no., size, make, type etc.
4.1.13	GPS Coordination	Vendor to capture GPS coordinates and shall include in job card of each joint at their own cost.
4.1.14	Hydraulic Crimping	Using of Hydraulic crimping tool is mandatory for crimping purpose
4.1.15	Coffin for completed joint and Joint Marker	After successfully completion of joint, Coffin shall be made by bidder for completed joint. Drawing shall be provided by BSES. Excluding drawing, everything shall be in the scope of bidder. After back filling a joint marker shall be fixed by bidder above ground to mark the joint location. Drawing is enclosed with this

		tech spec.
4.1.15	Electronic Ball Marker for 33kV and 66kV Cable Joint.	Passive and Active ball shall be supplied and placed at each and every joint to mark the joint electronically. Data shall be filled by bidder as per BSES requirement.
4.1.16	OFC	11kV 3CX400, 33kV 3CX400 and 66kV, 3CX300 sqmm cables are OFC embedded. OFC joint shall be supplied along with main cable joint. (36 single mode and 12 nos. multi mode OFC inbuilt inside cable). OFC joint shall be made separately from main cable joint**.**
4.2.0 Only for Heat Shrinkable STJ joints		
4.2.1	Stress Control System	a) The earthed insulation screen of an XLPE cable is terminated at a suitable distance from the connector (Ferrule). b) The stress control tube is in electrical contact with insulation screen. c) Impedance of the tube shall be constant up to an operating temperature and shall be within the range 1 x 10^8 ohm-cm to 8x10^8 ohm-cm. d) The physical and electrical properties shall conform to EA TS 09-13. d) For single phase repairing joint-stress control tube shall be suitable for long barrel mechanical connector/ferrule
4.2.1.1	Insulation build-up	a) Maximum three layers of insulation tubes shall be used. Total thickness of the insulation being provided in the joint shall not be less than 1.2 times the insulation of the cable being jointed. b) Outer-most tube shall be screened insulating tube (dual wall tube). This tube shall be manufactured by extrusion process. c) Physical and Electrical properties shall conform to EA TS 09-13. d) For single phase repairing joint-insulation build up shall be suitable for long barrel mechanical connector/ferrule
4.2.2	Sealing end of tube	By means of Core end sealing sleeve with red mastic coating
4.2.3	Mechanical Protection	a) For 3-core cable: By means of a rollable steel mat (with required protective coating against corrosion) b) For 1-core cable: i) Copper wire mesh ii) Adhesive coated medium wall tube iii) One more layer of copper wire mesh iv) Medium wall tube
4.2.4	Corrosion Protection	By means of semi-rigid tubes, internally coated with water blocking sealant. Thick wall Insulating tube

4.3.0 Only for Cold Shrinkable ST joints Scope: The term cold shrink applies to materials, which are capable of shrinking without raising the material above the ambient temperature of its immediate surroundings. The material of the rubber insulator used in the Cold Shrink assembly shall be silicone which is factory expanded and placed on a removable core. The removing of the core causes the cold shrink assembly to shrink. The cold shrink assembly shall maintain a compressive force on the cable continuously throughout the life of the product. This pressure will ensure a complete moisture seal.		
4.3.1	Stress Control System	By means of one piece body (splice assembly) providing stress control, insulation and screen continuity.
4.3.2	Mechanical Protection	By application of mastic coated vinyl tape and armor cast structural material. The taped armor cast layer may also be sprayed with water to hasten the curing.

4.4.0	Technical Particulars	Vendor shall submit Guaranteed Technical Particulars (GTP) as per Annexure A.
4.5.0 Testing & Inspection		
4.5.1	Type Tests (CPRI/ERDA)	a) Straight-Through Joint shall be of type-tested quality from CPRI/ERDA. Type Test report shall not be more than 5 years old. b) In addition to this, in case of rate contact, vendor will be required to conduct type-testing on heat/cold -shrinkable and moulded components, stress grading mastic, etc., in line with EA TS 09-13 standard, at third party test laboratory once in 6 months on randomly selected sample of each voltage rating without any commercial implication to BSES. Also special test shall be done as per IS 13573.2.2011, Table-7 without any cost implication to BSES. Cable for type test may be provided by buyer at the cost of bidders. C) If product is not type tested or test report is more than 10 years old from CPRI/ERDA (subject to no change in the relevant IS/IEC.IEEE) **,** same shall be carried out by seller, sample shall be selected randomly by BSES, test cost to be borne by seller. For new vendor, type test is mandatory from CPRI/ERDA of BSES sample at their own cost.
4.5.2	Routine & acceptance Tests	I) All the routine and acceptance tests shall be carried out as per EA TS 09-13 guidelines, refer Annexure C. II) H.V. Test shall be carried out on a randomly selected and installed Straight-Through Joint, in the presence of Purchaser's representative, at manufacturer's works. III) The joint shall withstand a test of 4Uo voltage for 4 hours.

4.5.6	Inspection	I) Purchaser reserves the right to inspect /witness all tests on the STJ Kits at Seller's works at any time, prior to dispatch, to verify compliance with the specification. II) In-process and / or final inspection call intimation shall be given in advance to purchaser.
4.5.7	Test Certificates	i) Three sets of complete Test Certificates (Routine & Acceptance tests) shall be submitted along with the delivery of STJ Kits. ii) Bought-out Items: Vendor shall submit Test Certificates, lot/batch number-wise, from their sub- suppliers / principal. TC's should clearly indicate the measured technical parameters, in accordance with sub-supplier's specification. (Also refer Annexure - C)
4.6.0	Documents	"Documents" refer to Documents, Data, Manuals, etc. (Scanned copy of signed documents also shall be part of entire soft file (e-file) or CD.
4.7.0	Along with the Bid	Vendor shall submit signed 3 sets (plus 1 set of soft copy) of following documents a) GTP (duly filled-in) (as per Annexure — A) b) Cross-sectional drawings for components Assembly. c) Type Test Certificates d) Complete Catalogue and Installation Instructions. e) Any other document.
4.8.0	After Award Contract	Vendor shall submit signed 2 sets (plus 1 set of soft copy) of above-mentioned documents within 15 days, for Purchaser's approval.
4.8.0	"As-Built" documents	Final signed "As-built" documents for the equipment in 3 sets (hard copy), 1 no. soft copy and 1 no. CD. These documents shall include signed Routine & Acceptance Test Certificates also.

4.9.0	Packing, Marking, Shipping, Handling and Storage	a). Every component / kit / box shall be properly sealed/ packed for protection against damage. Stress grading mastic shall be packed in air-tight / air-sealed packing. b). Every kit box shall be wrapped in polythene covers. c. Separate packing (sub-kits) shall be provided, for components (given below) used in crotch area and connector area. These sub-kits, labeled as "CROTCH KIT" and "CONNECTOR KIT', shall be placed inside every kit box. i) Crotch Kit Components --Conductive cable break-out -- Yellow moulded wedge -- Break-out end sealing tube -- Break-out finger sealing tube -- Stress grading mastic ii) Connector Kit : Components -- Ferrule (connector) -- Void Filling mastic (yellow)
4.9.1	Identification Label	Markings / Labels shall be on both sides of every packed box. 1) Identification number/type designation (as per manufacturer's standard) 2) Voltage grade, size, description of the Kit (including the voltage grade, size, type of the cables, for which it is to be used) 3) Batch no., lot no., etc. 4) Quantity 5) a) Purchase Order no. & date b) Purchaser's name c) BSES's SAP code number 6) Weights (kg) of each Cable Termination Kit and of each box containing kits. 7) Manufacturer's name 8) Month & Year of Manufacturing 9) Date of packing, shelf life (if applicable)
4.9.2	Transit damage	The seller shall be responsible for any transit damage due to improper packing.

5.0.0 Quality Assurance Plan (QAP)

5.1.0	Vendor's Quality Assurance Plan (QAP)	To be submitted for Purchaser's approval.
5.2.0	Sampling Method	Sampling Method for quality checks shall be as per manufacturer's standard practice / ESI guidelines and Purchaser's prior approval shall be taken for the same.
5.3.0	Inspection Hold-Points	To be mutually identified, agreed and approved in Quality Plan.

6.0.0 Deviations

6.1.0	Deviations	a) Deviations from this specification shall be listed by bidder clause wise along with optional offer and has to submit the list along with bid./quotation. BSES will review the deviations and if BSES is agreed with the deviation, seller has to take written confirmation from BSES on deviation during tender evaluation.. b) In the absence of any list of deviations from the Seller with bid as well as written confirmation from BSES on deviations, it will be assumed by the Buyer that the Seller complies with the Specification fully. c) Any deviations mentioned in any other submitted bid documents (i.e.in filled GTP, Catalog, BSES old approval, buyer's/seller's standards etc) by seller without separate deviation sheets will not be considered as a deviation from this tech spec at any stage of contract.

