BSES Yamuna Power Limited

NOTICE INVITING TENDER (NIT)
FOR
SUPPLY, ERECTION, TESTING, & COMMISSIONING OF 11KV SWITCHBOARD ALONG WITH ALLIED EQUIPMENTS, ACCESSORIES AND WORKS AT HASANPUR DEPOT ON TURNKEY BASIS.

NIT NO: CMC/BY/22-23/RS/MD/13

Due Date for Submission: 06.06.2022, 15:00 HRS

BSES YAMUNA POWER LIMITED (BYPL)
CONTRACTS & MATERIALS DEPT.,
SHAKTI KIRAN BUILDING, KARKARDOOMA,
DELHI-110032
CIN: U40109DL2001PLC111525
WEBSITE: www.bsesdelhi.com

BSES Yamuna Power Limited

INDEX

BSES Yamuna Power Limited

VOLUME – I: INFORMATION TO BIDDER (ITB)

BSES Yamuna Power Limited

SECTION – I: REQUEST FOR QUOTATION

1.00 EVENT INFORMATION

1.01 BSES Yamuna Power Ltd (hereinafter referred to as **"BYPL"**) invites sealed tenders in 2 envelopes for following scope of works:

S No.	Items	Estimate Cost Value In INR	EMD Value In INR
1	**SUPPLY, ERECTION, TESTING, & COMMISSIONING OF 11KV SWITCHBOARD ALONG WITH ALLIED EQUIPMENTS, ACCESSORIES AND WORKS AT HASANPUR DEPOT ON TURNKEY BASIS.**	2.88 Crore	5.76 Lakh

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

All envelopes shall be duly super scribed "BID FOR SUPPLY, ERECTION, TESTING, & COMMISSIONING OF 11KV SWITCHBOARD ALONG WITH ALLIED EQUIPMENTS, ACCESSORIES AND WORKS AT HASANPUR DEPOT ON TURNKEY BASIS, NIT NO: CMC/BY/22-23/RS/MD/13, DUE ON 06.06.2022, 15:00 Hrs."

Bid shall be submitted in two (02) parts. Details of part are as follow:
Part A – Techno-Commercial Bid
Part B – Price Bid

1.1. The schedule of specifications with detail terms & conditions can be obtained from address given below against submission of non-refundable demand draft of **Rs 1,180/-** drawn in favour of BSES Yamuna Power Ltd, payable at Delhi or Online transfer of requisite amount through NEFT/ RTGS. The tender documents & detail terms and conditions can also be downloaded from the website www.bsesdelhi.com **--> BSES YAMUNA POWER LTD --> Tender --> Open Tenders**
In case tender papers are downloaded from the above website, then the bidder has to enclose a demand draft covering the cost of bid documents.

1.2. Bids will be received up to **06.06.2022, 15:00 Hrs.** at the address given below.
Part A of the Bid shall be opened on **07.06.2022, 15:30 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.

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

1.3 BSES Yamuna Power Ltd reserves the right to accept/reject any or all tenders without assigning any reason thereof in the event of following:

a) Tender fee of requisite value is not deposited.

b) Earnest Money Deposit (EMD) of requisite value & validity is not deposited in shape of Bank Guarantee drawn in favor of BSES Yamuna Power Ltd, payable at Delhi or Online transfer of requisite amount through NEFT/RTGS

c) The offer does not contain prices indicating break-up towards all taxes & duties in prescribed format.

d) Complete Technical details are not enclosed as per the Technical Bid Submission Checklist

e) Tender is received after due date and time.

f) Technical offer contains any prices.

g) Prices are not FIRM and subject to Price Variation.

2.00 QUALIFICATION CRITERIA

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

2.01 **Technical Criteria:**

SN	Qualification Criteria	Documents to be submitted by bidder
1	The bidder should have own manufacturing facility in India for 11KV Switchgear Panels for last 3 years.	Factory incorporation certificate / Undertaking. Details of manufacturing units, locations and works from where supply against this tender shall be proposed to be furnished.
2	The bidder should have servicing , repairing, testing & refurbishment facility in INDIA with necessary spares and testing equipment for providing prompt after sales service for switchgear panels.	Relevant Details/certificates/Undertaking (Details of the set-up available shall be brought out in the offer.The bidder shall also submit undertaking along with the bid confirming the infrastructure details submitted)
3	The bidder should have manufacturing capacity for a minimum of 10-15 nos. 11KV switchgear panels per month.	Installed Capacity Certificate
4	The bidder should have successfully designed, supplied, installed/errected & commissioned a minimum of two projects of 11KV AIS Switchboards during the last 5 years.	a. Work Order copies b. Work completion certificates c. List of projects executed including customer name, PO number (with date), date of completion and rating (Capacity/Voltage etc) shall be provided.
5	Performance certificate for minimum 2 years satisfactory performance of projects of 11 kV switchgears,executed during the last 5 years from at least two utilities/ SEB/ PSUs / reputed firm wherin the end user shall be Utility/SEB's/PSU's. In case of bidder has previous association with BYPL/BRPL for similar product and service,the performance feedeback from BYPL/BRPL shall only be considered irrespective of performance certificates issued by any third party organization.	Performance certificate

6	The bidder is supposed to have agreement with manufacturer/service provider to provide support to BYPL for any service & spares related issues for time stipulated in the specification or service life of the equipments.	Undertaking for Back up support by OEM's
7	The Bidder must posses valid ISO 9001:2015 certification	Valid ISO 9001:2015 certificate

2.02 **Commercial Criteria:**

SN	Qualification Criteria	Documents to be submitted by bidder
1	Bidder should have Average Annual Sales Turnover of Rs 500 Crores or more during last three (3) Financial Years (i.e., FY 2019-20, 2020-21 & 2021-22).	Balance Sheet and Duly certified CA certificate to be submitted
2	The Bidder shall submit an undertaking that "No Litigation" is pending with BYPL or its Group/Associates Companies.	Self Undertaking
3	An undertaking that the bidder has not been blacklisted/debarred by any central/state government institution/Electricity utilities	Self Undertaking
4	The bidder must have valid PAN No., GST Registration Number, in addition to other statutory compliances. The bidder must submit the copies of registrations and submit an undertaking that the bidder shall comply all the statuary compliances as per the laws/rules etc. before the start of the supply/work.	Relevant Statutory Documents Copy/ Undertaking
5	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, suitable sub-contractor having the valid license shall be engaged for works at site wherein copy of valid license shall be submitted to BYPL before the start of the work OR Bidder to give undertaking that it will be obtained by them before the start of the work at site.	a. Electrical Contractor License Copy b. Self undertaking if not available

The subsidiaries of global/Indian companies are also eligible to bid if the qualification requirements stated above are met independently or in combination with parent/sister concern/group Company. However, the bidder should have an establishment of permanent nature in India.

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

3.00 BIDDING AND AWARD PROCESS

Bidders are requested to submit their offer strictly in line with this tender document. BYPL shall response to the queries raised by various bidders and the clarification will be distributed to all participating bidders through website.

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

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

3.01 BID SUBMISSION

Please mention our NIT Number: -"CMC/BY/22-23/RS/MD/13, DUE ON 06.06.2022, 15:00 Hrs". on the Tender and drop the same in our Tender Box placed at:
BSES Yamuna Power Ltd, Reception, Ground Floor, Shaktikiran Building, Karkardooma, Delhi 110032

The bids and the outer envelope shall be addressed to:

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

Kindly Note:

- Bidder will inform BYPL through mail within 02 hours from the submission or before the due date & time of submission to TPC & Buyer:
  1. Mr Rakesh Sharma, E-mail: Rakesh.Ku.Sharma@relianceada.com
  2. Mr Mahesh Dariyal, E-mail: Mahesh.Dariyal@relianceada.com
- Tender documents shall be submitted at main gate in tender box.
- Authorized person of TPC will collect the documents from tender box at scheduled time of tender submission and verify the bid documents with mails received. A confirmation of receipt shall be sent to bidder through mail by TPC on the same day.
- Bidder has to ensure that tender copy is dropped in correct box designated for tender submission only.
- BYPL shall not be responsible for any wrong placement of tender document by bidder.

BSES Yamuna Power Limited

PART A :: TECHNICAL **BID** comprising of following (1 Original copy + 1 soft copy in pen drive):

S. N	Descriptions	Type of Documents
Commercial :		
1	**Tender Fee - Demand Draft (Rs.1180/-) (Incl GST)**	Non-refundable demand draft for Rs 1180/- in case the forms are downloaded from website
2	**EMD**	In prescribed stamp paper & format
3	**Power-of-Attorney**	In prescribed stamp paper & format
4	**PQR Compliances**	Documentary evidence in support of qualifying criteria like: 1. Details of constitution of the company (Proprietary/Limited/etc along with the details), Memorandum of Association of the company 2. Bidders shall submit the certified annual Balance sheets for the last completed three (3) financial years 3. Supportive document on Positive Net worth. Credit rating/solvency certificate from competent authority. 4. Copies of Orders, Execution /Performance Certificate & Other Documents to support qualification Criteria
5	**Signed Tender document**	Original Tender documents duly stamped & signed on each page as token of acceptance
6	**Black listing undertaking**	Bidder should submit a Self-undertaking signed by its Authorized Signatories that the Bidder or any of their sub-contractor has not been blacklisted/barred by any Govt. Organization or Regulatory Agencies in India or abroad.
7	**Commercial Terms and Conditions**	Acceptance on Commercial Terms and Conditions viz Delivery schedule/period, Payment terms, PBG etc.
8	**Acceptance on Reverse Auction**	Duly signed Acceptance Form For Participation In Reverse Auction Event as per attached format
9	**Bid Form (Unpriced) Duly Signed**	Duly Signed Bid Form as per attached format
10	**Un price Bid Duly Signed**	Duly Signed Un price Bid as per attached format
Technical:		
11	**Technical Details/ Filled in GTP/Drawings**	Bidder shall submit duly filled GTP with all Technical documents and Drawings.
12	**Type Test Reports**	Bidders shall submit the copy of type test reports in their technical bids in support of technical specifications
13	**Testing Facilities**	Bidder shall submit the details of testing facilities available at their works/factory.
14	**Organization Chart & Manpower Details.**	Bidder shall submit the details of Organization & Manpower with qualification and experience.
15	**Pen drive**	Bidder shall submit above all document (technical bid) in Pen drive also.

PART B **:: FINANCIAL BID** comprising of (01 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	Due date
1	Last Date of Sale of Bid Documents	03.06.2022, 17:00HRS
2	Last Date of queries, if any	24.05.2022, 15:00HRS
3	Pre-Bid meeting	25.05.2022, 15:00HRS
4	Posting of consolidated replies to all Pre-Bid queries as received.	27.05.2022, 15:00HRS
4	Last Date of Receipt of Bid Documents	06.06.2022, 15:00HRS
5	Date & Time of Opening of PART A - Technical and Commercial Bid	07.06.2022, 15:30HRS

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. Bids shall be liable to reject if any price part is attached in Part-A technical bid.

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

Notwithstanding anything stated above, the Purchaser reserves the right to assess bidder's capability to perform the contract, should the circumstances warrant such assessment in the overall interest of the purchaser. In this regard the decision of the purchaser is final.

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

Notwithstanding anything stated above, the Purchaser reserves the right to assess bidder's capability to perform the contract, should the circumstances warrant such assessment in the overall interest of the purchaser. In this regard the decision of the purchaser is final. Bidder to submit their acceptance as per format attached ANNEXURE-C

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

BSES Yamuna Power Limited

4.00 AWARD DECISION

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

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

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

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

5.00 MARKET INTEGRITY

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

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

6.00 SUPPLIER CONFIDENTIALITY

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

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

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

7.00 CONTACT INFORMATION

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

BSES Yamuna Power Limited

Address	Name/ Designation	E-mail Address
Technical		
CES Dept. 3rd Floor, B-Block, BSES Yamuna Power Ltd Shaktikiran Building, Karkardooma, Delhi 110032	Gaurav Sharma Addl. VP (HOD-CES)	gaurav.a.sharma@relianceada.com
	Srinivas Gopu GM (CES)	srinivas.gopu@relianceada.com
	Abhishek Harsh DGM (CES)	abhishek.harsh@relianceada.com
Commercial		
C&M Dept. 3rd Floor, A-Block, BSES Yamuna Power Ltd Shaktikiran Building, Karkardooma, Delhi 110032	Robin Sebastian VP (HOD-C&M)	robin.sebastian@relianceada.com
	Santosh Singh Addl. VP (Head-Procurement)	Santosh.kum.singh@relianceada.com
	Mahesh Dariyal Asst. Manager (C&M)	mahesh.dariyal@relianceada.com

SECTION – II: INSTRUCTION TO BIDDERS

A. GENERAL

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

2.00 SCOPE OF WORK

The scope of work under this contract shall include the turnkey execution on End to End Basis , including Designing, manufacturing, inspection & testing, dispatches, loading , unloading ,storage at site, erection & installation, testing of the installation, commissioning ,handing over to the purchaser.

3.0 DISCLAIMER

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

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

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

this office immediately.

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

4 COST OF BIDDING

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

B. BIDDING DOCUMENTS

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

(a) Request for Quotation (RFQ)
(b) Instructions to Bidders
(c) General Terms & Conditions of Contract (T&C)
(d) Delivery schedule
(e) Price Formats & Summary T&C
(f) Bid Form
(g) Acceptance Format – RA
(h) EMD BG Format
(i) Vendor code of conduct
(j) Appendix
(k) Technical Specifications (TS)

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

6.0 AMENDMENT OF BIDDING DOCUMENTS

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

6.02 The Amendment shall be part of the Bidding Documents, pursuant to Clause 5.01, and it will be notified in web site **www.bsesdelhi.com** and the same will be binding on them.

6.03 In order to afford prospective Bidders reasonable time in which to take the Amendment into account in preparing their Bids, the Purchaser may, at its discretion, extend the deadline for the submission of Bids. The same shall be published as a corrigendum in website **www.bsesdelhi.com**

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

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

C. PREPARATION OF BIDS

7.0 LANGUAGE OF BID

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

8.0 DOCUMENTS COMPRISING THE BID

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

(a) Bid Form, Price & other Schedules (STRICTLY AS PER FORMAT) and Technical Data Sheets completed in accordance with Technical Specification.

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

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

9.0 BID FORM

9.01 The Bidder shall submit one "Original" and one "Copy" of the Bid Form and the appropriate Price Schedules and Technical Data Sheets duly filled in as per attached specification enclosed with the Bidding Documents.

9.02 EMD

Pursuant to Clause 8.0(b) above, the bidder shall furnish, as part of its bid, a EMD amounting to as specified in the Section-I. The EMD is required to protect the Purchaser against the risk of Bidder's conduct which would warrant forfeiture.

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

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

(b) EMD shall be valid for One Hundred Twenty (120) days after due date of submission drawn in favour of BSES Yamuna Power Ltd

The EMD may be forfeited in case of:

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

(b) the case of a successful Bidder, if the Bidder does not
(i) Accept the Purchase Order,
or
(ii) Furnish the required performance security BG.

10.0 **BID PRICES**

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

10.02 The prices offered shall be inclusive of all costs as well as Duties, Taxes and Levies paid or payable during execution of the supply work, breakup of price constituents, should be there.

10.03 Prices quoted by the Bidder shall be **"Firm"** and not subject to any price adjustment during the performance of the Contract. **A Bid submitted with an adjustable price/ Price Variation Clause will be treated as non -responsive and rejected.**

10.04 The quantity break up shown else-where other than Price Schedule is tentative. The bidder shall ascertain himself regarding material required for completeness of the entire work. Any items not indicated in the price schedule but which are required to complete the job as per the Technical Specifications/ Scope of Work/ SLA mentioned in the tender, shall be deemed to be included in prices quoted.

11.0 **BID CURRENCIES**

11.01 Prices shall be quoted in Indian Rupees Only.

12.0 **PERIOD OF VALIDITY OF BIDS**

12.01 Bids shall remain valid for 120 days from the due date of submission of the Bid.

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

13.0 **ALTERNATIVE BIDS**

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

14.0 **FORMAT AND SIGNING OF BID**

14.01 The original Bid Form and accompanying documents (as specified in Clause 5.0), clearly marked "Original Bid" plus one 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 copies, the original shall govern.

14.02 The original and copy of the Bid shall be typed or written in indelible ink and shall be signed by the Bidder or a person or persons duly authorized to sign on behalf of the Bidder. Such authorization shall be indicated by written Power-of-Attorney accompanying the Bid. The Bid submitted on behalf of companies registered with the Indian Companies Act, for the time being in force, shall be signed by persons duly authorized to submit the Bid on behalf of the Company and

shall be accompanied by certified true copies of the resolutions, extracts of Articles of Association, special or general Power of Attorney etc. to show clearly the title, authority and designation of persons signing the Bid on behalf of the Company. Satisfactory evidence of authority of the person signing on behalf of the Bidder shall be furnished with the bid. A bid by a person who affixes to his signature the word 'President', 'Managing Director', 'Secretary', 'Agent' or other designation without disclosing his principal will be rejected.

The Bidder's name stated on the Proposal shall be the exact legal name of the firm.

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

D. SUBMISSION OF BIDS

15.0 **SEALING AND MARKING OF BIDS**

15.01 Bid submission: One original (hard copy) & one pen drive (sort copy without price bid) of all the Bid Documents shall be sealed and submitted to the Purchaser before the closing time for submission of the bid.

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

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

16.0 **DEADLINE FOR SUBMISSION OF BIDS**

16.01 The original Bid, together with the required copies, must be received by the Purchaser at the address on or before the due date & time of submission.

16.02 The Purchaser may, at its discretion, extend the deadline for the submission of Bids by amending the Bidding Documents in accordance with Clause 6.0,in which case all rights and obligations of the Purchaser and Bidders previously subject to the deadline will thereafter be subject to the deadline as extended

17.0 **ONE BID PER BIDDER**

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

18.0 **LATE BIDS**

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

19.0 **MODIFICATIONS AND WITHDRAWAL OF BIDS**

19.01 The Bidder is not allowed to modify or withdraw its Bid after the Bid's submission subject to any corrigendum/addendum/modifications in the tender documents uploaded in website.

E. EVALUATION OF BID

20.0 **PROCESS TO BE CONFIDENTIAL**

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

21.0 **CLARIFICATION OF BIDS**

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

22.0 **PRELIMINARY EXAMINATION OF BIDS / RESPONSIVENESS**

22.01 Purchaser will examine the Bids to determine whether they are complete, whether any computational errors have been made, whether required sureties have been furnished, whether the documents have been properly signed, and whether the Bids are generally in order. Purchaser may ask for submission of original documents in order to verify the documents submitted in support of qualification criteria.

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

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

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

23.0 **EVALUATION AND COMPARISON OF BIDS**

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

23.02 The evaluation of the Bids shall be a stage-wise procedure. The following stages are identified for evaluation purposes: In the first stage, the Bids would be subjected to a responsiveness check.

The Technical & qualifying Proposals and the Conditional ties of the Bidders would be evaluated.

Subsequently, the Financial Proposals along with Supplementary Financial Proposals, if any, of Bidders with Techno-commercially Acceptable Bids shall be considered for final evaluation.

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

(a) Delivery Schedule

(b) Conformance to Qualifying Criteria

(c) Deviations from Bidding Documents

Bidders shall base their Bid price on the terms and conditions specified in the Bidding Documents.

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

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

F. AWARD OF CONTRACT

24.0 CONTACTING THE PURCHASER

24.01 If any Bidder wishes to contact the Purchaser on any matter related to the Bid, from the time of Bid opening to the time of contract award, the same shall be done in writing only.

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

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

Submission of bids shall not automatically construe qualification for evaluation. The Purchaser reserves the right to accept or reject any Bid and to annul the Bidding process and reject all Bids at anytime prior to award of Contract, without thereby incurring any liability to the affected Bidder or Bidders or any obligation to inform the affected Bidder or Bidders of the grounds for the Purchaser's action.