7.0.0 Delivery

7.1.0	Delivery	Dispatch of Material: Vendor shall dispatch the material, only after the Routine Tests /Final Acceptance Tests (FAT) of the material witnessed/waived by the Purchaser, and after receiving written Material Dispatch Clearance Certificate (MDCC) from the Purchaser.

8.0.0 Inspection Expenses

NA

9.0.0 Failure Analysis and Penalty

Failure of joint shall be analyzed by BSES and Vendor jointly. Joint failure in regards to poor quality joint, poor work man ship, etc. shall be in the account of vendors. Losses due to failure shall be recovered from vendor in case of warranty.

Annexure - A: Guaranteed Technical Particulars (GTP)

The Vendor is deemed to have examined all parts of the Specification documents and to have been fully informed, as to the nature of work and the conditions related to its performance.

S No.	Description	Purchase requirement	Vendor's data
1	Manufacturer's name		
2	Purchase Order no. & date		
3	Guarantee Period (minimum)	60 Months (from date of commissioning) / 66 Months (from date of receipt at Purchaser's store),whichever is earlier	
4	Applicable IS / IEC Standard followed by Vendor (incl. type test standard)		
5	Voltage Grade (kV)		
5.1	Lightning Impulse Voltage Withstand Test		
5.2	4Uo AC voltage withstand test for 4 hours	To be conducted on Installed joint at works	
6	Continuous operating temperature	90 deg. C	
7	Functional Requirements		
7.1	Method of Stress Control and Discharge Suppression		
7.2	Method of Insulation build-up and screening		
7.3	Method of earth bond a) Size and no. of braids b) Size of armour support c) No. of hose clips		
7.4	Method of mechanical protection a) for 3-core Cable b) for 1-core Cable		
7.5	Method of protection against corrosion (type & coating thickness of protective layer on steel mat)		

7.6	Method of conductor continuity a) For crimping connector b) For mechanical connector		
8	Description of items in the Kit, which are imported /sourced From Principal /Sub-suppliers		
9	Names of items in the Kit and their respective shelf life (months I years)		
10	Kit Content Table (KCT) enclosed? (Refer Annexure — B)	Yes / No	
11	Drawing for connector (ferrule) enclosed	Yes / No (If yes, mention the document reference)	
12	Is Annexure - D (Technical Deviation Sheet) duly filled-in?		
13	Packing (Qty) i) Packing of every Kit h) Group Packing	1 no -- No. of Kits per Box -- No. of Boxes	
14	Installation Procedure enclosed?	Yes / No (If yes, mention the document reference)	
15	Quality Assurance Program (QAP for raw materials, in-process inspection, factory testing) is enclosed?	Yes / No	
16	Whether all heat-shrinkable and moulded components of the kit meet the requirements of and have been tested in accordance with EA TS -09-1 3.(for heat-shrinkable joints)	Yes / No (If yes, details of test report no. /Date /name of test laboratory to be mentioned.)	
17	Type Test Reports (TTR) (Relevant test report no. & date, With type, size, other details of each type of Kit.) a) Prepared Joint: CPRI TTR as per BIS / IEC enclosed? b) Loose Components: CPRI TTR as per EA TS 09-13 enclosed?	Yes/No Yes/No	

18	Printing details on each of the Heat- shrinkable and Moulded components	(Mention the text, presently printed on each of the component)	
19	OFC kit (for OFC Embedded cable only of sizes 11kV 3CX400, 33kV 3CX400 and 66kV, 3CX300 sqmm cable)	Yes/no	

Annexure - B: Kit Content Table (KCT)

Vendor shall submit KCT as a consolidated table, consisting of all data, such as:

A. Heading

1. Voltage grade, size, description of the Kit
(Including the voltage grade, size, type of the cables, for which it is to be used)
2. Type designation (as per manufacturer's standard)

B. Details / Parameters (For each component/item of the KCT)

1. Lot no. /Batch no., etc.
2. Item number (manufacturer's standard)
3. Description
   a) Material, type, make and grade
   b) Dimensions cross sectional area
   c) Colour,
   d) Other description, if any
4. Function of the item
5. Quantity
6. Make/Name/Location of manufacturer/sub-vendor
   a) Minimum supplied (or in expanded form) diameter
   b) Maximum freely recovered diameter
7. a) Minimum supplied (or in expanded form) thickness
   b) Maximum freely recovered thickness

C. Notes on the KCT

Markings, printings and other details for individual/group of components is to be mentioned on KCT. For example:
a) Printing of item code, size, batch no., etc.
b) Printing on components
c) Other embossing or engraving, it any.

(Note: Vendor may attach an Annexure, for any additional information, if required.)

Annexure - C: Routine and Acceptance Test

A. Visual Examination

Condition of selected items / components, as per sampling method, shall be recorded. Some of the normal check-points can be as follows:

1. Every component shall be verified in quantity and description as per KCT.
2. All items shall be free from any defects, pin holes, cracks, etc.
3. Metallic components to be free from sharp edges.

B. Measurements of Dimensions

(Required / observed dimension — length, diameter, etc.)

1. Supplied dimensions
2. Recovered dimensions

C. Destructive Testing

On various heat-shrinkable / moulded components of ready Kits (items 3 and 4 are applicable only for heat-shrinkable components)

1. Tensile Strength
2. Wall Thickness Ratio
3. Heat Shock
4. Longitudinal Change, after full recovery
5. Ultimate Elongation
6. Low Temperature Flexibility
7. Dielectric Strength
8. Volume Resistivity

Routine Test Reports (RTR) (Typical)

Each RTR shall clearly indicate P.O. no. & date and also BSES's SAP code no. RTR shall record the serial numbers of the kits selected, as per vendor's sampling method. Following details, besides vendor's/manufacturers standard check-points, shall appear in every RTR.

Annexure - D: Deviation Sheet

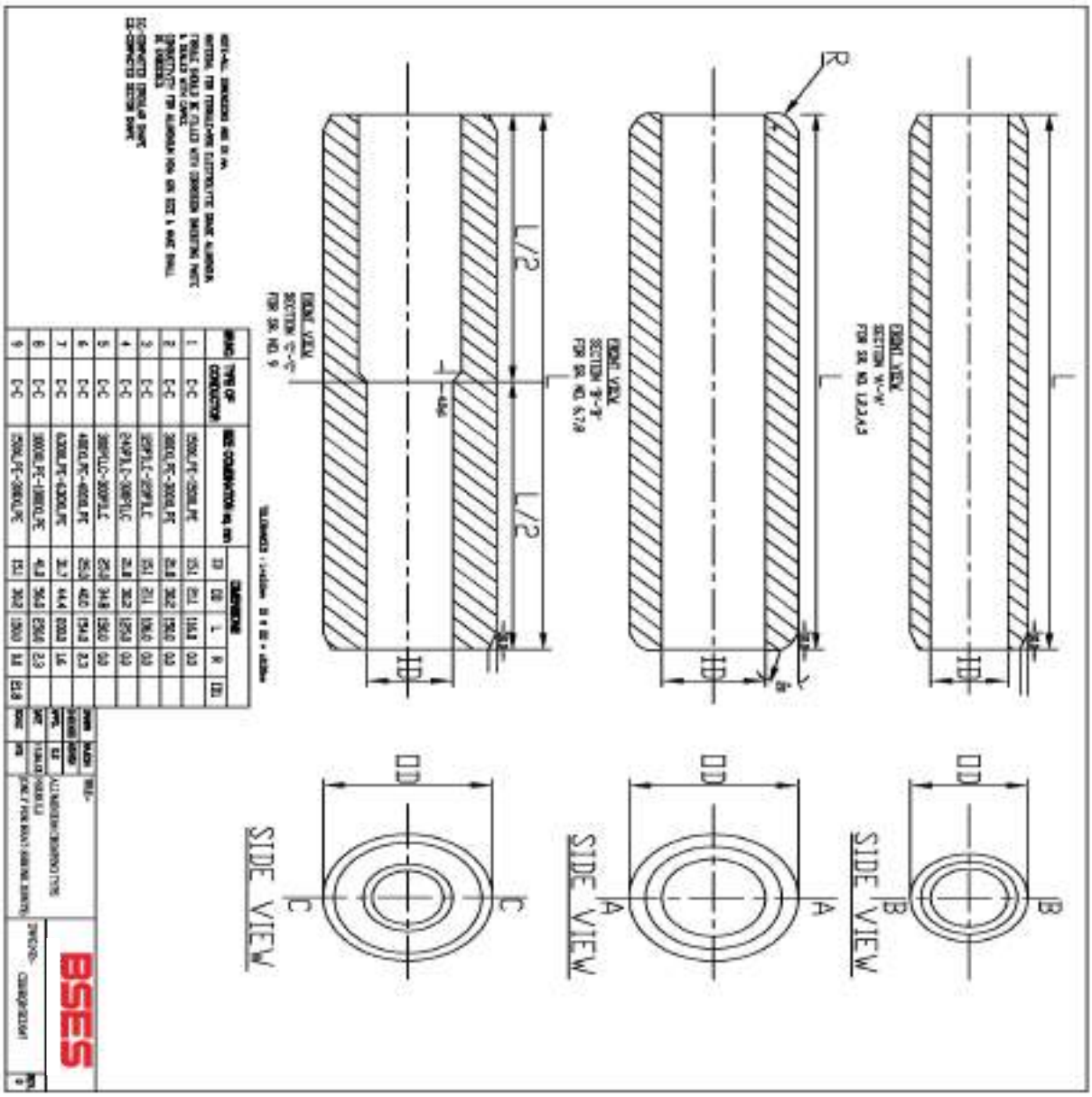
Sr No.	Clause No.	Deviation

Annexure - E: Service Conditions

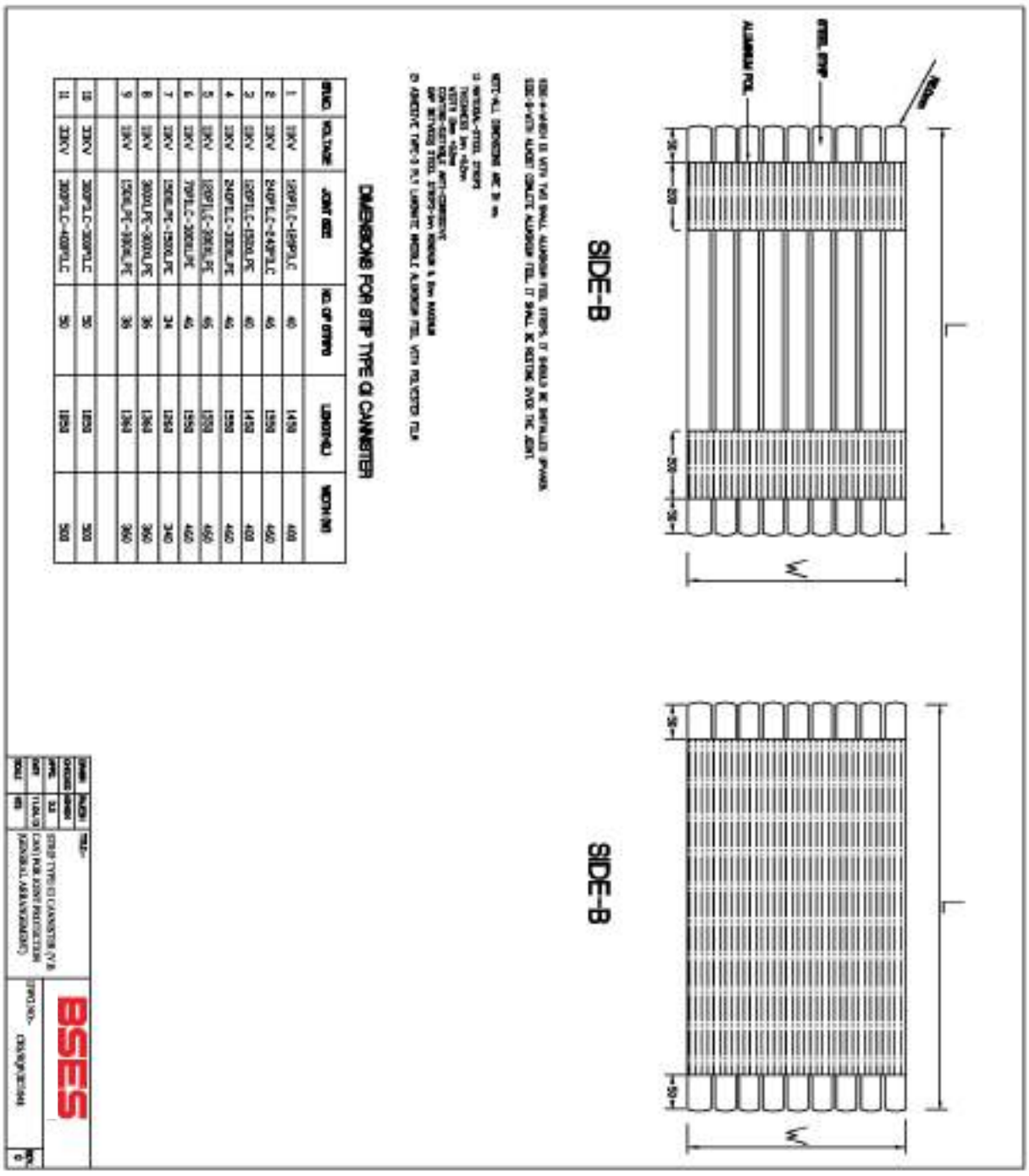
(Atmospheric conditions in Delhi)

a)	Average grade Soil Condition	
b)	Maximum altitude above sea level	1000 M
c)	Ambient Air temperature	Highest 50 Deg C, Average 40 Deg C
d)	Minimum ambient air temperature	0 Deg C
e)	Relative Humidity	100 % Max
f)	Thermal Resistivity of Soil	150 Deg C cm/W
g)	Seismic Zone	4
h)	Rainfall	750 mm concentrated in four months

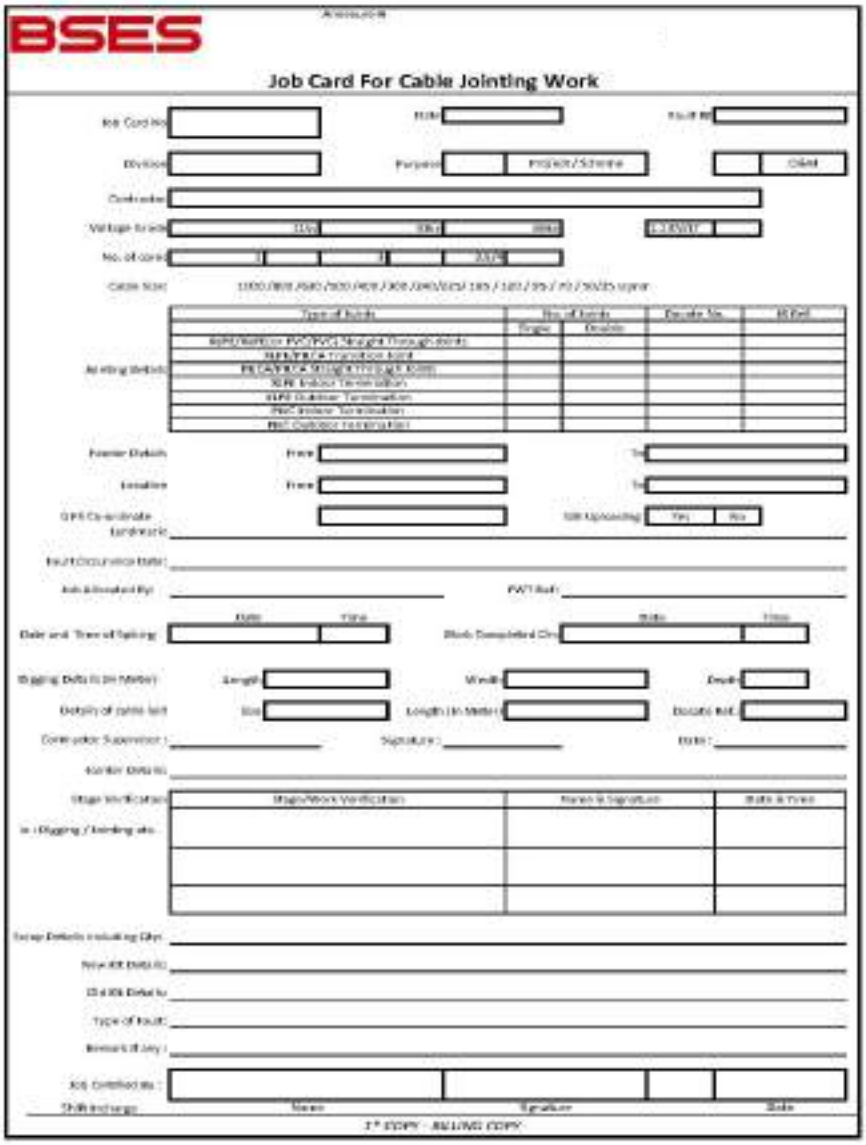
Annexure - F: Aluminium crimping-type Ferrule for compacted circular conductor only for Heat Shrink joints