26.0 AWARD OF CONTRACT

The Purchaser will award the Contract to the successful Bidder whose Bid has been Determined to be the lowest-evaluated responsive Bid, provided further that the Bidder has been determined to be qualified to satisfactorily perform the Contract. Purchaser reserves the right to award order to other bidders in the tender, provided it is required for timely execution of project & provided he agrees to come to the lowest rate. Purchaser reserves the right to distribute the entire tender quantity at its own discretion without citing any reasons thereof.

27.0 **THE PURCHASER'S RIGHT TO VARY QUANTITIES**

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

28.0 **LETTER OF INTENT/ NOTIFICATION OF AWARD**

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

29.0 **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.

30.0 **CORRUPT OR FRADULENT PRACTICES**

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

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

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

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

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

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

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

BSES Yamuna Power Limited

31.00 COMPLETION PERIOD

03 Months from the date of LOA/PO

02 months: Engineering - Drawing submission & approval, Electrical equipment Manufacturing, inspection & delivery at BYPL site. Detailed L2 schedule shall be finalised after award of contract.

01 month: Erection, Testing and Commissioning of electrical equipment and related accessories and handing over.

BSES Yamuna Power Limited

APPENDIX I

(FORMAT FOR EMD BANK GUARANTEE)

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

Whereas [*name of the Bidder*] (herein after called the "Bidder") has submitted its bid dated [*date of submission of bid*] for the supply of [*name and/or description of the goods*] (here after called the "Bid").

KNOW ALL PEOPLE by these presents that WE [name of bank] at [*Branch Name and address*], having our registered office at [*address of the registered office of the bank*] (herein after called the "Bank"), are bound unto BSES Yamuna Power Ltd., with its Corporate Office at Shaktikiran Building, Karkardooma, Delhi -110032, (herein after called —the "Purchaser") in the sum of Rs..... (Rupees..... only) for which payment well and truly to be made to the said Purchaser, the Bank binds itself, its successors, and assigns by these presents.

Sealed with the Common Seal of the said Bank this_____ day of_____ 20____.

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

BSES Yamuna Power Limited

BID FORM

To

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

Sir,

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

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

3 If our Bid is accepted, we under take to deliver the entire goods as) as per delivery schedule mentioned elsewhere in the bid document, 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 and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

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

7 Unless and until Letter of Intent is issued, this Bid, together with your written acceptance thereof, 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..... 20XX

Signature..... In the capacity of ……

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

(IN BLOCK CAPITALS) .....

BSES Yamuna Power Limited

ACCEPTANCE FORM FOR PARTICIPATION IN REVERSE AUCTION EVENT

(To be signed and stamped by the bidder)

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

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

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

Signature & seal of the Bidder

BSES Yamuna Power Limited

ANNEXURE - SCHEDULE OF DEVIATIONS

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

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

SL NO	Clause No.	Page No.	NIT Clause descriptions	Details of Clarification/deviation with justifications

BSES Yamuna Power Limited

Technical Bid Submission Check List

S. No.	Description	BYPL Requirement	Bidder's Compliance
1	**Tender No.**	Required	
2	**Technical Specification reference number**	Required	
3	**Communication Details**		
3.1	Name of the Bidder	Required	
3.2	Name of Authorized contact person	Required	
3.3	Contact No. of Authorized contact person	Required	
3.4	E-mail id of Authorized contact person	Required	
4	**Document Submission Format**		
4.1	Documents shall be strictly submitted in Box file/spiral binding. Any other format is not acceptable. Bid submitted in loose paper shall be rejected without any clarification to bidder.	Required	
4.2	Index of documents with page numbers for each document	Required	
4.3	Separator with document description shall be provided before each document	Required	
5	**Qualifying Requirement Compliance**		
5.1	Summary of compliance of qualifying criteria in tabular form along with summary of documentary proof provided	Required	
5.2	Detailed Documents supporting compliance of qualifying criteria	Required	
6	**Drawings/ Documents as per Technical Specification.**		
6.1	Signed copy of technical specification	Required	
6.2	Type Test reports of offered model/ type/ rating	Required	
6.3	Guaranteed Technical particulars (GTP)	Required	
6.4	Deviation Sheet	Required	
6.5	Detailed Drawings	Required	
6.6	Manufacturer's quality assurance plan	Required	
6.7	Other drawing/ documents mentioned in technical specification	Required	
7	**Soft copy of complete technical bid in pen drive**	Required	
8	**Samples as per technical specification.**	Required	

Note: Submission of Technical bid check list along with all items mentioned in the check list is mandatory. Order of documents shall be strictly as per the technical bid check list. Bids with incomplete/ wrong information are liable for rejection.

BSES Yamuna Power Limited

VENDOR CODE OF CONDUCT

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

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

I. Labour and Human Rights

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

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

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

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

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

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

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

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

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

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

II. Health and Safety

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

The health and safety standards are:

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

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

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

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

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

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

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

III. Environmental

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

The environmental standards are:

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

IV. Ethics

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

V. Management System

Vendors shall adopt or establish a management system whose scope is related to the content of this Code. The management system shall be designed to ensure (a) compliance with applicable laws, regulations and customer requirements related to the Vendors' operations and products; (b)

conformance with this Code; and (c) identification and mitigation of operational risks related to this Code. It should also facilitate continual improvement.

The management system should contain the following elements:

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

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

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

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

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

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

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

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

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

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

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

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

BSES Yamuna Power Limited

GENERAL CONDITIONS OF CONTRACT (GCC-SUPPLY)

BSES Yamuna Power Limited

GENERAL CONDITIONS OF CONTRACT (GCC)-SUPPLY

The General Condition of Contract shall form a part of specifications, contract document.

1.0 General Instructions

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

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

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

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

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

2.0 Definition of Terms

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

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

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

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

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

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

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

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

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

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

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

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

a) The written acceptance of material by the inspector at suppliers works to ship the materials.
b) Acceptance of material at Purchaser site stores after its receipt and due inspection/ testing and release of material acceptance voucher.
c) Where the scope of the contract includes supply, acceptance shall mean issue of necessary equipment / material takeover receipt after installation & commissioning and final acceptance.

3.0 Contract Documents & Priority

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

4.0 Scope of Supply -General

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

4.02 Bidder shall have to quote for the Bill of quantities as listed in Volume-II of this RFQ.

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

4.04 All relevant drawings, data and instruction manuals.

5.0 Quality Assurance and Inspection

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

5.02 Witness and Hold points are critical steps in manufacturing, inspection and testing where the supplier is obliged to notify the Purchaser in advance so that it may be witnessed by the

Purchaser. Final inspection is a mandatory hold point. The supplier to proceed with the work past a hold point only after clearance by purchaser or a witness waiver letter from BYPL.

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

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

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

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

6.0 INSPECTION & TEST CHARGES:

6.01 GOODS shall be inspected by BUYER and/or third party inspection agency nominated by BUYER. Inspection shall carry out stage wise/final inspection as per agreed QA /QC procedure.
In addition, inspection of GOODS shall be carried out at our Site/stores. SELLER shall, however, repair/replace the damaged/rejected GOODS to the satisfaction of BUYER at no extra cost.

6.02 Inspection charges are included in total order value, however BUYER will bear third party inspection charges. In case of futile/abortive visit of BUYER's inspector at SELLER'S works, the cost towards the same shall be debited from the SELLER's invoices.

6.03 GOODS covered by this PURCHASE ORDER shall not be dispatched in whole or in part until SELLER has received a written Release for Shipment Notice from BUYER or their designated representative.

6.04 Inspection call shall be raised minimum 15(fifteen) days in advance from delivery schedule mentioned in PO and duly filled Format issued by BYPL

7.0 HANDLING AND STORAGE:

7.01 Material Safety Data Sheet (MSDS), detail handling & storage instruction sheet/manual, wherever applicable, to be furnished before commencement of supply and one copy is to be submitted in store/site with First Lot.

8.0 Packing, Packing List & Marking

8.01 **Packing:** Supplier shall pack or shall cause to be packed all Commodities in crates/boxes/drums/containers/cartons and otherwise in such a manner as shall be reasonably suitable for shipment by road or rail to BYPL, Delhi/New Delhi stores/site without undue risk of damage in transit.

8.02 **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.

9.0 Prices/Rates/Taxes

9.01 **Price basis for supply of materials**

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

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

c) Transit insurance will be arranged by Purchaser; however bidder to furnish required details in advance for arranging the same by Purchaser

10.0 TAXES & DUTIES:

10.01 Prices for Goods are on Ex- Works basis. For the Goods covered under the GST laws, all taxes that are applicable under CGST, SGST, UGST, IGST and GST Compensation Cess shall be payable extra.

10.02 For the Goods not covered in the GST laws, the applicable ED, VAT / CST shall be payable extra at applicable rates.

10.03 GSTIN of BSES YAMUNA POWER LTD - 07AABCC8569N1Z0
CST No of BSES YAMUNA POWER LTD -07740254593
TIN NO of BSES YAMUNA POWER LTD - 07740254593
PAN NO of BSES YAMUNA POWER LTD - AABCC8569N

10.04 At the end of each month, the SELLER must submit their detail of invoices and amount thereof to the concerned officer in charge, within 07 days after the close of the respective month of which supply relates. Non submission of the said request would be treated as good as that the SELLER has no requirement of reconciliation.

11.0 INVOICING INSTRUCTIONS:

11.01 Invoices in triplicate [1) Original for recipient, 2) Duplicate for Transporter, 3) Triplicate for supplier] shall be made out and delivered to the following address: BSES YAMUNA POWER LIMITED, SHAKTI KIRAN BUILDING, KARKARDOOMA, DELHI-110032.
MDCC will be released separately for Capex & Opex. Invoice will be submitted by supplier as per the MDCC.

11.02 Vendor shall obtain GST registration in the State from where the supply will be carried out. Vendors supplying Goods to the Purchaser shall have a valid GST registration number and shall submit GST Tax Invoice and other documents as per SGST Act, CGST Act, IGST Act, UTGST Act, GST Compensation Cess Act and Rules made there under. Failure to submit GST Tax Invoice shall be liable for withholding SGST, CGST, IGST, UTGST, GST Compensation Cess amount charged by the vendor while releasing the payment.

11.03 Invoice in the name of BSES YAMUNA Power Limited & address of the store/site mentioned in the MDCC. Invoice should contain all information as required under GST Invoice, Debit Note and Credit Rules. The government has notified rules of invoicing under GST along with a template of

invoice(GST INV-01) covering the elements such as supplier's details, GSTIN No, HSN Codes, item details, GST tax rates, etc that need to be presented by the supplier.

11.04 Vendor to carefully examine and charge relevant CGST / SGST, UGST, IGST and GST compensation cess as applicable to the transactions.

11.05 Timely provision of invoices / Debit Notes / Credit Notes:

11.05.1 Vendor to timely provide invoice / Debit note / Credit note to enable Purchaser to claim tax benefit on or before stipulated time period. All necessary adjustment entries (Credit Note, Purchase Returns, Debit Notes) shall be made within the time lines prescribed under the GST Laws.

11.05.2 In case of receipt of advance, the Vendor undertakes to raise the tax invoice. Purchaser, upon payment of advance, shall issue payment voucher as per applicable GST laws and rules. Four copies of the invoices need to be provided by suppliers and wherever the law requires, an Electronic Reference Number for each invoice.
Documents and devices to be carried by a person-in-charge of a conveyance under.

12.0 Terms of payment and billing

12.01 For Supply of Equipments:

A. 70% prorata of supply value item wise shall be payable against R/A bills for supply of equipments and materials within 45 days against receipt & acceptance of material at site and submission of following documents duly certified by BYPL Project-in-charge, complete in all respects:

a) Signed copy of accepted Purchase Order (for first payment)
b) LR / RR / BL as applicable
c) Challan as applicable
d) Two (02) copies of Supplier's detailed Recipient Invoice showing Commodity description, quantity, unit price, total price and basis of delivery, and being 100% of the value of the consignment claimed.
e) Two (02) copies of Supplier's transporter invoice duly receipted by BYPL Stores & Original certificate issued by BYPL confirming receipt of the subject material at Stores/Site and acceptance of the same as per the provisions of the contract.
f) Two (02) copies Packing List / Detailed Packing List
g) Approved Test certificates / Quality certificates, if applicable
h) Certificate of Origin, if applicable
i) Material Dispatch Clearance Certificate (MDCC)
j) Insurance Policy / Certificate, if applicable
k) Warranty / Guarantee Certificate, if applicable
l) Check list for bill submission.

B. 20% prorata on account of supply value of the actual executed value after installation/erection of material duly certified by BYPL Project-in- charge.

C. Balance 10% on account of supply value of the actual executed value shall be paid in 30 days after completion of successful acceptance testing, commissioning and handing over of complete systems duly certified by BYPL Engineer-in-Charge specified in the tender and on submission of performance Bank Guarantee of 10% amount, in our format valid up to a defect liability period from the date of handing over of the scheme including submission of Electrical Inspector Clearance Certificate, Compliance of final punch point, No Demand Certificate, Letter of Indemnity by the supplier (The format of No Demand Certificate and Letter of Indemnity are

attached as Annexure) and after reconciliation & adjustments of payments, if any towards quantities of materials issued from purchaser's stock and consumed by the contractor for expeditious completion of the job.

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

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

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

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

13.0 TAX INDEMNITY CLAUSE:

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

13.02 In case any tax liability (including but not limited to income-tax, transfer pricing, value added tax, SGST, CGST, IGST, UTGST, GST Compensation Cess custom duty, excise duty, Research and Development Cess, etc.), cesses, interest, penalties or any other tax/ duty/ amount/ charge/ liability becomes payable by Purchaser due to failure of the Vendor, or any of its affiliates in India or overseas including any agent/ third party contractor or any other person appointed by such affiliates for the purpose of this agreement, to comply with the relevant laws/ regulations applicable in India or overseas, Vendor undertakes to indemnify Purchaser for an amount equal to amount payable by Purchaser.

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

13.04 The parties agree to follow the following process in case any communication of demand, arising out non-compliance by Vendor (along with its affiliates in India or overseas including any agent/

third party contractor or any other person appointed by such affiliates for the purpose of this agreement), is received by Purchaser :

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

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

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

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

14.0 The Micro, Small and Medium Enterprises (MSME):

14.01 If the SELLERS establishment is covered under the purview of The Micro, Small and Medium Enterprises Development Act, 2006, he shall declare so within the bid of its status failing which it will be presumed that it is a non-MSME unit. Also submit a copy of Udyog Aadhaar (UA) if available.

15.0 Price Validity

15.01 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.

16.0 Performance Guarantee

16.01 To be submitted within fifteen (15) days from the date of issuance of the Letter of Award/PO, supplier shall establish a performance bond in favor of BYPL in an amount not less than ten percent (10%) of the total price of the Contract (the "Performance Bond"). The Performance Bond shall be valid for a period of 60 months from the date of Commissioning or 66 months from the date of last dispatch whichever is earlier plus 3 months claim period.

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

17.0 Forfeiture

17.01 Each Performance Bond established under the contract shall contain a statement that it shall be automatically and unconditionally forfeited without recourse and payable against the presentation by BYPL of this Performance Bond, to the relevant bank referred to above, together with a simple statement that supplier has failed to comply with any term or condition set forth in the Contract. Each Performance BG established under will be automatically and unconditionally forfeited without recourse if BYPL in its sole discretion determines that supplier has failed to comply with any term or condition set forth in the contract.

18.0 Release

18.01 All Performance Bonds will be released without interest within seven (7) days from the last date up to which the Performance Bond has to be kept valid (as defined in Clause 16.0) except for the case set forth in Clause 24.0.

19.0 Defects Liability Period/Guarantee/Warranty

19.01 The bidder to Guarantee the materials / items supplied against any defect of failure, which arise due to faulty materials, workmanship or design for the entire defects liability period. The Defect liability period shall be 60 months from the date of commissioning or 66 months from the date of delivery whichever is earlier.

19.02 If during the Defects Liability Period any GOODS are found to be defective, they shall be promptly replaced or rectified by BIDDER at its own cost (including the cost of dismantling and (reinstallation) on the instructions of BUYER and if removed from SITE for such purpose, shall be removed and re-delivered to SITE by BIDDER at its own cost.

20.0 Return, Replacement or Substitution.

20.01 BYPL shall give Supplier notice of any defective Commodity promptly after becoming aware thereof. BYPL may in its discretion elect to return defective Commodities to Supplier for replacement, free of charge to BYPL, or may reject such Commodities and purchase the same or similar Commodities from any third party. In the latter case BYPL shall furnish proof to Supplier of the cost of such substitute purchase. In either case, all costs of any replacement, substitution, shipping, labour and other related expenses incurred in connection with the return and replacement or for the substitute purchase of a Commodity hereunder should be for the account of Supplier. BYPL may set off such costs against any amounts payable by BYPL to Supplier. Supplier shall reimburse BYPL for the amount, if any, by which the price of a substitute Commodity exceeds the price for such Commodity as quoted in the Bid. BUYER at its sole discretion shall have the opinion to dispose the material or GOODS so rejected and not taken back within forty-five days from the date of intimation of rejection.

21.0 Effective Date of Commencement of Contract:

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

22.0 Time – The Essence Of Contract

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

23.0 The Laws and Jurisdiction of Contract:

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

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

24.0 Events of Default

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

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

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

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

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

25.0 Consequences of Default.

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

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

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

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

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

26.0 Penalty for Delay

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

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

26.03 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.

22.4 If Penalty is levied as per the Order terms & conditions; BYPL will raise Invoice of the penalty amount along with applicable GST rates. Accordingly, after set off of the penalty Invoice amount, net payment shall be made.

27.0 VARIATION IN TAXES, DUTIES & LEVIES

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

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

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

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

28.0 TAXES & DUTIES ON RAW MATERIALS & BOUGHT OUT COMPONENTS:

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

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

29.0 Force Majeure

29.01 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.

29.02 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.

29.03 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.

29.04 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.

29.05 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.

29.06 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.

29.07 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.

29.08 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.

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

30.0 Transfer And Sub-Letting

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

31.0 Recoveries

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

32.0 Waiver

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

33.0 Indemnification

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

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

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

b) Spare Material Delivery For Restoration Of Grid Equipment (Major Defect) Under Guarantee Period Within Two Weeks. Seller must keep Requisite Inventory of Critical Switchgear Spares & Other Equipment's Covered in Guarantee Period to Restore Equipment within Two Weeks.
c) In Case Of Complete Replacement of Equipment, Complete Equipment to Be Replaced Within a Period Of 4 Weeks.

35.00 DOCUMENTATION

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

36.0 Limitation of Liability

36.01 Except as provided otherwise in the Contract and except for willful misconduct or gross negligence, neither Party shall be liable to the other Party for loss of use of any Works, loss of profit, loss of any contract or any other indirect or consequential loss or damage which may be suffered by the other Party in connection with the Contract. The total liability of the Contractor to the Purchaser under the Contract shall not exceed the Contract Value. Except that this Clause shall not limit the liability of the Contractor:
(a) Under any other provisions of the Contract which expressly impose a greater liability,
(b) In cases of fraud, willful misconduct or illegal or unlawful acts, or
(c) In cases of acts or omissions of the Contractor which are contrary to the most elementary rules of diligence which a conscientious Contractor would have followed in similar circumstances.

37.0 Liability of Contractors

37.01 Subject to the due discharge of its obligations under the Contract and except in case of gross negligence or willful misconduct on the part of the Contractor or on the part of any person acting on behalf of the Contractor, with respect to any loss or damage caused by the Contractor to the Purchaser's property or the Site, the Contractor shall not be liable to the Purchaser for the following:
(a) For any indirect or consequential loss or damage; and
(b) For any direct loss or damage that exceeds:
(i) The total payments made and expected to be made to the Contractor under the Contract including reimbursements, if any; or
(ii) The insurance claim proceeds which the Contractor may be entitled to receive from any insurance purchased by the Contractor to cover such a liability, whichever is higher.

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

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

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

38.0 Intellectual Property Rights and Royalties

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

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

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

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

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

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

38.07 If any software is used by the Contractor for the execution of the Works over which the Contractor

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

39.00 Commissioning Spares

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

40.0 Transit Insurance:

40.01 Transit Insurance shall be arranged by the Bidder.

40.02 DAMAGE / LOSS OF CARGO IN TRANSIT: Vendor shall be solely responsible for coordinating with the concerned insurance company for procuring insurance for material and/or Goods, processing claim lodgment and settlement. Notwithstanding the insurance cover, in case of loss / damage to material and/or Goods, in any manner and for any cause whatsoever, Vendor shall cause the damaged cargo to be replaced and delivered to the Purchaser with new material and/or Goods within 30 days of such loss / damage. The Vendor shall be solely responsible for all expenses in relation to the replacement and delivery in such circumstances.

41.0 Acceptance:

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

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

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

41.04 We expect your services and supplies are aligned to our Vision, Mission and Values. Please refer to the following link to know about our Vision, Mission and Values; https://www.bsesdelhi.com/web/bypl/about-bses

BSES Yamuna Power Limited

GENERAL CONDITIONS OF CONTRACT
(GCC-ETC)

BSES Yamuna Power Limited

GENERAL TERMS & CONDITIONS - ERRECTION, TESTING, & COMISSIONING

1. DEFINITIONS and INTERPRETATION:

The following terms shall have the following meanings:

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

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

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

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

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

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

2. EXAMINATION OF SITE AND LOCAL CONDITIONS:

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

3. LANGUAGE AND MEASUREMENT:

3.1 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.

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

4. SCOPE OF WORK:

4.1 The scope of work under this contract shall include the turnkey execution on End to End Basis , including Designing, manufacturing, inspection & testing, dispatches, loading , unloading ,storage at site, erection & installation, testing of the installation, commissioning ,handing over to the purchaser.

4.2 A Separate order will be placed for supply & ETC which inter-alia includes the Scope of Work as mentioned/required for satisfactory operation of the Scheme shall be in Bidder's scope. Bidder(s) must provide goods and services that conform to these specifications for the entire term of the agreement.

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

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

4.5 The scope shall also include installation, transportation, loading & unloading of free-issued materials if any and transportation of scrap (generated at Site), balance free-issued material, dismantled material from site to BYPL store including loading & unloading and no additional charges shall be paid against these activities.

4.6 After completion of E/T/C work , contractor has to obtain BYPL's clearance certificate of the electrical installation.

5. RATES:

5.1 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.

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

6. TAXES AND DUTIES:

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

7. BILL SUBMISSION PROCEDURE:

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

8. TERMS OF PAYMENT:

8.1 Payment shall be made as under:

A. 90% pro-rata payment of total installation value of the actual executed value shall be made progressively on submission of your running invoices on Monthly basis duly certified by our Engineer In charge & shall be paid within 30 days on receipt of such bills at our office.

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

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

9. COMPLETION PERIOD:

9.1 Work shall be completed within 30 days from the date of issue or order / intimation.

9.2 The rates of E/T/C shall be valid for the quantity ordered against this tender only.

10. CLEANLINESS:

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

11. COMMISSIONING & ACCEPTANCE TEST:

11.1 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.

11.2 On satisfactory completion of above, the system shall be deemed to have energized and placed in commercial operation. The Engineer In Charge will issue an acceptance certificate.

12. WORK COMPLETION CERTIFICATION, HANDING OVER:

12.1 The work carried out by the Contractor under this order has to be certified by Engineer In-charge for satisfactory completion of work allotted to the contractor with respect to specifications / Field Quality Procedures as per applicable standards. In case of modification/correction to be carried out, contractor shall carry out the said modifications/correction without additional cost. The Contractor shall remain in close contact with Engineer In-Charge at site to report the general findings of the fieldwork during the initial as well as later stage of the work at site.

13. PENALTY AND LIQUIDATED DAMAGES:

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

13.2 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.

13.3 If the Contractor failed perform the services within the time period specified in the order, the Company shall, without prejudice to its other remedies under the contract, deduct liquidated damages a sum equivalent to 1% of the Total 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.

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

14. SAFETY CODE:

14.1 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.

14.2 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.

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

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

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

15. STATUTORY OBLIGATIONS:

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

a) An Electrical license.
b) PF Code No. and all employees to have PF A/c No. under PF every Act, 1952.
c) All employees to have a temporary or permanent ESI Card as per ESI Act.

d) ESI Registration No.
e) Sales Tax registration number, if applicable.
f) PAN No.
g) Work Contract Tax Registration Number/ VAT Registration.
h) Labour License under Contract Labour Act (R & A) Act 1970.
i) Delhi Building and other Construction Worker (Regulation of Employment and Conditions of Services) Rules, 2002(B.O.C.W.)

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

15.2 The Contractor must follow:

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

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

16. WORKMAN COMPENSATION:

16.1 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.

16.2 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.

16.3 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.

17. STAFF AND WORKMAN:

(I) It shall be responsibility of contractor:

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

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

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

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

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

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

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

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

18. THIRD PARTY INSURANCE:

18.1 Before commencing the execution of the work the Bidder shall take third party insurance policy 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 Bidder shall be responsible for settlement of claims with the underwriters without any liability on the purchaser / owner and will arrange replacements / rectification expeditiously without a waiting settlement by insurance claim at Bidder's own cost.

19. ENVIRONMENTAL, HEALTH & SAFETY PLAN:

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

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

All contractor's staff are accountable for the following:

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

20. TEST CERTIFICATE & QUALITY ASSURANCE:

20.1 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.

21. SUB-CONTRACTING / SUBLETTING:

21.1 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.

21.2 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.

21.2 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.

22. INDEMNITY:

22.1 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.

22.2 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.

23. EVENTS OF DEFAULTS:

23.1 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.

23.2 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.

24. RISK & COST:

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

25. ARBITRATION:

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

26. FORCE MAJEURE:

26.1 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

26.2 Specific Events of Force Majeure:

Subject to the provisions of above clause, Events of Force Majeure shall include only the following to the extent that they or their consequences satisfy the above requirements: The following events and circumstances:

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

(ii) Explosions or fires

(iii) Declaration of the Site as war zone

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

26.3 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.

26.4 Mitigation of events of force majeure:

The Contractor shall:

(i) Make all reasonable efforts to prevent and reduce to a minimum and mitigate the effect of any delay occasioned by an Event of Force Majeure, including applying other ways in which to perform the Contract;

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

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

26.5 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.

26.6 Terminations for certain events of force majeure:

26.7 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.

27. SECRECY CLAUSE:

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

27.2 In the event of any breach of this provision, the Bidder shall indemnify the Company against any loss, cost or damage or claim by any party in respect of such breach.

28. TERMINATION:

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

29. QUALITY:

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

29.1 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.

30. INSURANCE POLICY FOR LIFE COVER:

30.1 Before commencing the execution of the work the CONTRACTOR shall take Life 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.

30.2 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 life cover policy shall be in contractor scope. The policy document shall be submitted before commencement of the work by the contractor.

31. ACCEPTANCE:

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

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

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

BSES Yamuna Power Limited

APPENDIX II

FORMAT OF PERFORMANCE BANK GUARANTEE
(To be executed on a Non-Judicial Stamp Paper of appropriate value)

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

1. WHEREAS M/s BSES Yamuna Power Limited, a Company incorporated under the provisions of Companies Act, 1956 having its Registered Office at Shaktikiran Building, Karkardooma, Delhi 110032, India hereinafter referred to as the " Owner ", (which expression shall unless repugnant to the context or meaning thereof include its successors, administrators, executors and assigns).

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

3. AND WHEREAS as per clause ____of conditions of Contract, the Suppliers are obliged to provide to the Owners an unconditional bank guarantee for an amount equivalent to ten percent (10%) of the total Contract Value for the timely completion and faithful and successful execution of the Contract from **[_____]** *pl. specify the name of Bank)* having its head/registered office at **[_____]** through its branch in _____*(pl. specify the name of Branch through which B.G is issued)* hereinafter referred to as "the Bank", (which expression shall unless it be repugnant to the context or meaning thereof be deemed to include its successors and permitted assigns).

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

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

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

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

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

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

(i) vary and/or modify any of the terms and conditions of the Contract;

(ii) Forebear or enforce any of the rights exercisable by the Owner against the Suppliers under the terms and conditions of the Contract; or

(iii) Extend and/or postpone the time for performance of the obligations of the Suppliers under the Contract;

and the Bank shall not be relieved from its liability by reason of any such act or omission on the part of the Owner or any indulgence shown by the Owner to the Suppliers or any other reason whatsoever which under the law relating to sureties would, but for this provision, have the effect of relieving the Bank of its obligations under this Guarantee.

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

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

12. NOTWITHSTANDING anything herein above contained, the liability of the BANK under this Guarantee shall be restricted to _____*(insert an amount equal to ten percent (10%) of the Contract Value)* and this Guarantee shall be valid and enforceable and expire on _____*(pl. specify date)* or unless a suit or action to enforce a claim under this Guarantee is filed against the Bank on or before the date of expiry.

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

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

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

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

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

(Signature)

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

BSES Yamuna Power Limited

BYPL BANK DETAIL WITH IFSC CODE:

1. Name of the Bank:	Axis Bank Limited
2. Branch Name & Full Address:	C-58, Basement & Ground Floor, Preet Vihar, Main Vikas Marg, New Delhi 110092
3. Branch Code:	055
4. Bank Account No:	911020005246583
5. IFSC Code:	UTIB0000055

BSES Yamuna Power Limited

FORMAT OF WARRANTY/GUARANTEE CERTIFICATE

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

Ref. Purchase Order No. :

Dear Sir,

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

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

Vendors Name & Signature

UNDERTAKING GST

The Vendor shall give an undertaking in the following words on each invoice in the absence of which tax payment as on the Vendor's invoice may be withheld.

"The tax component as mentioned in the invoice shall be deposited with GST Department as per law by way of actual payment or by way of legal set off as per law. The turnover billed shall be duly declared in my GST returns a copy of which shall be filed with the Purchaser. Should the input tax credit to the Purchaser be denied by way of any lapse on the part of the Vendor, the same shall be paid on demand and in any case the Purchaser is authorized to deduct the tax equivalent amount from the amount payable to the Vendor"

BSES Yamuna Power Limited

FORMAT OF NO DEMAND CERTIFICATE

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

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

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

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

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

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

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

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

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

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

Date:
Place:

Signature:
Name:
Designation:
(Company Seal)

BSES Yamuna Power Limited

FORMAT FOR LETTER OF INDEMNITY

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

Place:_____
Date: _____

To,

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

Dear Sirs,

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

For _____

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

Yours faithfully,

For M/s_____
Authorized Signatory

BSES Yamuna Power Limited

COMMERCIAL TERMS AND CONDITIONS SUMMARY

Sl N	Item Description	AS PER BYPL	BIDDER'S CONFIRMATION
1	Validity	120 days from the date of submission of bid	
2	Price basis	a) **"Firm"**, FOR Delhi store basis. Prices shall be inclusive of all taxes & duties, freight upto Delhi stores. b) Unloading at stores shall be in vendor's scope c) Transit insurance in Bidders scope	
3	Payment terms	For supply:- As per NIT (Clause 12.01 of GCC-SUPPLY) For ETC:- As per NIT (Clause 8 of GCC-ETC)	
4	Completion period	As per NIT (Clause 31.00 of INFORMATION TO BIDDER)	
5	Defect Liability period	60 months after commissioning or 66 months from the last date of dispatch, whichever is earlier	
6	Penalty for delay	1% per week of delay of the Total price of undelivered units or part thereof subject to maximum of 10% of total price of undelivered units	
7	Contract Performance/security Bank Guarantee	10% (Ten Percent) of contract Price valid up to completion period/ handing over of entire project	
8	Performance Bank Guarantee	10% (Ten Percent) of total PO value valid for 60 months after commissioning or 66 months from the last date of dispatch, whichever is earlier plus 3 months towards claim period	

BSES Yamuna Power Limited

VOLUME – II

PRICE BID FORMAT

BSES Yamuna Power Limited

GRAND SUMMARY

ALL PRICES IN INR (₹)

Item Name/Work	Quantity	Supply Price Landed	ITC price Landed	Total Cost (C=A+B)	Total Cost (D=C*Q)
	(Q)	(A)	(B)		
SUPPLY, ERECTION, TESTING, & COMMISSIONING OF 11KV SWITCHBOARD ALONG WITH ALLIED EQUIPMENTS, ACCESSORIES AND WORKS AT HASANPUR DEPOT ON TURNKEY BASIS	1 Lot				

The Un-priced bid should be marked as **"Quoted"** and to be submitted with Part – A

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

Date: Bidders Name:

Place: Bidders Address:

Signature: ..... Designation: .....

Printed Name: ..... Common Seal: .....

BSES Yamuna Power Limited

PRICE FORMAT – SUPPLY (A) (Kindly refer detail SCOPE OF SUPPLY attached as Volume III for Indicative Description of Goods/BOM, BOQ)

ALL PRICES IN INR (₹)

S No.	DESCRIPTION OF GOODS	UOM	QTY	UNIT BASIC PRICE INCL FREIGHT(Rs)	UNIT GST & CESS AS APPLICABLE (CGST & SGST/UTGST or IGST) (Rs)		UNIT LANDED COST(Rs)	TOTAL LANDED COST (Rs)
			(A)	(B)	(C)		(D = B+C)	(E = DXA)
1	**11 kV Switchboard**							
1.1	Incoming panel (with Line PT)	Nos	3					
1.2	Bus Coupler Panel	Nos	2					
1.3	Bus Riser cum Bus PT Panel	Nos	2					
1.4	Bus PT Panel	Nos	1					
1.5	Substation Transformer Panel	Nos	1					
1.6	Outgoing Panel	Nos	4					
1.7	Earthing Truck for Bus bar Side Earthing	Nos	2					
1.8	Earthing Truck for Cable Side Earthing	Nos	2					
2	**End Termination Kits**							
2.1	End termination kit for 11kV, 3C x 150 sqmm cable	Nos	2					
2.2	End Termination kit for 0.415 kV 1CX 150 sqmm cable	Nos	8					
3	**Cable and Associated Items**							
3.1	11 kV 3CX150 sqmm XLPE insulated, stranded aluminum conductor, PVC outer sheath Power cable	Lot	1					
3.2	0.415 kV 1R X 4C X 150 sqmm XLPE Insulated stranded conductor, PVC outer Sheath Power Cable	Lot	1					
3.3	LT Power Cable	Lot	1					
3.4	Control Cables with proper ferruling and tagging along with glands and lugs	Lot	1					
3.5	Cable Tray including bends etc with 50% spare capacity in each	Lot	1					
3.6	Cable Tray Support Structure	Lot	1					
3.7	Cable Sealing System	Lot	1					
3.8	Fire Resistant Coating	Lot	1					
3.9	Cable Support Structure along with Clamping Arrangement	Lot	1					
4	**Auxiliary Equipment**							
4.1	AC Distribution Board	Nos	1					
4.2	100 KVA Dry Type Station Transformer	Nos	1					
4.3	DC Distribution Board	Nos	1					
4.4	SMPS Battery Charger	Nos	1					

BSES Yamuna Power Limited

4.5	220 V Li Ion Battery Bank	Nos	1					
5	**Earthing System**							
5.1	Earthing	Lot	1					
5.2	Earth Resistivity Test	Nos	1					
6	Ethernet Switches	Nos	2					
7	Patch Cord	Lot	1					
8	Lightning Protection	Lot	1					
9	Angle Channel Arrangement	Lot	1					
10	Conduits	Lot	1					
11	Insulated Floor Coating	Lot	1					
12	SCADA Works	Lot	1					
13	Painting of Feeder names (SCADA code, Asset Code, etc)	Lot	1					
14	Licensed programming software	Nos	1					
15	Communication Cord	Lot	1					
16	Recommended & Mandatory Spares	Lot	1					
17	Accessories	Lot	1					
18	SLD	Nos	1					
19	Video surveillance system	Lot	1					
20	Emergency Exit Floor Marking	Lot	1					
GRAND TOTAL LANDED COST								
In words …….								
Note: All quantities mentioned above are estimated quantities. Actual quantities may vary as per actual site requirement								

BSES Yamuna Power Limited

PRICE FORMAT – E/T/C (B) (Kindly refer detail SCOPE OF WORK attached as Volume III for Indicative Description of Services/BOM, BOQ)

ALL PRICES IN INR (₹)

S No.	DESCRIPTION OF SERVICES	UOM	QTY	UNIT BASIC PRICE (Rs)	UNIT GST & CESS AS APPLICABLE (CGST & SGST/UTGST or IGST) (Rs)		UNIT LANDED COST(Rs)	TOTAL LANDED COST (Rs)
			(A)	(B)	(C)		(D = B+C)	(E = DXA)
1	**11 kV Switchboard**							
1.1	Incoming panel (with Line PT)	Nos	3					
1.2	Bus Coupler Panel	Nos	2					
1.3	Bus Riser cum Bus PT Panel	Nos	2					
1.4	Bus PT Panel	Nos	1					
1.5	Substation Transformer Panel	Nos	1					
1.6	Outgoing Panel	Nos	4					
1.7	Earthing Truck for Bus bar Side Earthing	Nos	2					
1.8	Earthing Truck for Cable Side Earthing	Nos	2					
2	**End Termination Kits**							
2.1	End termination kit for 11kV, 3C x 150 sqmm cable	Nos	2					
2.2	End Termination kit for 0.415 kV 1CX 150 sqmm cable	Nos	8					
3	**Cable and Associated Items**							
3.1	11 kV 3CX150 sqmm XLPE insulated, stranded aluminum conductor, PVC outer sheath Power cable	Lot	1					
3.2	0.415 kV 1R X 4C X 150 sqmm XLPE Insulated stranded conductor, PVC outer Sheath Power Cable	Lot	1					
3.3	LT Power Cable	Lot	1					
3.4	Control Cables with proper ferruling and tagging along with glands and lugs	Lot	1					
3.5	Cable Tray including bends etc with 50% spare capacity in each	Lot	1					
3.6	Cable Tray Support Structure	Lot	1					
3.7	Cable Sealing System	Lot	1					
3.8	Fire Resistant Coating	Lot	1					
3.9	Cable Support Structure along with Clamping Arrangement	Lot	1					

BSES Yamuna Power Limited

4	**Auxiliary Equipment**							
4.1	AC Distribution Board	Nos	1					
4.2	100 KVA Dry Type Station Transformer	Nos	1					
4.3	DC Distribution Board	Nos	1					
4.4	SMPS Battery Charger	Nos	1					
4.5	220 V Li Ion Battery Bank	Nos	1					
5	**Earthing System**							
5.1	Earthing	Lot	1					
5.2	Earth Resistivity Test	Nos	1					
6	Ethernet Switches	Nos	2					
7	Patch Cord	Lot	1					
8	Lightning Protection	Lot	1					
9	Angle Channel Arrangement	Lot	1					
10	Conduits	Lot	1					
11	Insulated Floor Coating	Lot	1					
12	SCADA Works	Lot	1					
13	Painting of Feeder names (SCADA code, Asset Code, etc)	Lot	1					
14	Licensed programming software	Nos	1					
15	Communication Cord	Lot	1					
16	Accessories	Lot	1					
17	SLD	Nos	1					
18	Video surveillance system	Lot	1					
19	Emergency Exit Floor Marking	Lot	1					
20	Training on application, programming, testing and commissioning of Numerical Relays	Days	2					
21	Training on commissioning, operations and maintenance of 11KV Switchgear	Days	2					
22	Training on IEC 61850	Days	2					
GRAND TOTAL LANDED COST								
In words								
Note: All quantities mentioned above are estimated quantities. Actual quantities may vary as per actual site requirement								

BSES Yamuna Power Limited

VOLUME – III

TECHNICAL SPECIFICATIONS
FOR
SUPPLY, ERECTION, TESTING, & COMMISSIONING OF 11KV SWITCHBOARD ALONG WITH ALLIED EQUIPMENTS, ACCESSORIES AND WORKS AT HASANPUR DEPOT ON TURNKEY BASIS.