Annexure – G: Strip type GI canister (V.B. Can) for joint protection only for Heat Shrink Joint



Annexure – H : Job card Details



BSES

Job Card For Cable Jointing Work

Job Card No

Date

Fault ID

Division

Purpose

Project/Scheme

O&M

Contractor

Voltage Grade

11kV

33kV

66kV

LT/HT/EHT

Others

No. of core

1

2

3

3.5/4

Cable Size

1000/800/630/500/400/300/240/185/150/120/95/70/50/35 sqmm

Type of Kits	No. of Kits Required		Feeder No.	ID Tag
	Single	Double		
66/33/11kV PVC/XLPE Straight Through Joints				
66/33/11kV Transition Joint				
66/33/11kV Straight Through Joints				
66/33/11kV Indoor Termination				
66/33/11kV Outdoor Termination				
66kV Indoor Termination				
66kV Outdoor Termination				

Feeder Details From To

Location From To

GPS Co-ordinate Landmark

GIS Uploading Yes No

Fault Occurrence Date:

Job Allocated By:

PMT Ref:

Date and Time of Taking

Date Time

Work Completed On

Date Time

Digging Dets (in Meter) Length Width Depth

Density of cable laid Size Length (in Mtr) Excess left

Contractor Supervisor : Signature : Date :

Incident Details:

Stage Verification

Stage/Work Verification	Name & Signature	Date & Time
a. Digging / bending etc.		

Scrap Details including Qty:

New Kit Dets Rc:

Old Kit Dets Rc:

Type of Fault:

Remark if any :

Job Certified By :

Name Signature Date

Shift Incharge

1st COPY - BILLING COPY

Annexure – I : SOP for jointing work

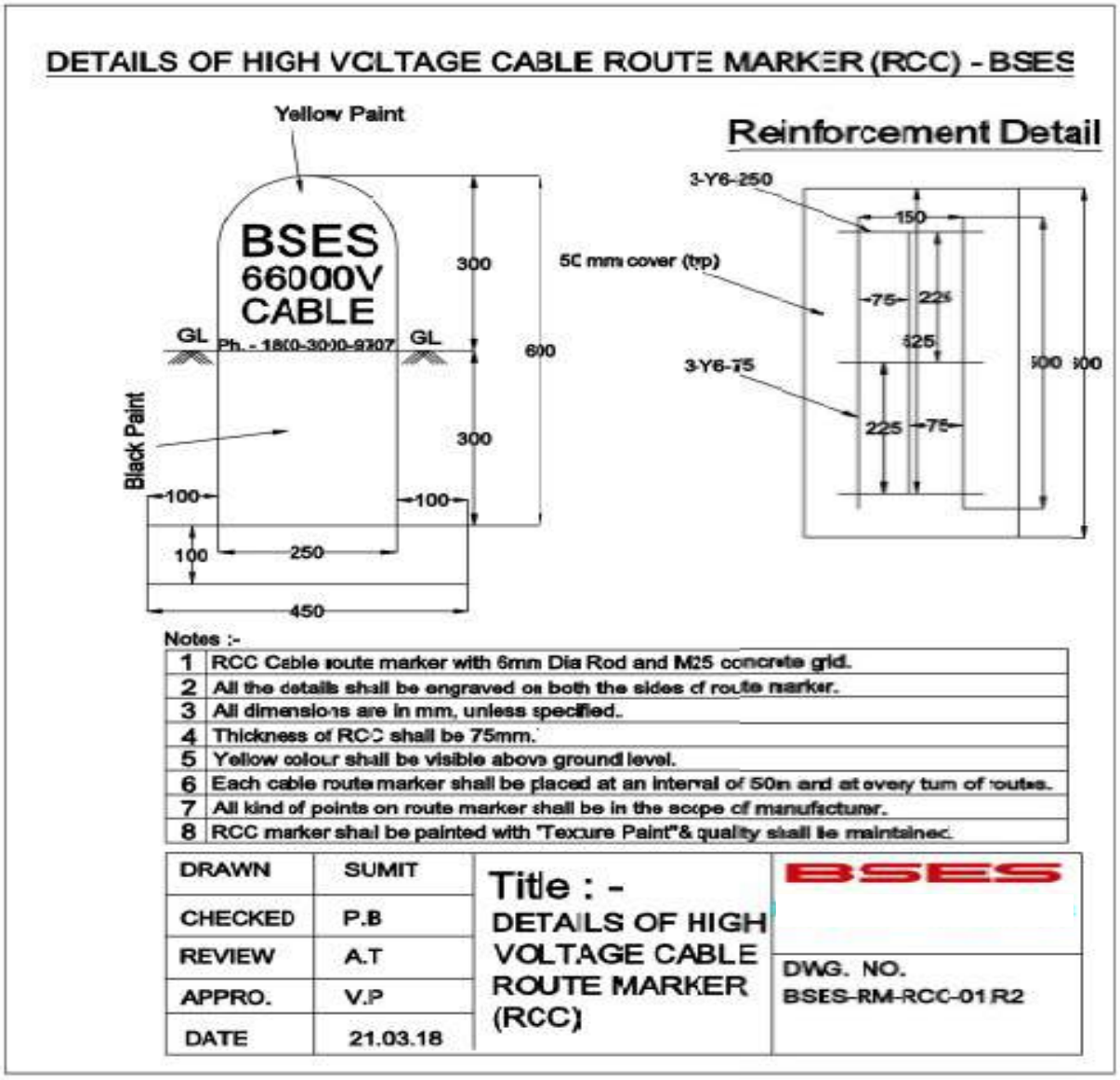
SOP FOR REPAIRING OF CABLE FAULT (Shall be part of PO)		
Sl. No.	Activity	Responsibility
Initiation		
1	Identify and isolate fault and inform GNIIT in case of cable fault	Break down team
2	Updation of the details in OMS against respective feeder tripping event.	GNIIT
Fault Location		
1	Information sent to FLC team and SDO.	GNIIT
2	Mobilize FLC team and cable jointing contractor.	SDO
3	Identification of fault location	FLC Team
Preparation for Jointing		
1	Seeking permission from road owning agency	SDO
2	Payment of RR charges to Road owning agency	Finance
3	Digging	Cable jointing contractor
4	Cut faulty section and Pre-test (HV test) cable for multiple fault	Cable jointing contractor
5	BOQ estimation for jointing work (type, size and length of cable, type of jointing kit)	Cable jointing contractor
6	Filling material reservation slip (MRS) in SAP	SDO
7	Issuing and transporting material from store.	Cable jointing contractor
Jointing		
1	Cable preparation (overlap length of cable, slide of armour, build up with inner sheath etc)	Cable jointing contractor (for jointing details refer to manufacturer instruction manual)
2	Copper tape shields	
3	Core preparation	
4	Location of parts in completed joints	
5	Earthing of connection	
6	Completion of joints	
7	Take Photographs before, during and after jointing and send to CES	SDO
8	Supervision during jointing	SDO
9	Sending failed joint to Division store	Cable jointing contractor
Completion and reporting		
1	Intimate to breakdown team about joint completion.	Cable jointing contractor
2	Conduct HV test	Break down team
3	Restore of Supply through jointed cable	Break down team

4	Backfilling, compaction of excavated soil and removing of excess earth from the site	Cable jointing contractor
5	Completion information in Job Card (Details of work done, material consumption, location, feeder name and joint tag no., date, supervisor name, jointer name) sent to SDO	Cable jointing contractor
6	Above information sent to GNIIT	SDO
7	Send information about GPS location of Cable fault to GIS	SDO
8	Daily report of cable jointing to CES	Division Head
9	Updating of information in OMS including supervisor name, jointer name, feeder name	GNIIT
10	Information to include GPS location of cable fault.	GNIIT

Special Note-

1) Joints to be done preferably during day. In case of constraints, DGM (O&M) to authorize for night time jointing with supervisor
2) Daily joint report to be shared with CES
3) Bi-monthly analysis of faulty joint for ensuring warranty compliance to be organized at circle level by contractor in presence of DGM (O&M) and CES
4) Certification of job card for payment by DGM (O&M) subject to OMS compliance CES to check any gaps.
5) After completion of jointing (33kV and 66kV), all the joints shall be covered with RCC coffin. Coffin shall be filled with white sand complete from the hole provided at the top of the coffin.

Annexure – J Joint Marker



BSES

Technical Specification
For Heat Shrinkable &
GIS Cable Termination Kit
(11 kV, 33 kV, 66 kV XLPE Insulated Cables)

Specification no – BSES-TS-45-TERM-R0

Rev:		0
Pages		22
Date:		19 Apr 2022
Prepared by	Abhishek Vashistha	
	Gautam Deka/Pronab Bairagi	19/4/22
Reviewed by	Puneet Duggal	
	Amit Tomar	
Approved by	Gaurav Sharma	
	Gopal Nariya	

Index

Record of Revision

Item/Clause No.	Change in Specification	Approved By	Rev

1.0.0 Scope of work

Heat Shrinkable & GIS Termination Kits, suitable for 11 kV & 33 kV, 66 kV XLPE / PILC cables, shall be designed, manufactured, tested, packed and delivered by the Vendor, as per Purchaser's requirements.