SCOPE OF TURNKEY EXECUTION

FOR

HASANPUR DEPOT SUBSTATION

Revision			1
Date			13.05.2022
Pages			Page 1 of 13
Prepared by	Abhishek Harsh	**CES**	Abhishek Harsh 3267d7c3-82b5-46cb-b5a6-867ee7820a34
Reviewed by	Srinivas Gopu	**CES**	5d32525e-ed3a-4f41-b1c7-b8a5e77d1519
	Manoj Vidhyarthi	**P&E**	Manoj Vidyarthi 482e4648-110f-4dbf-9528-b52a523b0db5
Approved by	Gaurav Sharma	**CES**	23dc2de2-95de-4472-99a7-dea873f472b6
	Pramod Kumar	**P&E**	Pramod J Kumar 8bbc64b3-a9d3-4fce-a14e-527ef4e0034f

Contents

1 INTENT

a. This document defines the scope for turnkey execution of Hasanpur Substation.

b. This document shall be read in conjunction with all technical documents enclosed in tender. In event of any contradiction between tender documents, the most stringent one shall govern.

2 SITE DETAILS

a. Hasanpur Depot Substation is situated at Patparganj, Delhi 110092.

b. Longitude and Latitude of the Hasanpur Depot is 28°38'05.8"N 77°18'28.0"E

3 BIDDER'S SCOPE

a. Bidder's Scope includes design, engineering, manufacture, shop testing, inspection, packing, dispatch, supply, loading, unloading, storage at site, assembly, erection, , complete pre-commissioning checks, testing & commissioning at site, obtaining statutory clearance & certification from Electrical Inspector and handing over of complete substation covered under scope of this document to BSES Yamuna Power Ltd.

b. Any supply/work details not explicitly mentioned in this scope but mandatory for successful commercial operation of the substation shall be deemed to be included in bidder's scope.

c. Bidder shall depute its representative at site to assess the condition of existing infrastructure in detail prior to submission of bid.

3.1 DESIGN & ENGINEERING

a. Detailed design and engineering of complete project as per tender requirements shall be in bidder's scope.

b. General guidelines for design are given below

3.1.1 CODES AND STANDARDS

a. The bidder shall comply with latest Indian/International standard and CEA regulations.

b. Refer respective equipment specification for applicable standards.

3.1.2 SERVICE CONDITIONS

3.1.2.1	Average grade atmosphere	Heavily polluted, Dry
3.1.2.2	Maximum altitude above sea level	1000M
3.1.2.3	Ambient air temperature	Highest 50Deg C,Average 40Deg C

3.1.2.4	Minimum ambient air temperature	0 Deg C
3.1.2.5	Relative Humidity	100%
3.1.2.6	Rainfall	750mm concentrated in four months
3.1.2.7	Seismic Condition	Zone IV
3.1.2.8	Max. Relative Humidity	100%

3.1.3 SYSTEM PARAMETERS

3.1.3.1	Nominal Voltage kV	11
3.1.3.2	Rated voltage kV	12
3.1.3.3	Power Frequency (kV rms) with stand voltage	28
3.1.3.4	Basic Insulation Level KVp	75
3.1.3.5	Rated Frequency Hz	50±5%
3.1.3.6	System Neutral Earthing	Solidly Grounded

3.2 SCOPE OF SUPPLY

S. No	Items	UOM	Qty	Remarks
3.2.1	11 kV Switchboard			
3.2.1.1	Incoming panel (with Line PT)	Nos	3	
3.2.1.2	Bus Coupler Panel	Nos	2	
3.2.1.3	Bus Riser cum Bus PT Panel	Nos	2	
3.2.1.4	Bus PT Panel	Nos	1	
3.2.1.5	Substation Transformer Panel	Nos	1	
3.2.1.6	Outgoing Panel	Nos	4	
3.2.1.7	Earthing Truck for Bus bar Side Earthing	Nos	2	
3.2.1.8	Earthing Truck for Cable Side Earthing	Nos	2	
3.2.2	End Termination Kits			
3.2.2.1	End termination kit for 11kV, 3C x 150 sqmm cable	Nos	2	For Terminating 11 kV Cables at 11 kV Station Transformer Panel
3.2.2.2	End Termination kit for 0.415 kV 1CX	Nos	8	For Terminating 0.415 kV

	150 sqmm cable			Cables at ACDB and Station Transformer
3.2.3	Cable and Associated Items			
3.2.3.1	11 kV 3CX150 sqmm XLPE insulated, stranded aluminum conductor, PVC outer sheath Power cable	Lot	1	For Station transformer
3.2.3.2	0.415 kV 1R X 4C X 150 sqmm XLPE Insulated stranded conductor, PVC outer Sheath Power Cable	Lot	1	For Station Transformer
3.2.3.3	LT Power Cable	Lot	1	For items specified in "Scope of Supply"
3.2.3.4	Control Cables with proper ferruling and tagging along with glands and lugs	Lot	1	For Items specified in "Scope of Supply"
3.2.3.5	Cable Tray including bends etc with 50% spare capacity in each	Lot	1	a) For routing Power, LT and Control Cables b) For items specified in "Scope of Supply" c) 50% spare capacity in each is tray is required
3.2.3.6	Cable Tray Support Structure	Lot	1	
3.2.3.7	Cable Sealing System	Lot	1	For all cables entering and exiting the Proposed Substation Building
3.2.3.8	Fire Resistant Coating	Lot	1	a) On all cable specified in "Scope of Supply" b) Fire rating-2 hours
3.2.3.9	Cable Support Structure along with Clamping Arrangement	Lot	1	a) For all Power Cable Terminations b) For Control Cable Termination wherever Required
3.2.4	Auxiliary Equipment			
3.2.4.1	AC Distribution Board	Nos	1	ACDB shall be of Type-2
3.2.4.2	100 KVA Oil Type Station Transformer	Nos	1	
3.2.4.3	DC Distribution Board	Nos	1	DCDB shall be of Type-2
3.2.4.4	SMPS Battery Charger	Nos	1	SMPS Battery Charger shall be of Type-2
3.2.4.5	220 V Li Ion Battery Bank	Nos	1	Battery Bank shall be of Type-2
3.2.5	Earthing System			
3.2.5.1	Earthing	Lot	1	Earthing of complete Grid Substation and items specified in "Scope of Supply"
3.2.5.2	Earth Resistivity Test	No	1	For Earthing Design
3.2.6	Ethernet Switches	No	2	
3.2.7	Patch Cord	LOT	1	

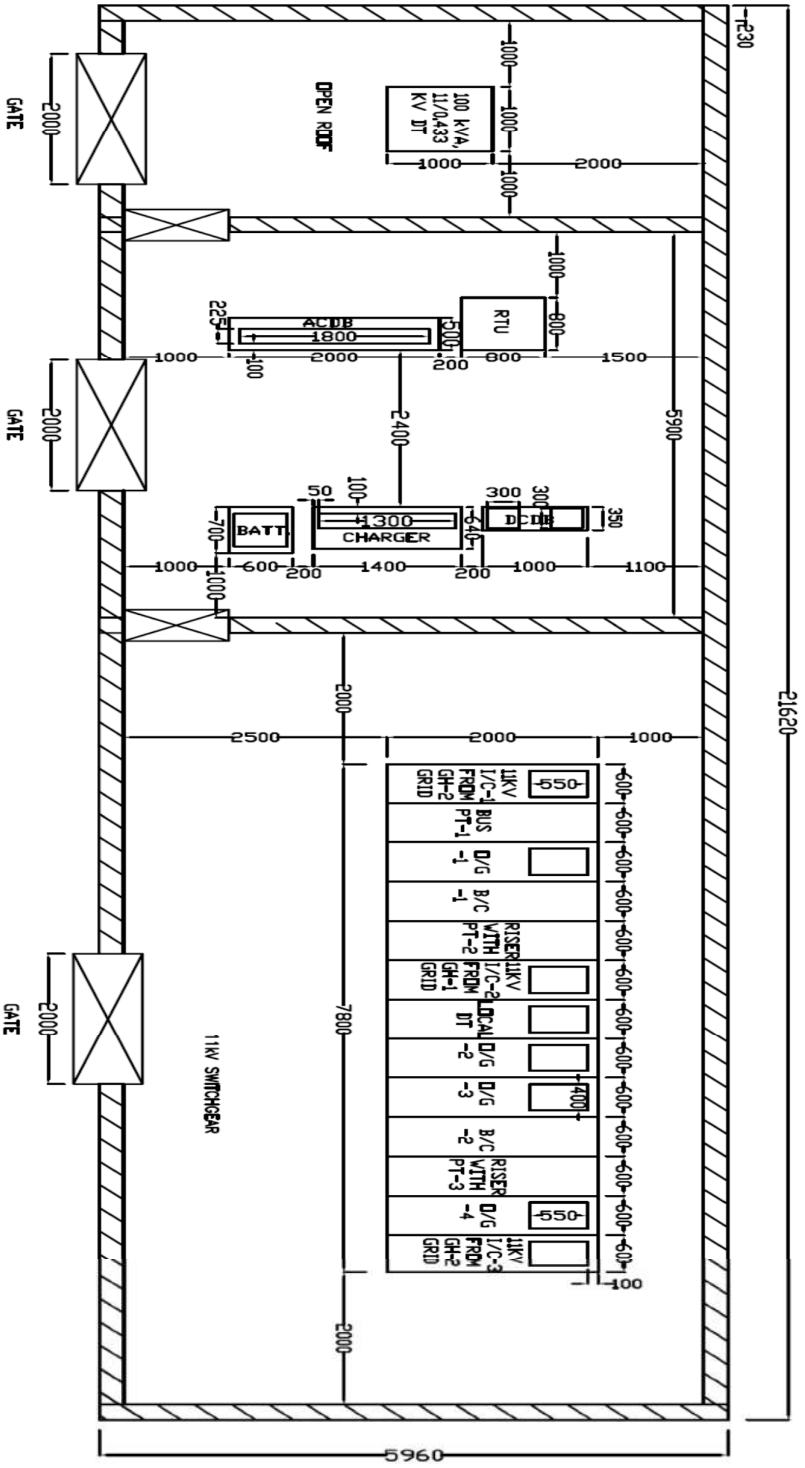
3.2.8	Lightning Protection	Lot	1	For complete Grid S/S
3.2.9	Angle Channel Arrangement	Lot	1	For Supplied equipment
3.2.10	Conduits	Lot	1	
3.2.11	Insulated Floor Coating	Lot	1	For Items specified in "Scope of Supply"
3.2.12	SCADA Works	Lot	1	As per Specification
3.2.13	Painting of Feeder names (SCADA code, Asset Code, etc)	Lot	1	As per Engineer Incharge Guidance
3.2.14	Licensed programming software	No	1	
3.2.15	Communication Cord	LOT	1	
3.2.16	Recommended & Mandatory Spares	Lot	1	As per Specification of Supplied items
3.2.17	Accessories	Lot	1	As per specification of Supplied Items
3.2.18	SLD	No	1	Covered in Acrylic Sheet
3.2.19	Video surveillance system	Lot	1	
3.2.20	Emergency Exit Floor Marking	Lot	1	For Items specified in "Scope of Supply"

3.3 SCOPE OF WORK

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

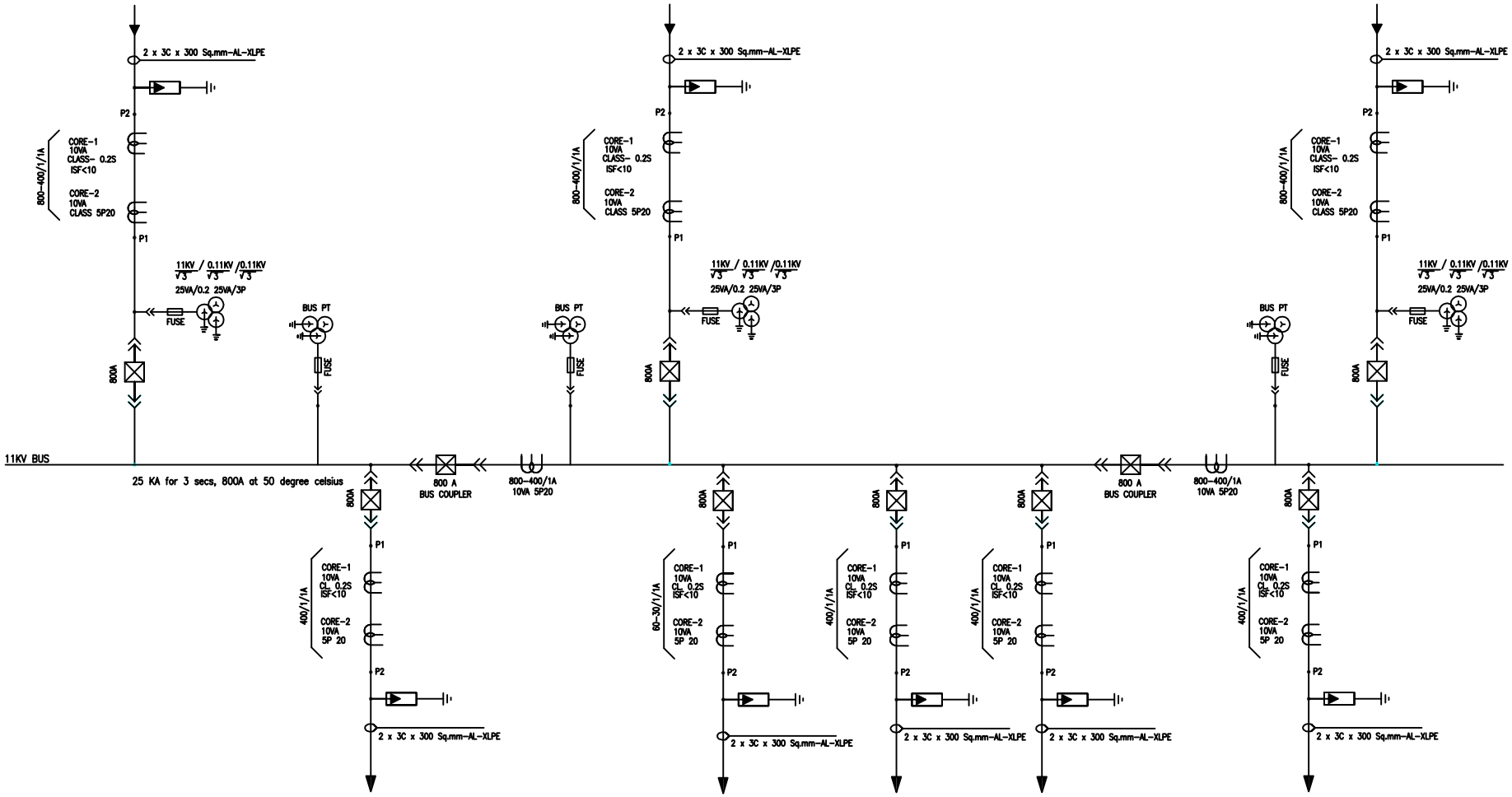
S. No	Items	Unit	Qty	Remarks
3.3.1	Erection, Testing and Commissioning of all items specified in “Scope of Supply”	Lot	1	
3.3.2	Training on application, programming, testing and commissioning of Numerical Relays	Days	2	One day classroom training at BYPL Training Centre and one day onsite training. Training shall be provided by Domain experts only
3.3.3	Training on commissioning, operations and maintenance of 11KV Switchgear	Days	2	One day classroom training at BYPL Training Centre and one day onsite training. Training shall be provided by Domain experts only
3.3.4	Training on IEC 61850	Days	2	Two - Day Classroom Training

3.4 REFERENCE LAYOUT & SLD



DRAWN	R.K/A.H	TITLE:- TENTATIVE 11KV SWITCHGEAR BUILDING LAYOUT FOR HASNPUR DEPOT FOR EV CONNECTION	BSES Yamuna Power Limited
CHECKED	S.G		
APPD.	G.S		
DATE	13.05.22		
SCALE	NTS		

SLD OF HASNPUR DEPOT



DRAWN	R.K/A.H
CHECKED	S.G
APPD.	G.S
DATE	09.05.22
SCALE	NTS

TITLE:-

TENTATIVE 11kV SWITCHGEAR BUILDING SLD FOR HASNPUR DEPOT FOR EV CONNECTION

BSES Yamuna Power Limited

3.5 SCOPE DEMARCATION

S. No	Head	BYPL	Bidder's Scope	Remarks
3.5.1	Permit to work request to BYPL authority	✗	✓	Permit Should be applied to Engineer Incharge prior to work through proper procedure
3.5.2	Permit to work issuance from BYPL authority	✗	✓	
3.5.3	Testing Equipment	✗	✓	
3.5.4	Lighting Arrangement	✗	✓	
3.5.5	Construction Power and Construction Water	✗	✓	For construction power, bidder may take temporary connection from BYPL on chargeable basis.
3.5.6	Safety and Security of Manpower(Labor, Engineers, Supervisors etc)	✗	✓	
3.5.7	Various Tools and Tackles related to Job	✗	✓	
3.5.8	Loading, Unloading and Transportation of Material	✗	✓	It includes transportation of dismantled equipment to BYPL store in stacked manner.
3.5.9	Cleanliness around work premises	✗	✓	
3.5.10	Document/Drawing Submission	✗	✓	
3.5.11	Document/Drawing Approval	✓	✗	
3.5.12	Security and Safety of material until handover	✗	✓	
3.5.13	Various Machines e.g. Crane, Hydra, JCB etc to complete the Job	✗	✓	
3.5.14	Maintenance of Equipment Until Handover to Engineer Incharge and EHV O&M	✗	✓	
3.5.15	Electrical Inspector Clearance	✗	✓	Only statutory fees will be borne by BYPL if applicable
3.5.16	Permit issuing agency for Works inside BYPL Premises	✓	✗	

3.5.17	Permit requesting Agency	✗	✓	Permit Should be applied to Engineer In charge prior to start of work. Isolation & permit of only one Feeder at a time, shall be given at a time, during final hook up. All necessary preparation works to be made, in order to minimize the Shutdown Time.
3.5.18	Temporary office near work premises	✗	✓	After handing over the equipment, contractor has to evacuate the premises within one week otherwise deemed fit action will be taken
3.5.19	Temporary store at work premises	✗	✓	
3.5.20	Yard aesthetics at work place should be maintained at the time and after the completion of Work	✗	✓	Disposal of Scrap/Debris etc from site and complete cleaning of working area till handover
3.5.21	Any damages done to the existing system, shall be repaired/ rectified/ replaced	✗	✓	
3.5.22	Clearance certificate	✗	✓	Clearance Certificate shall be taken from BYPL Departments (Quality, Safety, Protection, O&M, SCADA, EHV, etc.) before Final Charging of the Systems. Any Site Observations/ Punch points, observed during execution, shall be attended.
3.5.23	External Agency Clearance	✗	✓	Statutory fee shall be borne by BYPL
3.5.24	Various compliances pertaining to Job	✗	✓	IE rules, CEA Regulation 2010

3.6 DOCUMENTATION

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 drawing not included in the below table but necessary for detailed engineering shall be deemed to be included in bidder's scope.

S. No.	Description	Technical Bid	Drawing Approval	Pre-Dispatch	Pre-Closure
3.6.1	Tender No.	Required			
3.6.2	Communication Details				
3.6.2.1	Name of the Bidder	Required			
3.6.2.2	Name of Authorized contact person	Required			
3.6.2.3	Contact No. of Authorized contact person	Required			
3.6.2.4	E-mail id of Authorized contact person	Required			
3.6.3	Document Submission Format				
3.6.3.1	Documents shall be submitted in Box file/spiral binding. Any other format is not acceptable	Required			
3.6.3.2	Index of documents with page numbers for each document	Required			
3.6.3.3	Separator with document description shall be provided before each document	Required			
3.6.4	Qualifying Requirement Compliance				
3.6.4.1	Summary of compliance of qualifying criteria in tabular form along with summary of documentary proof provided	Required			
3.6.4.2	Detailed Documents supporting compliance of qualifying criteria	Required			
3.6.5	Drawings/ Documents as per Technical Specification.				
3.6.5.1	Signed copy of technical specification	Required			
3.6.5.2	Type Test reports of offered model/ type/ rating	Required	Required		
3.6.5.3	Deviation Sheet	Required	Required		
3.6.5.4	Detailed Drawings	Required	Required		
3.6.5.5	Other drawing/ documents	Required	Required		

S. No.	Description	Technical Bid	Drawing Approval	Pre-Dispatch	Pre-Closure
	mentioned in technical specification				
3.6.5.6	Soft copy of complete technical bid in pen drive	Required			
3.6.5.7	Samples as per technical specification.	Required			
3.6.5.8	Design Calculation		Required		
3.6.5.9	Manufacturer's quality assurance plan		Required		
3.6.5.10	GTP		Required		
3.6.5.11	Inspection Reports			Required	
3.6.5.12	As manufacturing Drawings			Required	
3.6.5.13	Operation and Maintenance Manual			Required	
3.6.5.14	As built Drawings				Required
3.6.6	Soft Copy				
3.6.6.1	In Pen drive	Required			
3.6.6.2	Through Mail		Required	Required	Required

4 APPROVED MAKE LIST

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

S. No	Equipment	MAKE
4.1.1	11 kV Power Cable	Universal/KEI/GEMSCAB/Polycab/Torrent/Sterlite/Gupta Power/KEC
4.1.2	11 kV Termination kit	Raychem/3M/Yamuna Power Infrastructure
4.1.3	Control cable	Universal/KEI/GEMSCAB/Polycab/ Cords Cable
4.1.4	Station Transformer	ABB/Schneider/Siemens/Transformer & Rectifiers/ EMCO/ Bharat Bijlee/ BHEL/Toshiba/Voltamp/CGL
4.1.5	11 kV AIS	ABB/Siemens/Schneider/CGL
4.1.6	Numerical relays	Siemens (Siprotec series) and Schneider /GE (Micom Series)
4.1.7	Ethernet Switch	Ruggedcom, Hirschman
4.1.8	Cable sealing system	Roxtec, MCT Brattberg
4.1.9	Fire retardant coating for cables	3M/Demech/Stanvac
4.1.10	Floor coating	3M/Demech/Stanvac
4.1.11	Earth Electrodes	JMV/Pragati
4.1.12	Earth Enhancing Material	JMV/Pragati/Marconite

Technical Specification

Of

HT Indoor Switchgear (33 & 11 kV)

Specification no – BSES-TS-66-HTSWG-R0

Rev:		0
Pages:		1 of 60
Date:		29 Apr 2022
Prepared by	Abhishek Harsh	3267d7c3-82b5-46cb-b5a6-867ee7820a34
Reviewed by	Srinivas Gopu	5d32525e-ed3a-4f41-b1c7-b8a5e77d1519
Approved by	Gaurav Sharma	23dc2de2-95de-4472-99a7-dea873f472b6

INDEX

1 SCOPE OF SUPPLY

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

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

2 CODES & STANDARDS

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

2.1	Indian Electricity Rules 1956	Latest edition
2.2	Indian Electricity act 1910	Latest edition
2.3	Switchgear and control gear	IEC : 60694, IEC: 60298, IEC : 62271-200, IEC : 60529, IS: 3427, IS: 12729, IS: 12063, IS: 13947, IS: 9046
2.4	Circuit breaker	IEC 62271 - 100, IS 13118, IS 2516
2.5	Isolators & earthing switches	IEC 62271 - 102
2.6	Current transformers	IS:2705, IEC:60185
2.7	Voltage transformer	IS:3156, IEC:60186,
2.8	Indicating Instruments	IS:1248
2.9	Energy meters	IS 13010
2.10	Relays	IS:8686, IS:3231, IS:3842
2.11	Control switches and push buttons	IS 6875
2.12	HV fuses	IS 9385
2.13	Arrangement of Switchgear bus bars, main connections and auxiliary wiring	IS:375
2.14	Code of practice for phosphating iron & steel	IS 6005
2.15	Colours for ready mixed paints	IS 5
2.16	Code of practice for installation and maintenance of switchgear	IS 3072

DocUUID : 39aff16e-ea33-46dd-b594-218f28cdb6d0

3 SERVICE CONDITION

3.1	Max Ambient Temperature	50 deg C
3.2	Max Daily average ambient temp	40 deg C
3.3	Min Ambient Temp	0 deg C
3.4	Maximum Humidity	95%
3.5	Minimum Humidity	10%
3.6	Maximum annual rainfall	750 mm
3.7	Average no of rainy days per annum	60
3.8	Rainy months	June to Oct
3.9	Altitude above MSL	300 M
3.10	Seismic Zone	IV

4 PANEL CONSTRUCTION

4.1	Enclosure Type	Free standing, Indoor, Fully compartmentalised, Metal clad, Vermin proof
4.2	Enclosure degree of protection	IP 4X for high voltage compartment IP 5X for low voltage compartment
4.3	Enclosure material	Pre-Galvanized CRCA steel
4.3.1	Load bearing members	2.5 mm thick
4.3.2	Doors and covers	2.0 mm thick
4.3.3	Gland plate	3.0 mm MS for multicore and 5. 0 mm Aluminium for single core cables. All gland plates should be detachable type with gasket
4.4	Dimension of Panel	Maximum 2700mm, Operating height maximum 1600mm. In case of Extension of Existing make panels, vendor shall match the dimension of existing panel.
4.5	Extensibility	On either side
4.6	Separate Compartments for	Bus bar, Circuit Breaker, HV incoming cable, HV outgoing cable, PT, LV instruments & relays
4.7	Transparent inspection window	For cable compartment at height of cable termination.
4.8	Bus end cable box	For direct cable feeder from bus
4.9	Rear Doors	Rear doors shall not be interlocked i.e. all door opening shall be independent to each other.

DocUUID : 39aff16e-ea33-46dd-b594-218f28cdb6d0

4.10	Breaker compartment door	Separate, with lockable handle (Design with breaker trolley as the front cover is not acceptable). Door of one panel should not cause hindrance for opening of adjacent panel.
4.11	Inter compartmental connections	
4.11.1	Breaker to bus bar compartment	Through seal-off bushings
4.11.2	Breaker to cable compartment	Through seal-off bushings
4.12	Nut Bolt	Shall be as less as possible for ease of opening of compartments
4.13	Pressure relief devices	To be provided for each HV compartment
4.14	Bus support insulator	Non-hygroscopic, track-resistant, high strength, Epoxy insulators (Calculation for validating dynamic force withstand capability to be submitted during detailed engineering)
4.15	Fixing arrangement	Doors - Concealed hinged, door greater than 500mm shall have minimum three sets of hinges Covers - SS bolts Gasket - Neoprene
4.16	Required HV cable termination height in the cable compartment	650 mm for 11 KV. 1000mm for 33 KV
4.17	Panel Base Frame	Steel Base frame as per manufacturer's standard.
4.18	Handle	Removable bolted covers with handle for cable chamber and busbar chamber. Panel no./identification to be provided on cable box cover also.

4.19	APFC	a. Controlling of Capacitor Banks' switching shall be done by APFC. Although APFC shall not be in bidder's scope, Space for cut out shall be provided in the Capacitor panel. Space requirement-150X150 mm^2 b. Wiring of Bus PT , Incomer CT and Capacitor CT upto spare terminal for APFC shall also be provided in Capacitor Panel
4.20	Technical particulars	As per Annexure –C

5 CIRCUIT BREAKER

5.1	Type	Truck or cassette type
5.2	Mounting	On withdrawable truck or carriage, with locking facility in service position.
5.3	Switching duty	c. Transformer (oil filled and dry type) d. Motor (of small and large ratings – DOL starting with starting current 6 to 8 times the full load current & with a maximum of 3 starts per hour) e. Underground cable with length up to 10 km
5.4	Interrupting medium	Vacuum
5.5	Contact	Tulip contact shall be provided without any gap between contacts
5.6	Breaker operation	Three separate identical single pole units operated through the common shaft
5.7	Operating Mechanism	Re-strike free, Trip free, with electrical anti-pumping feature
5.7.1	Type	Motor wound, spring charged, stored energy type with manual charging facility
5.7.2	Operation on supply failure	One O-C-O operation possible after failure of power supply to the spring charging motor
5.8	Breaker indications & push buttons	

5.8.1	ON/ OFF / Emergency trip push button	a. Manual / mechanical. b. Emergency Off push button should be provided with a protective flap. c. Mechanical ON shall have padlocking facility.
5.8.2	Mechanical ON – OFF indication	On breaker trolley front
5.8.3	Operation counter	On breaker trolley front
5.8.4	Test-service position indicator	On breaker trolley front
5.8.5	Mechanism charge / discharge indicator	On breaker trolley front
5.9	Breaker positions	Service, Test and Isolated
5.10	Inter changeability	Possible, only with breaker of same rating
5.11	Breaker Control	On panel front only
5.12	Handle	Breaker shall be provided with handles for easy handling, rack in–out operation and manual spring charging as applicable.
5.13	Pin Sequence and Configuration of Pin of Adaptor Plug	(a) Pin sequence and No of Pins of Adaptor plug shall be same in Outgoing and Capacitor Panel (b) Pin sequence and No of Pins of Adaptor plug shall be same in Incoming and Bus Coupler Panel
5.14	Technical particulars	As per Annexure-C

6 FUNCTIONAL REQUIREMENTS

6.1	Interlocks	
6.1.1	Breaker compartment door opening	Opening of door and rack out to test/isolated position should be possible with breaker in OFF position only.
6.1.2	Breaker compartment door closing	Should be possible even when breaker is in isolated position
6.1.3	Racking mechanism safety interlock	Mechanical type
6.1.4	Racking in or out of breaker inhibited	When the breaker is closed

DocUUID : 39aff16e-ea33-46dd-b594-218f28cdb6d0

6.1.5	Racking in the circuit breaker inhibited	Unless the control plug is fully engaged
6.1.6	Disconnection of the control plug inhibited	As long as the breaker is in service position
6.1.7	Opening of cable compartment cover of Incomer Panels inhibited	As long as cable end is alive
6.2	Safety Devices	
6.2.1	Exposure to live parts	In case the breaker panel door is required to be opened during a contingency, the personnel should not be exposed to any live part. Suitable shrouds/barriers/insulating sleeves should be provided.
6.2.2	Breaker handing	In case the breaker is mounted on a carriage which does not naturally roll out on the floor, a trolley for handling the breaker is to be provided.
6.3	Operation of breaker	In either service or test position
6.3.1	Closing from local	Only when local/remote selector switch is in local position
6.3.2	Closing from remote	Only when local/remote selector switch is in remote position
6.3.3	Tripping from local	Only when local/remote selector switch is in local position
6.3.4	Tripping from remote	Only when local/remote selector switch is in remote position
6.3.5	Tripping from protective relays	Irrespective of position of local/remote switch
6.3.6	Testing of breaker	In test or isolated position keeping control plug connected
6.4	Safety shutters.	

DocUUID : 39aff16e-ea33-46dd-b594-218f28cdb6d0

6.4.1	Automatic safety shutter for female primary disconnects	To fully cover contacts when breaker is withdrawn to test. Independent operating mechanism for bus bar & cable side shutters, separately pad-lockable in closed position.
6.4.2	Label for identification	For Bus side and cable side shutters
6.4.3	Warning label on shutters of incoming and other connections	Clearly visible label "Isolate elsewhere before earthing" be provided
6.5	Breaker electrical operation features	
6.5.1	Trip circuit supervision	To be given for breaker close & open condition
6.5.2	Trip circuit supervision relay contact	For indication, alarm & to inhibit closing of breaker
6.5.3	Emergency trip push button contact	Wired directly to trip coil (wired to Master trip relay if second trip coil provided)
6.5.4	Emergency trip push button contact	Wired to inhibit closing of breaker
6.5.5	Master trip relay contact (if given)	Wired to inhibit closing of breaker
6.5.6	Tripping or opening of breaker through relay but not routed through Lockout (Example- SCADA Opening, Undervoltage, Overvoltage)	Wired to Contact multiplication Relay and then from CMR to tripping of breaker
6.5.7	Closing of breaker through relay	Wired to Contact multiplication Relay and then from CMR to closing of breaker
6.6	DC control supply bus in all panels	Fed by two DC incoming sources in Bus coupler panel with auto changeover facility
6.7	PT supply bus in all panels	Fed normally by bus PT with automatic changeover facility to incomer line PT
6.8	Flaps for Internal Arc Protection	Flaps shall not have any pores/ opening during normal operation

7 SURGE SUPPRESSOR

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

8 CURRENT TRANSFORMER

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

9 POTENTIAL TRANSFORMER

9.1	Type	Shall be cast resin type with insulation class of E or better.
9.2	Rating and technical particulars	As per Annexure – C (Technical particulars) and Annexure – F (SLDs)
9.3	Mounting	It shall be mounted on a withdrawable carriage. Mounting of PT on the breaker truck is not acceptable. Mounting of PT on the panel top is also not acceptable. Primary PT fuse shall be easily accessible.
9.4	Neutral	The HV neutral connection to earth shall be easily accessible for disconnection during HV test.

10 FEEDER AND BUS EARTHING

10.1	Earthing arrangement	Through separate earthing truck for bus & feeder
10.2	Short time withstand capacity of earthing truck	Equal to rating of breaker. Refer technical parameters.
10.3	Operation from front	Mechanically operated by separate switch.

10.4	Interlocks and Alarm	To prevent inadvertent closing on live circuit, with padlocking arrangement to lock truck in close or open position.

11 EQUIPMENT EARTHING

11.1	Material of earthing bus	Aluminium
11.2	Earthing Bus Position	It shall run through whole switchgear passing nearer to Power Cable Position
11.3	Earth bus joints	All bolted joints in the bus should be made by connection of two bolts.
11.4	Rating	Sized for rated short circuit current for 3 seconds
11.5	Enclosure & non -current carrying part of the switchboard / components	Effectively bonded to the earth bus.
11.6	Hinged doors	Earthed through flexible copper braid
11.7	Circuit breaker frame /carriage	Earthed before the main circuit breaker contacts/ control circuit contacts are plugged in the associated stationary contacts
11.8	Metallic cases of relays, instruments and other LT panel mounted equipment	Connected to the earth bus by independent copper wires of size not less than 2.5 sq. mm with green colour insulation. For this purpose LT compartment should have a clear designated earth bus to which earth connections from all components are to be connected.
11.9	CT and PT neutral	Earthed at one place at the terminal blocks through links.

12 METERS

12.1	Mounting	Flush mounted
12.2	Multifunction Meter	
12.2.1	SCADA Interfacing	RS485 rear port suitable for integration on Modbus Protocol
12.2.2	Size	96x96 mm^2

DocUUID : 39aff16e-ea33-46dd-b594-218f28cdb6d0

12.2.3	Panels where to be provided	All panels except Bus PT Panel
12.2.4	Accuracy Class	1
12.2.5	Signal List	R-Ph Current, Y-Ph Current, B-Ph Current, Neutral Current, R-Y Ph Voltage, Y-B Ph Voltage, B-R Ph Voltage, Active Power, Active Energy, Reactive Power, Power Factor, Max Demand, Phase angle 1, Phase angle 2, Phase angle 3, THD Mean Current, THD Mean Voltage
12.2.6	Data Type	MFI
12.2.7	Compatibility with RTU	ABB 560
12.2.8	Programmability	CT secondary shall be programmable i.e for both 1 A and 5 A
12.2.9	Auxiliary Supply	a. 48 – 240VDC and AC i.e universal type. b. Although in Scheme, MFM must be wired up with DC only
12.3	Voltmeter	Digital type with programmable ratio
12.3.1	Size	96x96 mm^2
12.3.2	Panels where to be provided	Incomer and bus PT panel
12.3.3	Voltmeter switch	Inbuilt in meter
12.3.4	Accuracy Class	1.0
12.4	Energy meter provision	Energy meter is not in supplier's scope. Only space and CT/PT wiring is to be provided in all panels except bus coupler and bus PT. Space for Energy meter shall be 200(w) X 350(h) mm^2

13 INDICATION, ALARMS & ANNUNCIATION

13.1	Indications	Flush mounted, High intensity, clustered LED type
13.1.1	Breaker ON	Red
13.1.2	Breaker Off	Green
13.1.3	Spring Charged	Blue
13.1.4	DC control supply fail	Amber
13.1.5	AC control supply fail	Amber
13.1.6	Auto trip	Amber
13.1.7	Test Position	White
13.1.8	Service Position	White

DocUUID : 39aff16e-ea33-46dd-b594-218f28cdb6d0

13.1.9	Heater circuit healthy	Yellow (Indication with integrated push button for checking)
13.1.10	Trip circuit healthy	White
13.1.11	PT supply as applicable	R,Y B
13.2	Annunciator (For 33kV Panels only)	
13.2.1	Type	Static type alongwith alarm. Annunciations shall be repetitive type and shall be capable of registering the fleeting signal. Fascia test facility should also be provided.
13.2.2	Note	LED type indications may not be provided for alarm signals provided on annunciator.
13.2.3	Mounting	Flush mounted
13.2.4	Fascia	12 window
13.2.5	Signals to provided on Fascia	Window 1 – Main Protection Operated (Distance /Differential) Window 2 – Backup O/C & E/F Protection Operated Window 3 – LBB operated Window 4 – CB Autotrip Window 5 – Trip Circuit Unhealthy Window 6 – DC Fail Window 7 – AC Fail Window 8 – VT Fuse Fail Window 9 – Protection Relay Faulty
13.2.6	Push Buttons	For test, accept and reset
13.2.7	Potential Free Contacts	To be provided for event logger
13.3	Alarm scheme with isolation switch	a. For DC fail, TC fail and CB auto trip in 11kV panels b. For all signals wired to annunciator in 33kV panels

Sequence of operation of the annunciator shall be as follows-

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

14 SELECTOR SWITCHES & PUSH BUTTONS

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

15 INTERNAL WIRING

15.1	Internal wiring	1100 V grade, PVC insulated (FRLS) stranded flexible copper wire.
15.2	Size	2.5 sq mm for CT circuit, 1.5 sq mm for PT & control circuits
15.3	Colour code	
15.3.1	CT & PT	R Ph – Red Y Ph – Yellow B Ph – Blue Neutral – Black

DocUUID : 39aff16e-ea33-46dd-b594-218f28cdb6d0

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

16 TERMINAL BLOCKS

16.1	Rating and Type	1100 V grade, moulded piece, stud type screw driver operated terminals complete with insulated barriers, washers, nuts and lock nuts.
16.2	Segregation	TBs shall be segregated.
16.3	Suitability	Terminal Block shall be Stud Type Screw Driver Operated suitable for 6sqmm control cable. Disconnecting facility shall be provided in CT and PT terminal. Shorting and Earthing facility shall be provided in CT
16.4	Marking and covers	White fibre markings strip with clear plastic, slip-on / clip-on terminal covers to be provided.
16.5	Disconnecting Facility	To be provided in CT and PT terminals

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

17 RELAYS

17.1	Protection Relays – General Features	
17.1.1	Technology and Functionality	Numerical , microprocessor based with provision for multifunction protection, control, metering and monitoring
17.1.2	Mounting	Flush Mounting, IP5X
17.1.3	Architecture	Hardware and software architecture shall be modular and disconnectable to adapt the protection and control unit to the required level of complexity as per the application.
17.1.4	Programming and configuration	Relay shall utilize a user friendly setting and operating multi-lingual software in windows environment with menus and icons for fast access to the data required. Programming software and communication cord for offered relays should be included in scope of supply.
17.1.5	Conformal Coating	a. Required on all cards and Components to protect against moisture, dust, chemicals, temperature extremes etc b. Testing shall be as per IEC 60068-2-60