2.0.0 Codes & standards

2.1.0 National Standards:

SL	Standard Number	Title
2.1.1	IS – 13573: 2011	Joints & Terminations of Polymeric Cables for working voltages from 6.6 kV up to and including 33 kV Performance Requirements and Type Tests
2.1.2	IS – 7098 Part 2 : 2011	Cross-linked Polyethylene (XLPE) Insulated PVC sheathed cables : Part 2 : For working voltages from 3.3 kV up to and including 33 kV
2.1.3	IS – 692: 1994	Paper insulated lead-sheathed cables (PILC) for rated voltages up to and including 33 kV specification
2.1.3	IS – 10810: 1984	Methods of test for cables
2.1.4	IS – 7098 Part 3 : 2019	Cross-linked polyethylene insulated thermoplastic sheathed Cables specification: Part 3 - For working voltages from 66 kV up to and including 220 KV

2.1.1 International Standards:

S No.	Standard Number	Title
2.2.1	EA TS – 09 – 13	Electricity Association – Technical Specification -09-13 Material component for use in Electric Power Cable Termination & Joints for System voltage above 1000 V up to 36 kV
2.2.2	IEEE – 48	Standards Test Procedures and requirements for high voltage alternating current cable termination
2.2.3	IEC – 60183	Guide to the selection of high voltage cables
2.2.4	IEC – 885 Part 1-3	Electric test methods for electric cables
2.2.5	IEC – 60840	Power cable with extruded insulation and their accessories for rated voltage above 30 Kv (Um=36 kV) up to 150 KV (Um=170 kV) – test methods and requirements.

3.0.0 Cable Construction

Normal sizes of XLPE cables used in BSES system and the construction features of these cables are indicated below:

a. 11 kV, 3-core x 150 sq mm AL
b. 11 kV, 3-core x 300 sq mm AL
c. 11 kV, 3-core x 400 sq mm AL
d. 11 kV, 3-core x 400 sq mm AL(OFC Embedded)
e. 11 kV, 1-core x 1000 sq mm AL
f. 11 kV, 1-core x 150 sq mm AL HTAB with copper metallic screen
g. 11 kV, 1-core x 150 sq mm AL HTAB with Aluminium wire metallic screen
h. 11 kV, 1-core x 95 sq mm AL HTAB with copper metallic screen
i. 11 kV, 1-core x 95 sq mm AL HTAB with Aluminium wire metallic screen
j. 33 kV, 3-core x 400 sq mm AL
k. 33 kV, 3-core x 400 sq mm AL (OFC Embedded)
l. 33 kV, 1-core x 1000 sq mm AL
m. 66 kV, 1-core x 630 sq mm AL
n. 66 kV, 1 core x 1000 sq mm AL
o. 66 kV, 3-core x 300 sq mm AL
p. 66 kV, 3-core x 300 sq mm AL(OFC Embedded)

PILC type Cables:

3-core 240 or 300 sq. Mm. Al

3.1.0	Conductor	For XLPE : a) Electrolytic Grade stranded Aluminium Conductor / Annealed Copper Conductor b) Grade: H2/ H4 as per IS: 8130/84 (For Al) c) Shape: Compacted Circular d) Class 2 For PILC : a) 11 kV : sector-shaped b) 33Kv: oval-shaped
3.2.0	Conductor Screen	For XLPE : Extruded Semi Conducting material For PILC : 11 kV : no conductor screen 33 kV : carbon paper
3.3.0	Insulation	For XLPE: Extruded TR XLPE For PILC: Layers of impregnated papers

3.4.0	Insulation Screen	**Non Metallic Screen:** For XLPE Insulated cable: a) For 11, 33 U/G cable and HTAB cable - Freely strippable Semi Conducting (without application of heat) b) For 66kV cable - Firmly bonded semi conducting **Metallic Screen:** a) For For 11, 33 & 66 Kv U/G cable – Copper Tape b) For HTAB – option 1 – Copper Tape (old installations) and option 2 – Aluminium wire (new installations) For PILC : a) 11 kV : absent (Belted) b) 33kV: metallised paper tape
3.5.0	Water Swellable Tape	For XLPE: Semi-conducting Water Swellable Tape shall be provided under the copper tape on each core. For PILC : not applicable
3.6.0	Filler	For XLPE: All interstices, including centre interstices filled by PP filler. Note- In special cases, for 66kV 3CX300 sqmm, 33kV, 3CX400 and 11kV 3CX400 cable are with-36 nos. Single mode and 12 nos. Multi modes OFC are also inbuilt as filler.Requirement of cable joint kit with OFC shall be fulfilled as per tender requirement For PILC : a) 11 kV : Crushed paper filler b) 33kV: Jute twine
3.7.0	Over all three cores	XLPE : Binder tape PILCA : 11 kV : belt paper 33kV: Copper Woven Fabric tape
3.8.0	Inner Sheath	For XLPE: Extruded Inner Sheath of Black PVC type ST-2. For PILC : Lead alloy sheath
3.9.0	Bedding Tape	For XLPE: not applicable For PILC: two layers of paper, followed by compounded (bituminized) cotton tape.
3.10.0	Copper Woven Fabric Tape (CWF tape)	For XLPE : not applicable For PILC : a) 11 kV : absent (Belted cable) b) 33 kV : applicable for screened cable
3.11.0	Armour	For XLPE : a) Galvanised Steel round Wires/ Galvanised steel flat strip armour (For 3 core cables) b) Hard drawn Aluminium Wire (For 1 core cables) c) Aluminium or lead sheathed for 1Core 66kV cables For PILC : a) 11 kV double steel tape armour
3.12.0	Binder Tape	For XLPE: Rubberised cotton tape

3.13.0	Outer Sheath	For XLPE: Extruded outer sheath of PVC (ST-2) for 11 kV/ 33 KV and HDPE for 66kV Cable with termite- repellent. For 66kV Cable- HDPE extruded semicon layer or HDPE with graphite layer. For PILC : compounded (bituminised) Jute/PVC
3.14.0	HTAB Cable (1CX150 and 1CX95) core construction	Aluminium conductor-conductor semicon screen- TR XPLE insulation-insulation semicon screen–Water Swell-able tape –Round wire armou installation) / Copper Tape (old installation)) Water Swell-able tape-outer sheath

4.0.0 Cable Termination Kits

General Technical Requirements for Cable Termination Kits are as follows:

4.1.0	Scope	Design, manufacture, testing and supply of Cable Termination Kits for H. T. Power Cables.
4.2.0	Functional Requirements	
4.2.1	Conductor Connection	

Voltage Grade	Cable Size	Application	Material of Lug	Connection Method
11 kV	3Cx150, 3Cx300 and 3Cx400 sq mm	Indoor	Bi-Metal	Crimping
		Outdoor	Bi-Metal/ Aluminium as per tender requirement	Crimping
	1Cx1000 sq mm	Indoor	Aluminium	Crimping
		Outdoor	Aluminium	Crimping
HTAB (indoor not required)	1Cx95	Outdoor	Aluminium	Crimping
	1Cx150	Outdoor	Aluminium	Crimping
33 kV	3Cx400 sq mm	Indoor	Aluminium	Crimping
		Outdoor	Aluminium	Crimping
	1Cx1000 sq mm	Indoor	Aluminium	Crimping
		Outdoor	Aluminium	Crimping
66 kV	3Cx300	Indoor	Aluminium	Crimping
		Outdoor	Aluminium	Crimping
	1Cx630, 1Cx1000 sq mm	Indoor	Aluminium	Crimping
		Outdoor	Aluminium	Crimping