DocUUID : 39aff16e-ea33-46dd-b594-218f28cdb6d0

17.1.6	SCADA Interface port	LC type Dual fibre optic port for interfacing with SCADA on IEC 61850 & PRP compatible. Through this port relays shall be connected to Ethernet switches..
17.1.7	Processing Indications	SCADA functions for monitoring shall be executed on SPI (Single Point Input) and DPI (Double Point Input). DPI shall only be used in case of Isolator and Circuit breaker “close” and “open” indication.
17.1.8	Command Processing	Functionality of command processing offered for SCADA interface shall include the processing of single and double commands i.e SCO (Single Command Output) and DCO (Double object command Output). DCO shall only be used in case of Isolator and Circuit Breaker “close” and “open” command.
17.1.9	PC Interface port	Front port (preferably serial) for configuration/data downloads using PC. Cost of licensed software and communication cord, required for programming of offered protection relays shall be included in the cost of switchgear.
17.1.10	User Interface	An alphanumeric key pad and graphical LCD display with backlight indicating measurement values and operating messages. It should be possible to access and change all settings and parameters without the use of PC.
17.1.11	SCADA Interface	Relay shall communicate all measured & monitored parameters, analog signals, event record, fault record, DIs , DOs etc to SCADA
17.1.12	Relay Characteristics	Relay shall integrate all necessary protections for different applications in accordance with IS and IEC. Relay shall provide wide setting ranges and choice of all IEC, IEEE and other tripping curves through a

		minimum of two setting groups.
17.1.13	GOOSE Messaging	Relays shall communicate all status signals, commands and events on GOOSE messaging.
17.1.14	Event and Fault records	Relay shall have the facility of recording of various parameters during event/fault with option to set the duration of record through settable pre fault and post fault time. Relay shall store records for last 10 events and 10 faults (minimum). It should be possible to download records locally to PC and remotely to SCADA.
17.1.15	Self diagnosis	Relay shall be able to detect internal failures. A watchdog relay with changeover contact shall provide information about the failure.
17.1.16	Time synchronization	All relays shall be capable of being synchronized with the system clock using SCADA interface and PC.
17.1.17	Operation Indicators	LEDs with push button for resetting.
17.1.18	Test Facility	Inbuilt with necessary test plugs.
17.2	Protection Relays for 11kV Incomer panel	
17.2.1	Relay 1	3-phase Directional Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		Undervoltage and overvoltage protection
		Trip Circuit Supervision
		Sync Check function
		PT supervision (fuse failure monitoring)
		Relay shall communicate all measured and monitored parameters like current, voltage, active power, reactive power, apparent power, power factor, phase angle, event record, fault record, DIs ,

DocUUID : 39aff16e-ea33-46dd-b594-218f28cdb6d0

		DOs etc to SCADA
17.2.2	Relay 2	High Impedance Restricted Earth fault protection.
17.2.3	User Configurable DIs and Dos	Relay-1 & 2 should have a total of 16 Dis and 10 Dos (minimum). Each relay should have atleast 2 Dis and 4 Dos
17.2.4	Note	Combining functions of Relay-1 and Relay-2 in single relay is not acceptable.
17.2.5	SLD	Refer annexure – F1
17.3	Protection Relays for 11kV Bus Section panel	
17.3.1	Relay 1	3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		Sync Check function
		Trip Circuit Supervision
		PT supervision (fuse failure monitoring)
		User Configurable 16 Dis and 8 Dos (minimum)
		Relay shall communicate all measured and monitored parameters like current, voltage, active power, reactive power, apparent power, power factor, phase angle, event record, fault record, DIs , DOs etc to SCADA
17.3.2	SLD	Refer annexure – F2
17.4	Protection Relays for 11kV Outgoing panel	
17.4.1	Relay 1	3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		Trip Circuit Supervision
		User Configurable 12 Dis and 6 Dos (minimum)
		Relay shall communicate all measured and monitored parameters like current, voltage, active power, reactive power, apparent power, power factor, phase angle, event record, fault record, DIs ,

		DOs etc to SCADA
17.4.2	SLD	Refer annexure – F3
17.5	Protection Relays for 11kV Station Transformer panel	
17.5.1	Relay 1	3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		Trip Circuit Supervision
		User Configurable 12 DIs and 6 DOs (minimum)
		Relay shall communicate all measured and monitored parameters like current, voltage, active power, reactive power, apparent power, power factor, phase angle, event record, fault record, DIs , DOs etc to SCADA
17.5.2	SLD	Refer annexure – F4
17.6	Protection Relays for 11kV Capacitor panel	
17.6.1	Relay 1	3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		Undervoltage and Overvoltage protection(From Bus PT)
		Trip Circuit Supervision
		Neutral Unbalance protection(From RVT associated to Cap Bank)
		Timer for on time delay (minimum 600 seconds)
		User Configurable 12 DIs and 6 DOs (minimum)
		Relay shall communicate all measured and monitored parameters like current, voltage, active power, reactive power, apparent power, power factor, phase angle, event record, fault record, DIs , DOs etc to SCADA
17.6.2	SLD	Refer annexure – F5.
17.7	Protection Relays for 33kV Incomer	

17.7.1	Relay 1	Line differential protection (Dual channel, ST Port Compatible for Single Mode Fibre having wavelength 1310 nm)
		Distance Protection
		Software based CT ratio correction
		Dedicated port for communication with remote end relay through optical fibre. This port should be in addition to PC interface and SCADA interface ports.
17.7.2	Relay 2	Bay control unit having MIMIC with 3-phase Directional Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics.
		Trip Circuit Supervision
		Sync check function
		Under Frequency, Over Frequency, Rate of Change of Frequency
		Circuit Breaker failure protection
		Reverse blocking function
		PT supervision
		Relay shall communicate all measured and monitored parameters like current, voltage, active power, reactive power, apparent power, power factor, phase angle, event record, fault record, DIs , DOs etc to SCADA
17.7.3	User Configurable DIs and Dos	Relay-1 & 2 should have a total of 16 DIs and 12 DOs (minimum). Each relay should have atleast 2 DIs and 6 Dos
17.7.4	Note	Combining functions of Relay-1 and Relay-2 in single relay is not acceptable.
17.7.5	SLD	Refer annexure – F6
17.8	Protection Relays for 33kV Transformer Feeder Panel	
17.8.1	Relay 1	Biased differential protection
		REF protection

		Software based ratio and vector correction feature (without ICT)
		H2 and H5 harmonic restraint
17.8.2	Relay 2	Bay control unit having MIMIC with 3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		Trip Circuit Supervision
		Under Frequency, Over Frequency, Rate of Change of Frequency
		Reverse Blocking function
		Circuit Breaker failure protection
		Relay shall communicate all measured and monitored parameters like current, voltage, active power, reactive power, apparent power, power factor, phase angle, event record, fault record, DIs , DOs etc to SCADA
17.8.3	User Configurable DIs and DOs	Relay-1 & 2 should have a total of 16 DIs and 12 DOs (minimum). Each relay should have atleast 2 DIs and 6 DOs.
17.8.4	Note	Combining functions of Relay-1 and Relay-2 in single relay is not acceptable.
17.8.5	SLD	Refer annexure – F7
17.9	Protection Relays for 33kV Buscoupler Panel	
17.9.1	Relay 1	Bay control unit having MIMIC with 3-phase Overcurrent and earthfault protection with IDMT, Definite time and instantaneous characteristics.
		Trip Circuit Supervision
		Sync check function
		Reverse Blocking Function
		Circuit Breaker failure protection
		PT supervision (fuse failure monitoring) for Bus PT-1
		User Configurable 16 DIs and 8 DOs (minimum)

		Relay shall communicate all measured and monitored parameters like current, voltage, active power, reactive power, apparent power, power factor, phase angle, event record, fault record, DIs , DOs etc to SCADA
17.9.2	Relay 2	Under Frequency, Over Frequency, Rate of Change of Frequency
		PT supervision (fuse failure monitoring) for Bus PT-2
17.9.3	SLD	Refer annexure – F8
17.10	Protection Relays for 33kV Outgoing Panel (For Installation at KCC Consumer Premises)	
17.10.1	Relay 1	Bay control unit having MIMIC with 3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		Trip Circuit Supervision
		Reverse Blocking Function
		Under Frequency, Over Frequency, Rate of Change of Frequency
		Circuit Breaker failure protection
		User Configurable 12 DIs and 6 DOs (minimum)
		Relay shall communicate all measured and monitored parameters like current, voltage, active power, reactive power, apparent power, power factor, phase angle, event record, fault record, DIs , DOs etc to SCADA
17.10.2	SLD	Refer annexure – F9
17.11	Protection Relays for 33kV Incomer from 66/33kV Autotransformer	
17.11.1	Relay 1	High Impedance Restricted Earth fault protection
17.11.2	Relay 2	Bay control unit having MIMIC with 3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		Trip Circuit Supervision

		Under Frequency, Over Frequency, Rate of Change of Frequency
		Reverse Blocking Function
		Sync check function
		Undervoltage and overvoltage protection
		Circuit Breaker failure protection
		PT supervision (fuse failure monitoring)
		Relay shall communicate all measured and monitored parameters like current, voltage, active power, reactive power, apparent power, power factor, phase angle, event record, fault record, DIs , DOs etc to SCADA
17.11.3	User Configurable DIs and DOs	Relay-1 & 2 should have a total of 16 DIs and 12 DOs (minimum). Each relay should have atleast 2 DIs and 6 Dos
17.11.4	Note	Combining functions of Relay-1 and Relay-2 in single relay is not acceptable
17.11.5	SLD	Refer annexure – F10
17.12	Protection Relays for 33kV Outgoing from 66/33kV Autotransformer	
17.12.1		Power swing blocking
	Relay 1	Line differential protection(Dual channel, ST Port Compatible for Single Mode Fibre having wavelength 1310 nm)
		Distance Protection
		Software based CT ratio correction
		Dedicated port for communication with remote end relay through optical fibre. This port should be in addition to PC interface and SCADA interface ports.
17.12.2	Relay 2	Bay control unit having MIMIC with 3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics.
		PT Supervision
		Under Frequency, Over Frequency, Rate of Change

		of Frequency
		Trip Circuit Supervision
		Reverse Blocking Function
		Circuit Breaker failure protection
		Relay shall communicate all measured and monitored parameters like current, voltage, active power, reactive power, apparent power, power factor, phase angle, event record, fault record, DIs , DOs etc to SCADA
17.12.3	User Configurable DIs and DOs	Relay-1 & 2 should have a total of 16 DIs and 12 DOs (minimum). Each relay should have atleast 2 DIs and 6 Dos
17.12.4	Note	Combining functions of Relay-1 and Relay-2 in single relay is not acceptable.
17.12.5	SLD	Refer annexure – F11
17.13	Protection Relays for 33kV Buscoupler for Switchboard of 66/33kV Autotransformer	
17.13.1	Relay 1	Bay control unit having MIMIC with 3-phase Overcurrent and earthfault protection with IDMT, Definite time and instantaneous characteristics.
		Trip Circuit Supervision
		Sync check function
		Circuit Breaker failure protection
		PT supervision (fuse failure monitoring) for Bus PT-1
		User Configurable 16 DIs and 8 DOs (minimum)
		Relay shall communicate all measured and monitored parameters like current, voltage, active power, reactive power, apparent power, power factor, phase angle, event record, fault record, DIs , DOs etc to SCADA
17.13.2	Relay 2	Under Frequency, Over Frequency, Rate of Change of Frequency
		PT supervision (fuse failure monitoring) for Bus PT-2

17.13.3	SLD	Refer annexure – F12
17.14	Protection Relays – SCADA Interfacing	
17.14.1	Configuration and wiring of DIs in Protection Relays (All panels) for routing status signals to SCADA	DI-1 – TC-1 Healthy DI-2 – TC-2 Healthy DI-3 – CB Autotrip (contact from lockout relay) DI-4 – CB Open DI-5 – CB Close DI-6 – CB in service DI-7 – CB in test DI-8 – Spring Charged DI-9 – L/R switch Remote DI-10 – AC fail DI-11 – Adjacent Panel DC Fail/DC MCB Trip DI-12 – Adjacent Panel Protection Relay fail DI-13 – PT MCB trip (metering and protection, for incomer and capacitor panel only) Sequence of DIs should be strictly as mentioned above. Change in sequence of DIs will not be acceptable.
17.14.2	Configuration and wiring of DOs in Protection relays (all panels) for execution of SCADA commands through SCADA interface port (refer clause 16.1.5).	DO-1 – CB Open DO-2 – CB close DO-3-Electrical Reset Sequence of DOs should be strictly as mentioned above. Change in sequence of DOs will not be acceptable.
17.14.3	Looping of numerical relays	All relays in the switchboard have to be looped to form a common bus for interfacing with SCADA.
17.14.4	Spare DIs and DOs	Should be wired upto terminal block for future use.
17.15	Transformer Monitoring cum AVR Relay	
17.15.1	Features	As per annexure –B
17.15.2	Requirement	To be provided in 33KV Transformer panel only
17.16	Auxiliary Relays – General Features	

17.16.1	Relays for auxiliary, supervision, trip and timer relays	Static or electromechanical type.
17.16.2	Reset mechanism for auxiliary relays	Self reset contacts except for lock-out relays.
17.16.3	Reset mechanism for lockout relays	Electrical reset type for 11kV outgoing panels only. Hand reset type for all other panels.
17.16.4	Operation indicators	With hand-reset operation indicators (flags) or LEDs with pushbuttons for resetting.
17.17	Auxiliary relays – Requirement	
17.17.1	Anti pumping (94), lockout (86),	a. For each breaker b. Lock Out Relay mounting shall be flush type on front side of Panel
17.17.2	PT selection relays	To be provided in bus coupler panel for selection between Bus PT and Line PT of respective sections.
17.17.3	Switchgear with two incomer & bus coupler	Lockout relay (86) contact of each incoming breakers to be wired in series in closing circuit of other incoming breakers & bus coupler.
17.17.4	Contact Multiplication Relay for Tripping and closing of Breaker	a. One for Tripping and one for closing with each breaker b. Current Rating shall be 30 percent more than closing and tripping coil current rating c. Shall be of closed type i.e. direct unauthorised access shall not be provided.
17.17.5	Auxiliary Relays, contact multiplication relays etc.	To effect interlocks and to exchange signals of status & control
17.17.6	Transformer trouble relays (For 33kV Transformer feeder panel only)	Auxiliary relays with indicating flags (contactors will not be accepted) should be provided for the following trip and alarm commands – a. Buchholz trip b. OSR trip c. PRV trip d. SPR trip e. WTI Trip f. OTI Trip g. Buchholz Alarm

DocUUID : 39aff16e-ea33-46dd-b594-218f28cdb6d0

		h. Low oil level alarm i. OTI Alarm j. WTI Alarm.
17.18	General Requirements for all relays/contactors	Auxiliary supply will be 50/220VDC based on requirement. All relays/contactors shall be suitable for continuous operation at 15% overvoltage.

18 SYNCH CHECK PHILOSOPHY

18.1	Dead Bus – Live Line	a. Application - Required for Charging of Bus from Line Supply b. Logic - Sync check relay installed on line panel will check the line and bus voltage and derive that the line is live and bus is in dead condition i.e bus has to be charged by the line breaker. Hence Sync check relay will allow the line breaker to close in this condition.
18.2	Dead Line – Live Bus	a. Application - Required for Charging of Line from Bus Supply b. Logic - Sync check relay installed on line panel will check line and bus voltage and derive that the line is dead and bus is in live condition i.e line has to charged from bus. Hence Sync check relay will allow the line breaker to close in this condition.
18.3	Live Bus – Live Line	a. Application - Required for paralleling of bus and line supply b. Logic - Sync check relay installed on line panel will compare magnitude and phase sequence of line and bus voltages. If the variations are within the range set in the relay, sync check relay will allow the closing of line breaker.
18.4	Live Bus – Dead Bus	a. Application – Required for charging of dead bus through another live bus. b. Logic – Sync check relay installed on bus coupler/bus section panel will check voltage of both buses and derive that one bus is dead and other bus is live i.e dead bus is being charged from live bus. Hence Sync check relay will allow the bus coupler/bus section breaker to close in this condition.

DocUUID : 39aff16e-ea33-46dd-b594-218f28cdb6d0

18.5	Live Bus – Live Bus	a. Application – Required for paralleling of two buses/bus sections. b. Logic – Sync check relay installed on bus coupler/bus section panel will compare the magnitude and phase sequence of voltage of both buses (or bus sections). If the variations are within the range set in the relay, sync check relay will allow the bus coupler/bus section breaker to close.

19 ETHERNET SWITCHES & FIBRE OPTICS

19.1	Ethernet Switch	
19.1.1	Numbers	Two at each site
19.1.2	FO Port	16 Nos
19.1.3	RJ 45 Port	4 Nos
19.1.4	Communication Protocol	IEC 61850
19.1.5	Network Protocol	PRP
19.1.6	Downlink Rate	100 MBPS
19.1.7	Uplink Rate	1 GBPS
19.1.8	Coating	Conformal
19.1.9	Power Supply Voltage	220 / 50 VDC as per site condition
19.1.10	Grade	Industrial
19.1.11	Certification required	KEMA,CE & FCC for IEC 61850 compliance
19.1.12	Operating Temperature	
19.1.13	Mounting	In Switchgear Panel
19.1.14	Blinking LED Indicators	On each RJ45 ports
19.1.15	Separate Maintenance/console Part	Required
19.1.16	Latency	Less than or equal to 10 ms
19.1.17	Fibre Optic Compatibility	Multimode, 1310 nm
19.1.18	Placement	Din Rail Arrangement Inside Switchgear
19.2	Fibre Optics (Patch Cord) and Ethernet cable	
19.2.1	Connection	From Relays, Meters to Ethernet Switch
19.2.2	Mode of Fibre Optics	Multimode
19.2.3	Wavelength	1310 nm
19.2.4	Ethernet Cable Type	CAT VI
19.2.5	Associated Connectors and Accessories	Required

DocUUID : 39aff16e-ea33-46dd-b594-218f28cdb6d0

20 SPACE HEATERS

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

21 SOCKETS, SWITCHES ,ILLUMINATION LAMPS & MCBs

21.1	Illumination lamp with switch	For LV & cable chamber
21.2	Universal type (5/15 A) Socket with Switch	In LV chamber
21.3	MCBs	a. MCBs of Proper rating may be provided. b. Although Main MCB shall be directly wired up to Trip Circuit, No other MCB shall be provided in between c. Rating of MCB shall be 300% of full load current of relevant circuit

22 NAMEPLATES AND MARKING

22.1	Nameplates	To be provided as per the following description
22.1.1	Equipment Nameplates	a. All equipment mounted on front side as well as equipment mounted inside the panels shall be provided with individual name plates with equipment designation engraved. b. All front mounted equipment shall be also provided at the rear with individual name plates engraved with tag numbers corresponding to the one shown in the

DocUUID : 39aff16e-ea33-46dd-b594-218f28cdb6d0

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

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

23 SURFACE TREATMENT & PAINTING

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

24 APPROVED MAKES OF COMPONENTS

24.1	Numerical Relays	Siprotec series of Siemens, Micom series of Schneider/Alstom. Numerical relays used in complete switchboard should be of same make. Use of two different makes of relays in a switchboard is not acceptable.
24.2	Transformer monitoring cum AVR relay	A-eberle
24.3	Electromechanical Relays	Alstom/Schneider/Siemens/ABB/ER
24.4	Aux Relays	ABB/Jyoti/Omran
24.5	Contactors	ABB/Siemens/Telemechanique
24.6	Instrument transformers	ECS/ Pragati/ Gemini/Schneider/CGL/Kappa/Narayan power tech
24.7	MCBs	Siemens/Schneider/Legrand/ABB
24.8	Control switches	Switron/Kaycee
24.9	Test terminal blocks	IMP/Schneider/Alstom
24.10	Terminal blocks	Elmex/Connectwell
24.11	Indicating lamps	Siemens/ Teknic/ Binay

DocUUID : 39aff16e-ea33-46dd-b594-218f28cdb6d0

24.12	Surge Suppressors	Oblum/Tyco
24.13	Meters	Rishabh(Rish delta Energy)/Conzerv
24.14	Ethernet Switch	Ruggedcom/Hirschman