* For Bimetallic Lug Copper portion shall be tinned

		a) For GIS cable termination kits: Plug in type, Conductor connection assembly shall be by standard method of split, silver-plated copper cone and pressure-fit contact assembly or as per manufacturer's standard. b) Top corners of all lugs shall be circular shape not rectangular. Refer Annexure F for details.(Except GIS kit)
4.2.2	Stress Control System	a) The earthed insulation screen of an XLPE cable is terminated at a suitable distance from the conductor. b) The tube is in electrical contact with insulation screen. c) Impedance of the tube shall be constant up to an operating temperature and shall be within the range $1x10^{08}$ ohm-cm to $8x10^{08}$ ohm-cm. d) Length of stress control tube for 11 kV and 33 kV shall be 130 mm and 260 mm respectively or according to insulation tube length. For 66kV termination kits, stress control tube shall be as per type tested design. e) The physical and electrical properties shall conform to ESI 09: 13. f) For GIS cable termination kits Stress control shall be by means of a polymeric stress cone. External profile of the cone shall match inner profile of GIS epoxy bushing. Vendor shall specify the material (EPDM / Silicone) of the cone.
4.2.3	Insulation Protection	a) XLPE insulation shall be protected by means of an outer tube, resistant to tracking and weathering. b) One end of the tube shall be coated internally with red sealant mastic for a length of 50 mm. c) Physical and Electrical properties shall conform to ESI 09: 13. d) Insulation Tube length for termination- shall be 650 mm for both Indoor and Outdoor Termination kits of 11kV, 3CX150, 3CX300 and 3CX400 sqmm cable. All other accessories related to termination shall be according to 650mm insulation tube length.
4.2.3.1	Outer Anti-tracking Tube	Outer length of the tube shall be controlled by providing creepage Extension Shed having the same material composition as the tube. These lengths are given in the table below: Creepage distance shall be 31mm/kV minimum.
4.2.3.2	OFC (66kV, 3CX300 sqmm , 33kV, 3Cx400 sqmm and 11kV, 3Cx400 sqmm cable)	Termination kit for OFC (36 single mode and 12 nos. Multi mode) shall be supplied along with termination kit.

Cable System		Length of tube (mm)		Creepage Extension Shed (No.)	
Voltage	Cores	Indoor	Outdoor	Indoor	Outdoor
11 kV	3 – core	650	650	Nil	2

	1 – core	340	340	NIL	2
33 kV	3 – core	800	1200	2	5
	1 – core	600	600	2	5

4.2.3.3	Oil Barrier Tube (applicable for PILC cable termination)	a) Transparent tube is used for restoring the insulation provided by belt paper, which is terminated at the crotch. b) 33 kV PILC Termination: The oil barrier tube provides an oil-resistant layer to contain impregnating compound within, thus preventing anti-tracking tube coming in contact with the impregnating compound.
4.2.4	Environmental Sealing System	a) Red Sealant Mastic Tape: This tape, used for sealing at ends, shall be synthetic rubber-based and resistant to tracking and weathering. Sufficient quantity of this tape shall be provided. b) Lug-sealing Sleeve: It shall have the same material composition as outer anti-tracking tube. The sleeve shall be fully coated internally with red sealant mastic tape. Length of the sleeve shall be so as to cover half length of the lug barrel and an equal length of track-resistant tube. c) Conductive Break-out: It shall be provided over the crotch for 3-core cables. The break-out base shall overlap PVC outer sheath by a 50 mm. Minimum. d) For GIS termination kits : Environmental sealing of cores below the switchgear shall be by means of a trifurcation kit, consisting of heat shrinkable conductive break-out and heat-shrinkable conductive tube of total length of 6 metres supplied in one roll.

4.2.5	Earth Bond System	Minimum Armour Fault Current Carrying capacity of cbles is as following: 11 kV U/G Cable – 11 kA for 1 sec 33 kV Cable – 31.5 kA for 1 sec 66 kV Cable – 31.5 kA for 1 sec 11 kV HTAB Cable – 11 kA for 1 sec Fault current requirement shall be met by Tinned copper braid as per following: 11 kV U/G cables – Three No's 25 sq mm each 33 kV Cable – Four No's of 50 sq mm each 66 kV Cable – Four No's of 50 sq mm each HTAB Cable with copper tape metallic screen – Three No's of 25 sq mm each Length of the copper braided conductor shall be 750 mm. Each copper braided conductor shall be supplied with copper lug, crimped at one end For HTAB Cable with Aluminium wire metallic screen – Tinned copper braid is not required. 1 No's of Aluminium crimping lug of 120 sq mm cross section area shall be provided instead
4.2.6	Suppression of electrical discharges	Following materials are required for use during cable termination : a) Silicone-based compound Required for filling-in minute services/ surface cracks over XLPE insulation. b) Polymeric mastic Required for application over semicon screen, for, eliminating any air-entrapment at any cut point on the surface. It should have sufficient elongation and electrical properties compatible with stress control tube.
4.2.7	Installation. Instruction Sheet	It shall be in English and Hindi language and shall be provided inside every kit.
4.2.8	Paper Measuring Tap	Required for use during cable preparation / terminations.
4.2.9	Identification Tag (for traceability)	a) An aluminum pouch with paper tag & sealing arrangement at one end shall be provided. b) This tag is required to be tied over the cable at one side of the joint. c) The paper tag shall give following information 1) Vendor kit designation 2) Division 3) Breakdown ID/Shutdown ID/Scheme No. 4) Cable section 5) Type of joint 6) Size of Joint 7) Make of joint 8) Voltage class

		9) Serial no. of kit 10) Vendor lot & batch no 11) Month & year of manufacturing 12) Date of installation 13) Name of jointer 14) Name of vendor supervisor 15) Name of BSES supervisor 16) Remarks In addition to above Stainless Steel Tag shall be provided with following details for straight through joint a. Manufacturing month and year (MM/YY format) b. Manufacturer name i.e Comp c. Manufacturer own sl no for future tracing
4.3.0	Technical Particulars	Vendor shall submit Guaranteed Technical Particulars (GTP) as per Annexure A.
4.4.0	Type Tests	i. Termination Kit shall be of type-tested quality from CPRI/ERDA/KEMA/CESI as per the BIS/IEC/IEEE within last 5 years. ii. In case of type test is more than 5 years old but less than 10 years old, bidder has to give undertaking that there is no changes in design. iii. In case of type test report is more than 10 years old, bidder has to conduct type test from CPRI/ERDA/KEMA/CESI as per the BIS/IEC/IEEE without any cost implications to BSES
4.5.0	Testing & Inspection	
	a) Tests	All the routine and acceptance tests shall be carried out as per ESI guidelines. (Also refer Annexure -C)
	b) Inspection	1) Buyer reserves the right to witness all tests specified on individual H. S. components, Moulded components or completed Cable Termination Kit. 2)Buyer reserves the right to inspect Cable Termination Kit at the Seller's works at any time, prior to dispatch, to verify compliance with the specification. 3) In-process and final inspection call intimation shall be given in 10 days advance to purchaser.
	c) Test Certificates	Three sets of complete Test Certificates (Routine & Acceptance tests) shall be submitted along with the delivery of Cable Termination Kits.
4.6.0	Documents	"Documents" refer to Documents, Data, Manuals, etc. (Scanned copy of signed documents also shall be part of entire soft file (e-file) or CD.)

4.6.1	Along with the Bid	Vendor shall submit signed 3 sets (plus 1 set of soft copy) of following documents: a) GTP (duly filled-in) (as per Annexure - A). b) Cross-sectional drawings for components Assembly c) Type Test Certificates d) Complete Catalogue and Instructions. e) Any other document.
4.6.2	After Award of Contract	Vendor shall submit signed 2 sets (plus 1 set of soft copy) of above mentioned documents within 15 days, for Purchaser's approval.
4.6.3	"As-Built" documents	Final signed "As-built" documents for the equipment in 3 sets (hard copy), 1 no. soft copy and 1 no. CD. These documents shall include signed Routine & Acceptance Test Certificates also.
4.7.0	Packing, Marking, Shipping, Handling and Storage	Every component/kit/box shall be properly sealed/ packed for protection against damage.
a)	Identification Labels:	Markings / Labels shall be on both sides of every packed box. 1) Identification number/type designation (as per manufacturer's standard) 2) Voltage grade, size, description of the Kit (including the voltage grade, size, type of the cables, for which it is to be used) 3) Batch no., lot no., etc. 4) Quantity 5) a) Purchase Order no. & date b) Purchaser's name c) BSES's SAP code number 6) Weight (kg) of each Cable Termination Kit and of each box containing kits. 7) Manufacturer's name 8) Month & Year of Manufacturing 9) Date of packing, Shelf life (if applicable) 10) In case, the termination kit is for RMU, following text shall be written in bold letters, with higher font size : "For RMU Application".
b)	Transit damage	The seller shall be responsible for any transit damage due to improper packing.

5.0.0 Quality Assurance (QA)

5.1.0	Vendor's Quality Plan (QP)	To be submitted for Purchaser's approval.
5.2.0	Sampling Method	Sampling Method for quality checks shall be as per manufacturer's standard practice / ESI guidelines and Purchaser's prior approval shall be taken for the same.
5.3.0	Inspection Hold-Points	To be mutually identified, agreed and approved in Quality Plan.