25 INSPECTION , TESTING & QUALITY ASSURANCE

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

DocUUID : 39aff16e-ea33-46dd-b594-218f28cdb6d0

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

26 PACKING

26.1	Packing Protection	Against corrosion, dampness, heavy rains, breakage and vibration. During transportation/ transit and storage, panels may be subjected to outdoor conditions. Hence, packing of each panel shall be weatherproof.
26.2	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection & identification
26.3	Details of Packing Identification Label on each packing case	a. Individual serial number b. Purchaser's name c. PO number (along with SAP item code, if any) & date d. Equipment Tag no. (if any) e. Destination f. Project Details g. Manufacturer / Supplier's name h. Address of Manufacturer / Supplier / it's agent i. Description and Quantity j. Country of origin k. Month & year of Manufacturing l. Case measurements m. Gross and net weights in kilograms n. All necessary slinging and stacking instructions

DocUUID : 39aff16e-ea33-46dd-b594-218f28cdb6d0

27 SHIPPING

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

28 HANDLING AND STORAGE

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

29 DEVIATION

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

30 ACCESSORIES & TOOLS

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

31 DRAWINGS & DATA SUBMISSION MATRIX

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

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
31.1	Contact Person Name, Email ID and Mobile Number	Required			
31.2	Consolidated Deviation Sheet	Required	Required		
31.3	GTP	Required	Required		
31.4	Relevant Type Test as per IS/IEC	Required			
31.5	Power Cable and control cable Philosophy and Schedule		Required		
31.6	Manufacturer's quality assurance plan and certification for quality standards		Required		
31.7	Sizing Calculation of Associated Equipment		Required		

DocUUID : 39aff16e-ea33-46dd-b594-218f28cdb6d0

31.8	Recommended Spares Apart from spares stated in Spec(for five years of operation)		Required		
31.9	11 kV / 33 kV Switchgear drawing				
31.9.1	General Arrangement	Required	Required		
31.9.2	Sectional Layout		Required		
31.9.3	Door Layout		Required		
31.9.4	LV Box Internal Layout		Required		
31.9.5	SLD	Required	Required		
31.9.6	Schematic Circuit diagram and Scheme of Each type of Panel		Required		
31.9.7	Communication Architecture		Required		
31.9.8	Bus Bar Arrangement		Required		
31.9.9	QAP		Required		
31.9.10	Panel wise BOQ		Required		
31.9.11	Logic Operation Diagram		Required		
31.9.12	Plan		Required		
31.9.13	Synch Logic Diagram		Required		
31.9.14	Foundation Diagram		Required		
31.9.15	DI sheet		Required		
31.9.16	DO Sheet		Required		
31.9.17	TB Details		Required		
31.9.18	Make of all Component as per specification		Required		
31.10	Drawing of CT, PT and Surge Arrestor		Required		
31.11	Drawing of Substation Room		Required		
31.12	Ventilation detail requirement of GIS Room		Required		

DocUUID : 39aff16e-ea33-46dd-b594-218f28cdb6d0

31.13	Installation, erection and commissioning manual for switchgear		Required		
31.14	Inspection Reports			Required	
31.15	As manufacturing Drawings			Required	
31.16	Operation and Maintenance Manual			Required	Required
31.17	Trouble shooting manual			Required	Required
31.18	As built Drawings				Required
31.19	Test Report				Required
31.20	Weekly progress report				Required

ANNEXURE – A - SCOPE OF SUPPLY

Scope of supply should include the following –

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

1.2 Base channel frame of the switchgears with hardware.

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

1.4 Programming software and communication cord for numerical relays.

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

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

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

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

1.9 All relevant drawings, data and instruction manuals.

DocUUID : 39aff16e-ea33-46dd-b594-218f28cdb6d0

ANNEXURE – B – TRANSFORMER MONITORING CUM AVR RELAY

1	General features	
1.1	Technology and Functionality	Microprocessor based with provision for multifunction control and monitoring.
1.2	Mounting	Flush Mounting
1.3	Architecture	Hardware and software architecture shall be modular and disconnectable to adapt the control unit to the required level of complexity as per the application.
1.4	Programming and configuration	AVR shall utilize a user friendly setting and operating multilingual software in windows environment with menus and icons for fast access to the data required.
1.5	User Machine Interface	UMI with an alphanumeric key pad and graphical LCD display with backlight indicating measurement values and operating messages. Capability to access and change all settings and parameters.
1.6	PC Interface port	Front port (preferably serial) for configuration using PC. Cost of licensed software and communication cord, required for programming of offered protection relays using PC, shall be mentioned separately in the bid.
1.7	SCADA Interface port	LC Type Dual fibre optic port for interfacing with SCADA on IEC 61850 & PRP compatible. Through these ports relays shall be connected to Ethernet switches.
1.8	Self diagnosis	Shall be able to detect internal failures. A watchdog relay with changeover contact shall provide information about the failure.
1.9	Cable Termination	Termination of cable shall be at rear side.
1.10	Auxiliary supply	220VDC or 48VDC
2	Inputs and Outputs	
2.1	CT Input	1/5A selectable through programming
2.2	PT Input	110VAC
2.3	Binary Inputs	Sixteen programmable binary inputs should be provided

2.4	Analog Inputs (4-20mA)	One input to be provided
2.5	PT-100 direct input	Two inputs to be provided
2.6	Direct Resistance Input	For tap position indication (18 steps)
2.7	Binary Outputs	Ten programmable binary outputs should be provided
3	Control	
3.1	Control Tasks	Ability to implement control functions through programmable logics
3.2	Voltage setting	Programmable Voltage set point
3.3	Voltage Regulation	Raise/Lower tap position to maintain the preset value of voltage.
3.4	Voltage Regulation modes	Automatic and Manual
3.5	Operation Modes	Local and Remote
3.6	Fan and Pump control	To be provided
3.7	Transformer Paralleling	Capability to parallel transformers whose AVRs are interconnected via a communication network.
4	SCADA Interfacing	
4.1	Configuration of DIs for routing alarm/trip signals to SCADA.	DI-1 – Buchholz trip DI-2 – OSR Trip DI-3 – PRV trip DI-4 – SPR trip DI-5 – OTI trip DI-6 – WTI trip DI-7 – Buchholz alarm DI-8 – Oil Level low alarm (MOG alarm) DI-9 – WTI alarm DI-10 – OTI alarm DI-11 – Tap changer trouble/stuck/out of step DI-12 – Tap changer motor supply fail DI-13 – Tap changer in local control All signals from DI-1 to DI-10 are to be wired up from transformer trouble auxiliary relays.
4.2	Configuration of DOs for	DO-1 – Tap raise

	executing commands from SCADA through interface port/CRP	DO-2 – Tap lower DO-3 – Fan group 1 control DO-4 – Fan group 2 control
4.3	Spare DIs and DOs	To be wired upto the terminal block.
5	Measurement, Event Recording and Monitoring	
5.1	Measured Quantities (optional)	Voltage, Current, Active Power, Reactive Power, Apparent Power, Power factor, frequency
5.2	Event Recording	Facility for recording parameters during various events such as tap change, change in binary input status etc.
5.3	Monitoring	Capability to monitor important transformer parameters such as Oil temperature, Winding Temperature etc and give indication/alarm when the value of a particular parameter exceeds the preset value.

DocUUID : 39aff16e-ea33-46dd-b594-218f28cdb6d0

ANNEXURE – C - TECHNICAL PARTICULARS

1.0	SWITCHGEAR		
1.1	Type	Metal clad, air insulated with VCB type circuit breaker	
1.2	Service	Indoor	
1.3	Mounting	Free standing, floor mounted	
1.4	System Voltage	11 KV	33kV
1.5	Voltage variation	+/- 10%	
1.6	Frequency	50 Hz +/- 5%	
1.7	Phase	3	
1.8	Rated voltage	12 KV	36 kV
1.9	Rated current	As per SLDs given in Annexure-F	
1.10	Short time rating for 3 sec.	25kA	25kA
1.11	Internal arc classification and rating		
1.11.1	Classification	IAC – A - FLR	IAC – A - FLR
1.11.2	Rating	25kA for 1 second	25kA for 1 second.
1.12	Insulation level (PF rms / Impulse peak)	28 kV / 75 kV	70 kV/ 170 kV
1.13	System ground	Effectively earthed	Effectively earthed
1.14	Enclosure degree of protection	IP – 4X for high voltage compartment and IP – 5X for metering and protection compartment	
1.15	Bus bar - Main	Rating as per SLDs given in annexure - F, Short time rating as per clause 1.10.	
1.15.1	Material	Tinned Electrolytic copper	
1.15.2	Bus bar sleeve	Sleeved with shrouds on joints. Tape on joints is not acceptable.	
1.15.3	Bus identification	Colour coded	
1.15.4	Temperature rise	40 deg. C for conventional joints. 55 deg. C for silver plated joints	

1.16	Auxiliary bus bar	Electrolytic grade tinned copper	
1.17	Auxiliary DC Supply	220 V DC / 48 V DC	
1.18	Auxiliary AC supply	240 V AC 50 Hz	
1.19	Hardware	Stainless steel.	
1.20	Earth bus	Aluminium	
1.21	Bus duct entry	From top (where ever applicable)	
1.22	Power cable entry	From bottom and rear	
1.23	Control cable entry	From bottom and front (i.e breaker compartment)	
2.0	CIRCUIT BREAKER		
2.1	Voltage class, insulation level, short time rating	As specified for switchgear	
2.2	Rated current	As per SLDs given in annexure - F. Use of two breakers in parallel to meet the required current rating shall not be acceptable.	
2.3	Duty cycle	O – 0.3 sec – CO - 3min - CO	
2.4	Short circuit rating		
2.4.1	A.C sym. breaking current	25kA	25kA
2.4.2	Short circuit making current	62.5kA	62.5kA
2.5	Operation time		
2.5.1	Break time	Not more than 4 cycles	
2.5.2	Make time	Not more than 5 cycles	
2.6	Range of Auxiliary Voltage		
2.6.1	Closing	85% - 110%	
2.6.2	Tripping	70% - 110%	
2.6.3	Spring Charging	85% - 110%	
2.7	No. of spare aux. Contacts of Breaker, for Owner's use.	Minimum 6 NO + 6 NC	

2.8	No. of spare contacts of Service and Test position limit switch	2 NO	
3.0	CURRENT TRANSFORMERS		
3.1	Voltage class, insulation level and short time rating	As specified for switchgear	
3.2	Type	Cast resin, window / bar primary type	
3.3	Class of insulation	Class E or better	
3.4	Ratio	As per SLDs given in annexure - F	
3.5	Number of secondaries	As per SLDs given in annexure - F	
3.6	Accuracy class		
3.6.1	Protection core	5P20	
3.6.2	Protection (Diff. / REF)	PS	
3.6.3	Metering	0.2s	
3.6.4	Core balance CT	PS	
3.7	Burden (VA)	Adequate for the protection & instruments offered	
3.8	Excitation current of PS Class CTs	30 mA at Vk/4	
3.8	Knee Point Voltage of PS Class CTs (Vk)	>= 40 (Rct + 4)	
3.9	Primary operating current sensitivity of CBCTs	5A	
4.0	VOLTAGE TRANSFORMERS		
4.1	Type	Cast resin, draw out type, single phase units	
4.2	Rated Voltage		
4.2.1	Primary	11000/sq.rt.3	33000/sq.rt.3
4.2.2	Secondary	110V/sq.rt.3	
4.3	No. of phases	3	
4.4	No. of secondary windings	2	
4.5	Method of connection	Star/Star	

4.6	Rated voltage factor	1.2 continuous, 1.9 for 30 seconds	
4.7	Class of insulation	Class E or better	
4.8	Accuracy class		
4.8.1	Protection	3P	
4.8.2	Metering	0.2	
4.9	Primary and secondary fuses	HRC current limiting type, Primary fuse replacement shall be possible with VT in withdrawn position	
5.0	HV FUSES		
5.1	Voltage class	12kV	36kV
5.2	Rupturing capacity	50kA	
5.3	Rated current	As per application	
6.0	SURGE ARRESTORS	For 11kV switchgear	For 33kV switchgear
6.1	Rated Voltage	9kV	30kV
6.2	Maximum continuous operating voltage (MCOV)	7.65kV	25kV
6.3	Discharge current	10kA	10kA
6.4	Discharge class	3	3

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

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

Vendor must submit clause wise compliance in Excel sheet against specification at the time of drawing approval clearly highlighting the deviations from specification against each clause.

DocUUID : 39aff16e-ea33-46dd-b594-218f28cdb6d0

ANNEXURE – E – SPARES REQUIREMENT

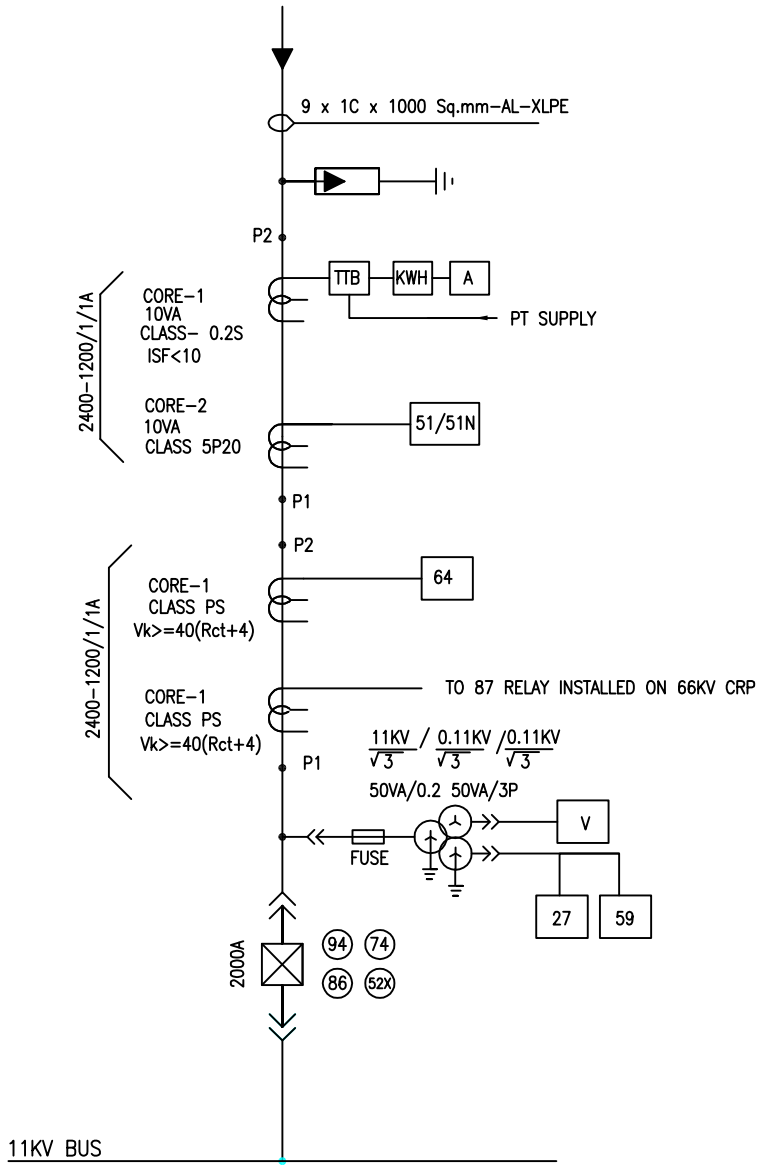
Unit rate of all below mentioned spares have to be provided in the bid.

S No.	Description	Qty
1	Line voltage transformer	3 (1 set)
2	Bus voltage transformer	3 (1 set)
3	Current transformer of each ratio	3 (1 set)
4	Trip Coil	4
5	Closing Coil	4
6	CB Spring charging motor	2
7	Auxiliary switch	2 sets (2 Nos. each type)
8	Bursting disc / pressure relief plate complete	2
9	Numerical relay of each type	1 nos. (each type)
10	Ethernet Switch	1 No (Each Site)
11	Optical Fibre	20% of Supplied Items
12	CAT VI Ethernet cable for Communication	20% of Supplied Items
13	Vacuum Interrupter Bottle	1 set (3 nos.) of each rating
14	Breaker contacts for busbar	1 set (3 nos.) of each rating
15	Breaker testing cable with plug suitable for breaker on one side and plug suitable for the panel on the other side	3 meter(each type)
16	SCADA Spare	20% of Supplied Items

ANNEXURE – F – SLDs

DocUUID : 39aff16e-ea33-46dd-b594-218f28cdb6d0

ANNEXURE–F1



25 KA for 3 secs, 2000A at 50 degree celsius

LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

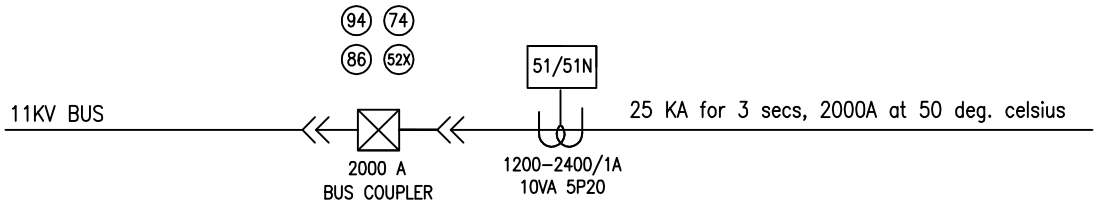
SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:–

1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

DRAWN	R.K/A.H H.K	TITLE:– STANDARD SLD FOR 11KV INCOMER	BSES
CHECKED	S.G/A.S		
APPD.	G.S/G.N		
DATE	29.04.22		SPECIFICATION NO. BSES–TS–66–HTSWG–R0
SCALE	NTS		SLD–SWG–11KV–01

ANNEXURE–F2



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:–

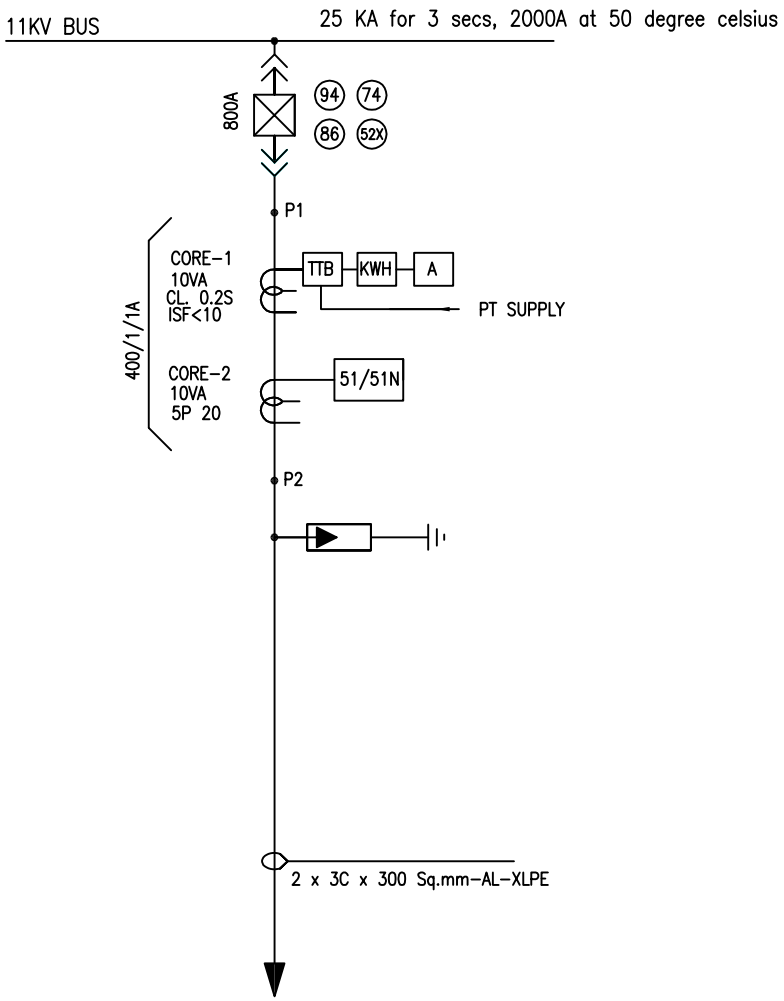
1. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