6.0.0 Deviations

6.1.0.	Deviations	a) Deviations from this specification shall be listed by bidder clause wise along with optional offer and has to submit the list along with bid./quotation. BSES will review the deviations and if BSES is agreed with the deviation, seller has to take written confirmation from BSES on deviation during tender evaluation.. b) In the absence of any list of deviations from the Seller with bid as well as written confirmation from BSES on deviations, it will be assumed by the Buyer that the Seller complies with the Specification fully. c) Any deviations mentioned in any other submitted bid documents (i.e.in filled GTP, Catalog, BSES old approval, buyer's/seller's standards etc) by seller without separate deviation sheets will not consider as a deviation from this tech spec at any stage of contract.

7.0.0 Delivery

7.1.0.	Delivery	Despatch of Material: Vendor shall despatch the material, only after the Routine Tests/Final Acceptance Tests (FAT) of the material witnessed/waived by the Purchaser, and after receiving written Material Despatch Clearance (MDC) from the Purchaser.

8.0.0 Inspection Expenses

Not Applicable

9.0.0 Penalty

Joint/Termination failure under warranty in regards to poor quality joint, poor work man ship, etc. shall be in the account of vendors. All kind of losses due to Joint/Termination failure shall be recovered from vendor.

Annexure – A: Guaranteed Technical Particulars (GTP)

The Seller is deemed to have examined all parts of the Specification documents and to have been fully informed, as to the nature of work and the conditions related to its performance.

S No.	Description	Purchase requirement	Vendor's data
1	Manufacturer's name		
2	Purchase Order no. & date		
3	Guarantee Period (minimum)	60 Months (from date of commissioning) / 66 Months (from date of receipt at Purchaser's store), whichever is earlier	
4	Applicable IS / IEC Standard followed by Vendor (incl. type test standard)		
5	Voltage Grade (kV)		
5.1	Lightning Impulse Voltage Withstand Test		
5.2	4Uo AC voltage withstand test for 4 hours	To be conducted on Installed joint at works	
6	Continuous operating temperature	90 deg. C	
7	Functional Requirements		
7.1	Method of Stress Control and Discharge Suppression		
7.2	Method of Insulation build-up and screening		
7.3	Method of earth bond a) Size and no. of braids b) Size of armour support c) No. of hose clips		
7.4	Method of mechanical protection a) for 3-core Cable b) for 1-core Cable		
7.5	Method of protection against corrosion (type & coating thickness of protective layer on steel mat)		
7.6	Method of conductor continuity a) For crimping connector b) For mechanical connector		

8	Description of items in the Kit, which are imported /sourced From Principal /Sub-suppliers		
9	Names of items in the Kit and their respective shelf life (months I years)		
10	Kit Content Table (KCT) enclosed? (Refer Annexure — B)	Yes / No	
11	Drawing for connector (ferrule) enclosed	Yes / No (If yes, mention the document reference)	
12	Is Annexure - D (Technical Deviation Sheet) duly filled-in?		
13	Packing (Qty) i) Packing of every Kit h) Group Packing	1 no -- No. of Kits per Box -- No. of Boxes	
14	Installation Procedure enclosed?	Yes / No (If yes, mention the document reference)	
15	Quality Assurance Plan (QAP for raw materials, in-process inspection, factory testing) is enclosed?	Yes / No	
16	Whether all heat-shrinkable and moulded components of the kit meet the requirements of and have been tested in accordance with EA TS -09-1 3.(for heat-shrinkable joints)	Yes / No (If yes, details of test report no. /Date /name of test laboratory to be mentioned.)	
17	Type Test Reports (TTR) (Relevant test report no. & date, With type, size, other details of each type of Kit.) a) Prepared Joint: CPRI TTR as per BIS / IEC enclosed? b) Loose Components: CPRI TTR as per EA TS 09-13 enclosed?	 Yes/No Yes/No	

18	Printing details on each of the Heat- shrinkable and Moulded components	(Mention the text, presently printed on each of the component)	
19	OFC kit (For OFC embedded cable only 66Kv, 3CX300 sqmm , 33Kv, 3cx400 sqmm and 11kv, 3cx400 sqmm)	Yes/no	

Annexure – B: Kit Content Table (KCT)

Vendor shall submit KCT as a consolidated table, consisting of all data, such as:

A. Heading

1. Voltage grade, size, description of the Kit
(Including the voltage grade, size, type of the cables, for which it is to be used)

2. Type designation (as per manufacturer's standard)

B. Details / Parameters

(For each component/item of the KCT)
1. Lot no. /Batch no., etc.
2. Item number (manufacturer's standard)
3. Description
a) Material, type, make and grade
b) Dimensions cross sectional area
c) Colour,
d) Other description, if any
4. Function of the item
5. Quantity
6. Make/Name/Location of manufacturer/sub-vendor
7. a) Minimum supplied (or in expanded form) diameter
   b) Maximum freely recovered diameter
8. a) Minimum supplied (or in expanded form) thickness
   b) Maximum freely recovered thickness

C. Notes on the KCT

Markings, printings, other details for individual/group of components are to be mentioned on KCT. For example:
a) Printing of item code, size, batch no., etc.
b) Printing on components
c) Other embossing or engraving, it any.

(Note: Vendor may attach an Annexure, for any additional information, if required.)

Annexure – C: Routine and Acceptance Test

A. Visual Examination

Condition of selected items / components, as per sampling method, shall be recorded. Some of the normal check-points can be as follows:

1. Every component shall be verified in quantity and description as per KCT.
2. All items shall be free from any defects, pin holes, cracks, etc.
3. Metallic components to be free from sharp edges.

B. Measurements of Dimensions

(Required / observed dimension — length, diameter, etc.)

1. Supplied dimensions
2. Recovered dimensions

C. Destructive Testing

On various heat-shrinkable / moulded components of ready Kits

(Items 3 and 4 are applicable only for heat-shrinkable components)

1. Tensile Strength
2. Wall Thickness Ratio
3. Heat Shock
4. Longitudinal Change, after full recovery
5. Ultimate Elongation
6. Low Temperature Flexibility
7. Dielectric Strength
8. Volume Resistivity

D. Routine Test Reports (RTR)

(Typical)

Each RTR shall clearly indicate P.O. no. & date and also BSES's SAP code no. RTR shall record the serial numbers of the kits selected, as per vendor's sampling method. Following details, besides vendor's/manufacturers standard check-points, shall appear in every RTR.

Annexure – D: Technical Deviation Sheet

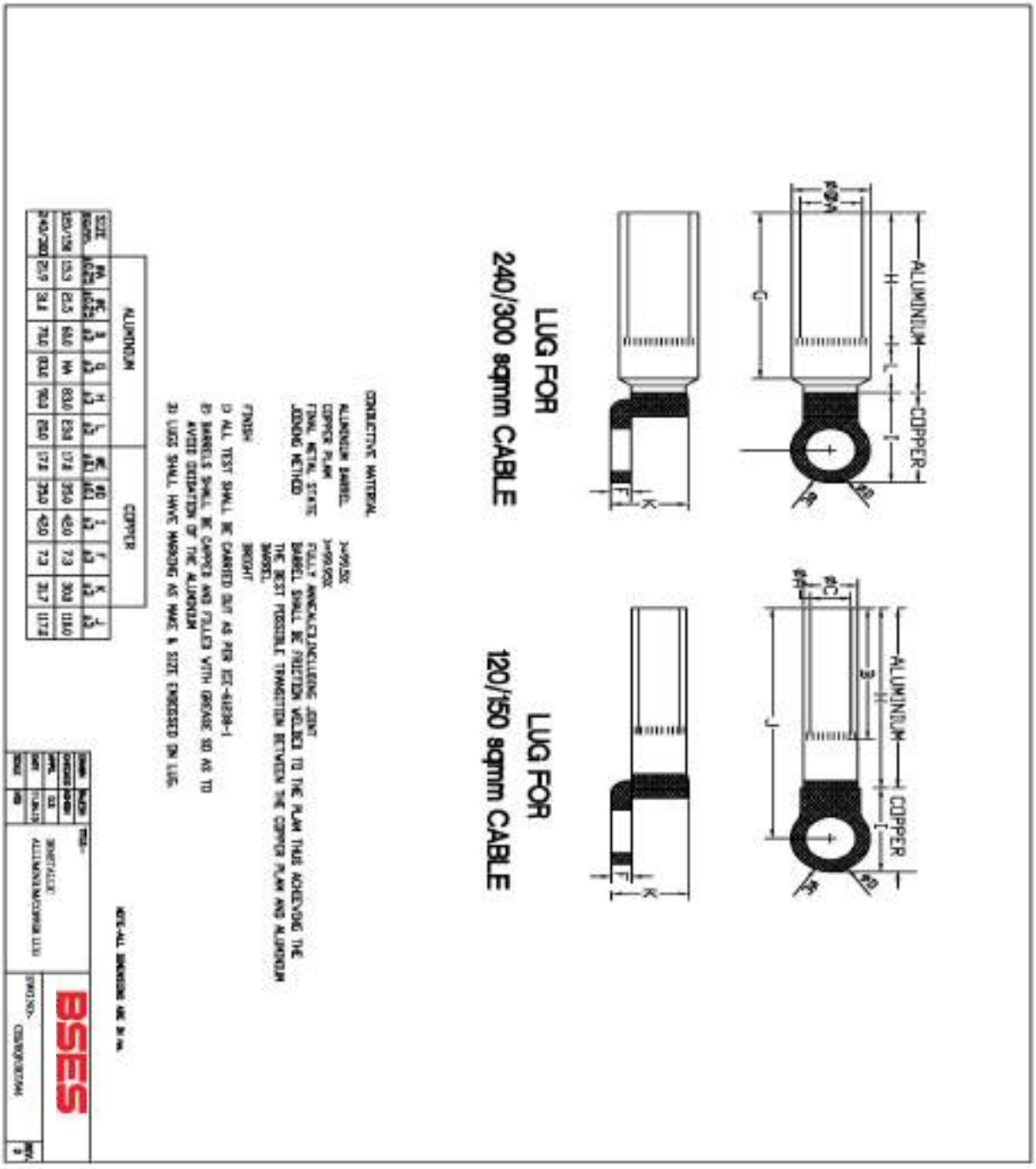
Sr No.	Clause No.	Deviation

Annexure – E: Service Conditions

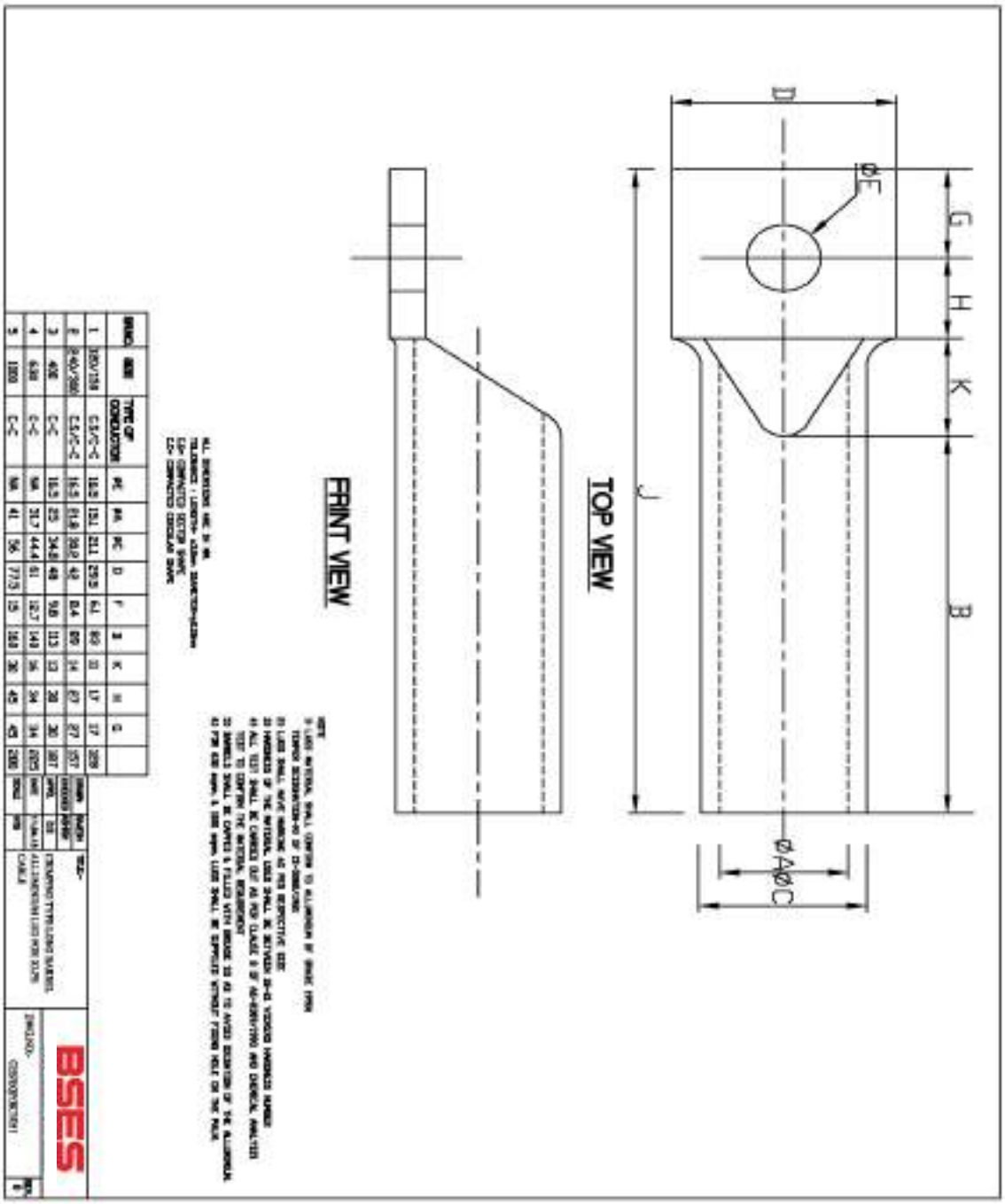
(Atmospheric conditions at Site)

1	Delhi	
a)	Average grade Atmospheric Condition:	Heavily Polluted, Dry
b)	Maximum altitude above sea level	1000 M
c)	Ambient Air temperature	Highest 50 deg C, Average 40 deg C
d)	Minimum ambient air temperature	0 deg C
e)	Relative Humidity	90 % Max
f)	Thermal Resistivity of Soil	150 Deg. C cmm
g)	Seismic Zone	4
h)	Rainfall	750 mm concentrated in four months

Annexure – F: Bimetallic Aluminium / Copper Lug



Annexure – G: Aluminum/Copper Lug For XLPE Cable



Annexure-H

SOP FOR REPAIRING OF CABLE FAULT (Shall be part of PO)		
Sl. No.	Activity	Responsibility
Initiation		
1	Identify and isolate fault and inform GNIIT in case of cable fault	Break down team
2	Updation of the details in OMS against respective feeder tripping event.	GNIIT
Fault Location		
1	Information sent to FLC team and SDO.	GNIIT
2	Mobilize FLC team and cable jointing contractor.	SDO
3	Identification of fault location	FLC Team
Preparation for Jointing		
1	Seeking permission from road owning agency	SDO
2	Payment of RR charges to Road owning agency	Finance
3	Digging	Cable jointing contractor
4	Cut faulty section and Pre-test (HV test) cable for multiple fault	Cable jointing contractor
5	BOQ estimation for jointing work (type, size and length of cable, type of jointing kit)	Cable jointing contractor
6	Filling material reservation slip (MRS) in SAP	SDO
7	Issuing and transporting material from store.	Cable jointing contractor
Jointing		
1	Cable preparation (overlap length of cable, slide of armour, build up with inner sheath etc)	Cable jointing contractor (for jointing details refer to manufacturer instruction manual)
2	Copper tape shields	
3	Core preparation	
4	Location of parts in completed joints	
5	Earthing of connection	
6	Completion of joints	
7	Take Photographs before, during and after jointing and send to CES	SDO
8	Supervision during jointing	SDO
9	Sending failed joint to Division store	Cable jointing contractor
Completion and reporting		
1	Intimate to breakdown team about joint completion.	Cable jointing contractor
2	Conduct HV test	Break down team
3	Restore of Supply through jointed cable	Break down team
4	Backfilling, compaction of excavated soil and removing of excess earth from the site	Cable jointing contractor

5	Completion information in Job Card (Details of work done, material consumption, location, feeder name and joint tag no., date, supervisor name, jointer name) sent to SDO	Cable jointing contractor
6	Above information sent to GNIIT	SDO
7	Send information about GPS location of Cable fault to GIS	SDO
8	Daily report of cable jointing to CES	Division Head
9	Updating of information in OMS including supervisor name, jointer name, feeder name	GNIIT
10	Information to include GPS location of cable fault.	GNIIT

Special Note-

1) Joints to be done preferably during day. In case of constraints, DGM (O&M) to authorize for night time jointing with supervisor
2) Daily joint report to be shared with CES
3) Bi-monthly analysis of faulty joint for ensuring warranty compliance to be organized at circle level by contractor in presence of DGM (O&M) and CES
4) Certification of job card for payment by DGM (O&M) subject to OMS compliance CES to check any gaps.
5) After completion of jointing (33kV and 66kV), all the joints shall be covered with RCC coffin. Coffin shall be filled with white sand complete from the hole provided at the top of the coffin.