DRAWN	R.K/A.H H.K	TITLE:– STANDARD SLD FOR 11KV BUS SECTION	BSES
CHECKED	S.G/A.S		
APPD.	G.S/G.N		
DATE	29.04.22		
SCALE	NTS		

SPECIFICATION NO. BSES–TS–66–HTSWG–R0

SLD–SWG–11KV–02

ANNEXURE–F3



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

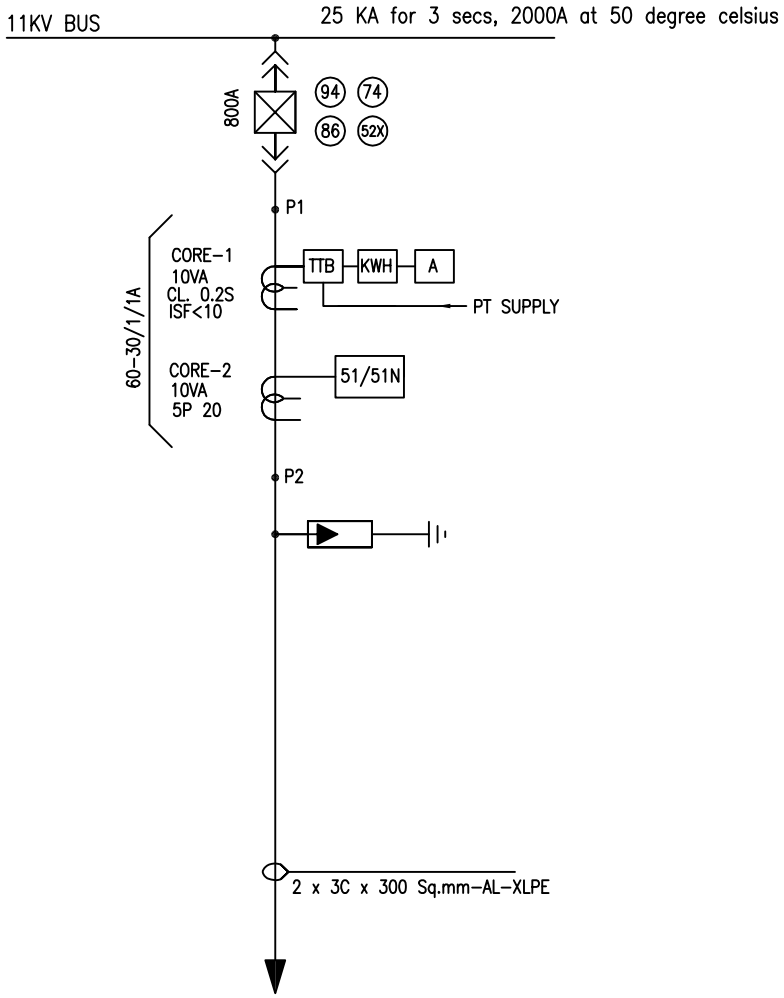
SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:–

1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

DRAWN	R.K/A.H H.K	TITLE:– STANDARD SLD FOR 11KV OUTGOING FEEDER	BSES
CHECKED	S.G/A.S		
APPD.	G.S/G.N		
DATE	29.04.22		SPECIFICATION NO. BSES–TS–66–HTSWG–R0
SCALE	NTS		SLD–SWG–11KV–03

ANNEXURE–F4



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

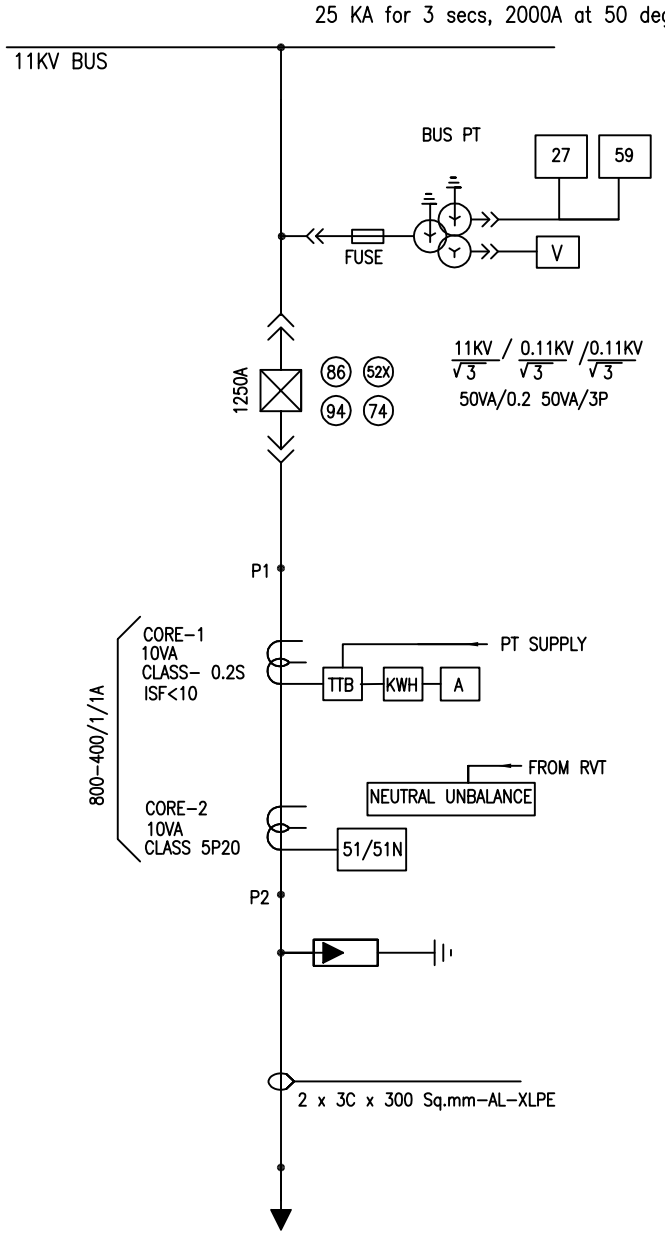
SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:–

1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

DRAWN	R.K/A.H H.K	TITLE:– STANDARD SLD FOR 11KV STATION TRANSFORMER FEEDER	BSES
CHECKED	S.G/A.S		SPECIFICATION NO. BSES–TS–66–HTSWG–R0
APPD.	G.S/G.N		SLD–SWG–11KV–04
DATE	29.04.22		
SCALE	NTS		

ANNEXURE–F5



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

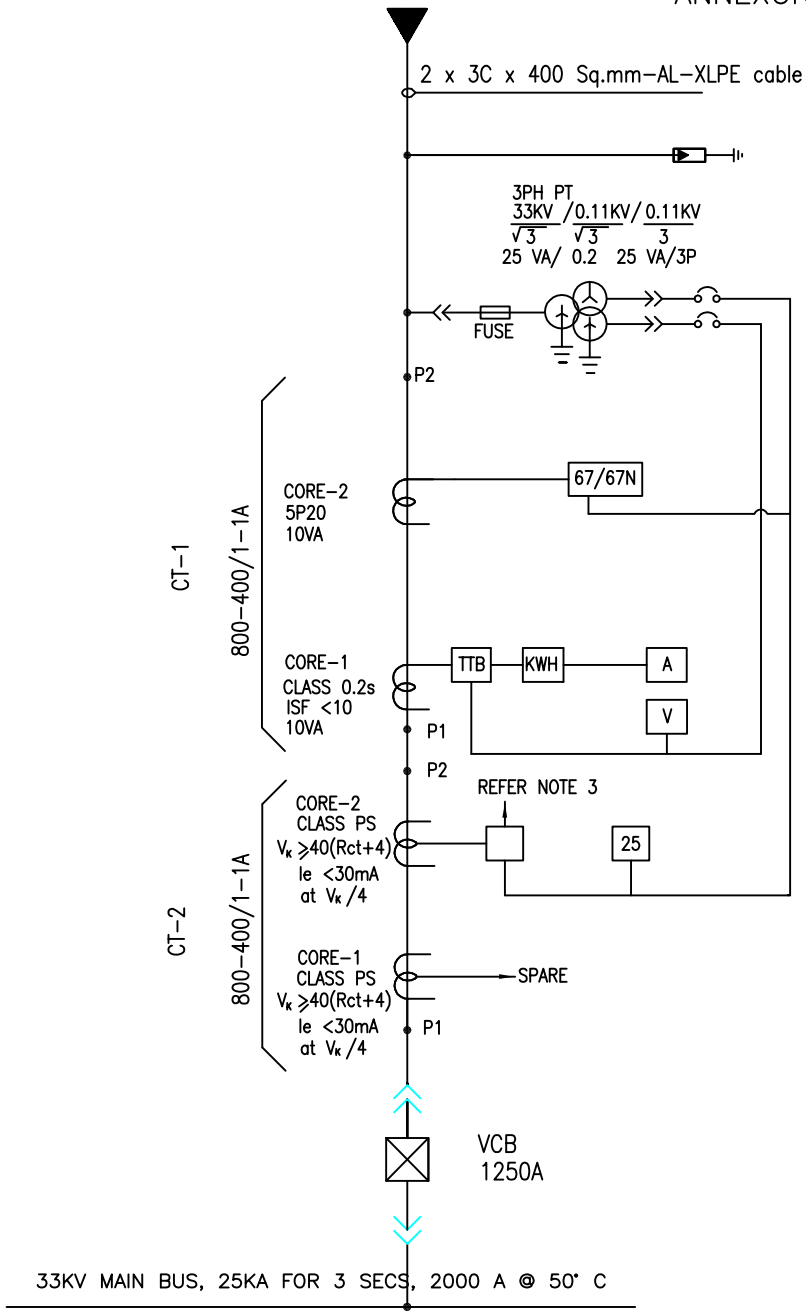
SYMBOL	DESCRIPTION
KWH	ENERGY METER
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:–

1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS
3. ONE BPT TO BE CONSIDERED FOR EACH CAPACITOR PANEL

DRAWN	R.K/A.H H.K	TITLE:– STANDARD SLD FOR 11KV CAPACITOR FEEDER	BSES
CHECKED	S.G/A.S		
APPD.	G.S/G.N		SPECIFICATION NO. BSES–TS–66–HTSWG–R0
DATE	29.04.22		SLD–SWG–11KV–05
SCALE	NTS		

ANNEXURE–F6



LEGEND

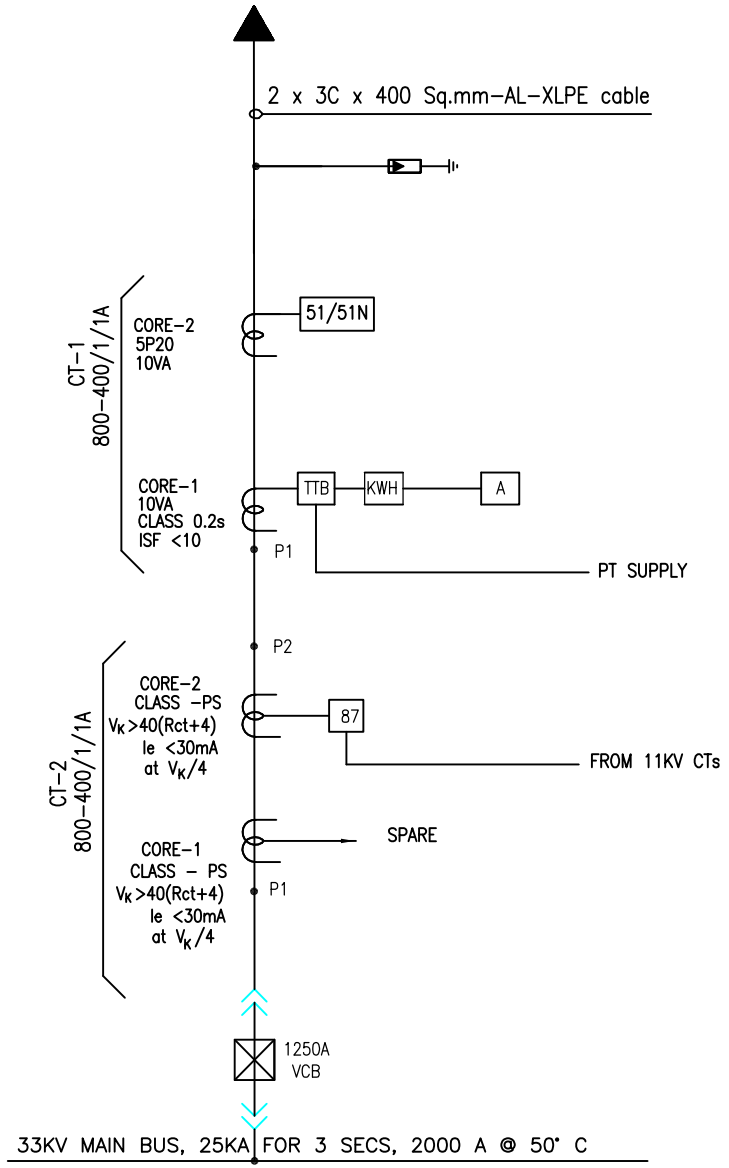
SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:
1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS
3. LINE DIFFERENTIAL OR DISTANCE RELAY. REFER CLAUSE 16.7.1 OF SPECIFICATION

DRAWN	R.K/A.H H.K	TITLE TYPICAL SLD FOR 33KV INCOMER	BSES
CHECKED	S.G/A.S		SPECIFICATION NO. BSES-TS-66-HTSWG-R0
APPD.	G.S/G.N		SLD-SWG-33KV-01
DATE	29.04.22		
SCALE	NTS		

ANNEXURE–F7



LEGEND

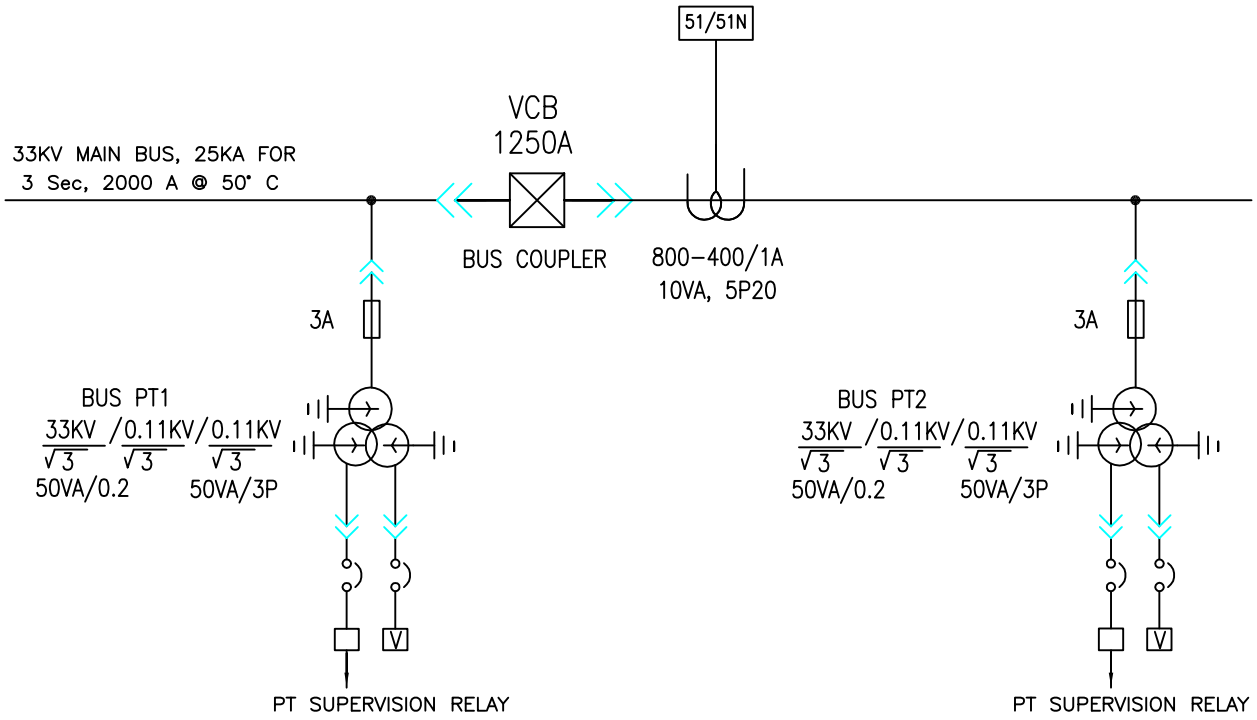
SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:
1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

DRAWN	R.K/A.H H.K	TITLE TYPICAL SLD FOR 33/11KV TRANSFORMER FEEDER	BSES
CHECKED	S.G/A.S		SPECIFICATION NO. BSES-TS-66-HTSWG-R0
APPD.	G.S/G.N		SLD-SWG-33KV-02
DATE	29.04.22		
SCALE	NTS		

ANNEXURE–F8



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

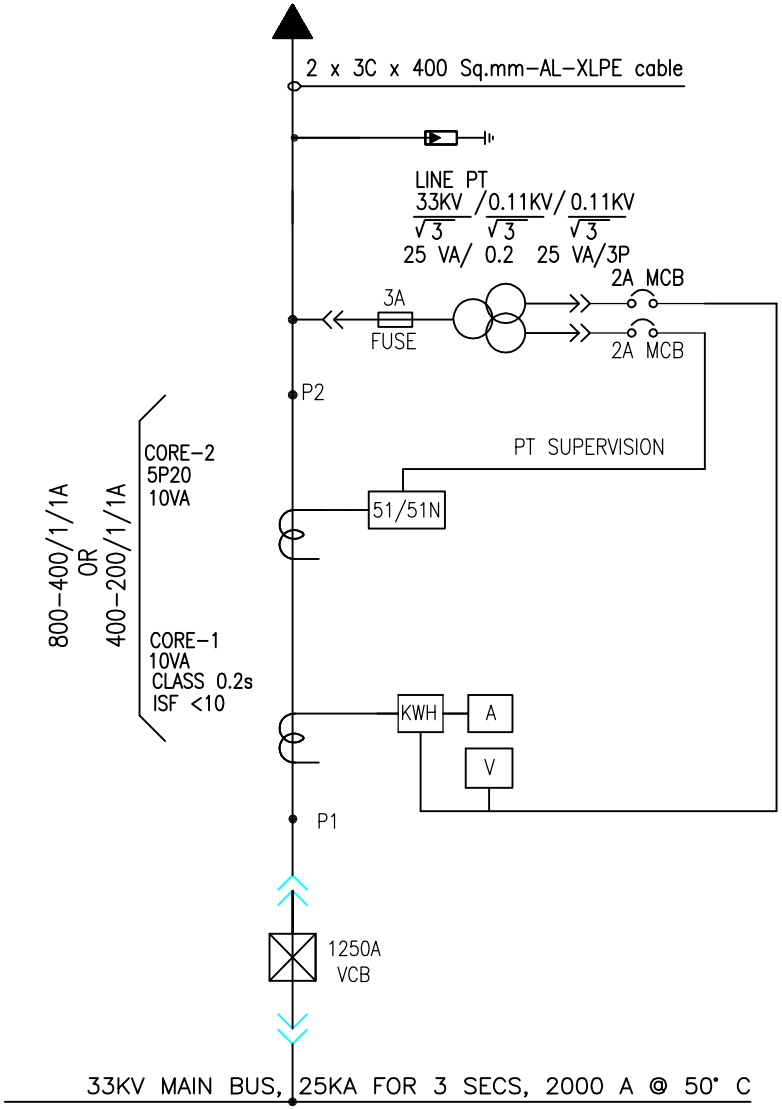
SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:–

1. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

DRAWN	R.K/A.H H.K	TITLE	BSES
CHECKED	S.G/A.S	TYPICAL SLD FOR 33KV BUS COUPLER CUM BUS PT	SPECIFICATION NO. BSES-TS-66-HTSWG-R0
APPD.	G.S/G.N		SLD-SWG-33KV-03
DATE	29.04.22		
SCALE	NTS		

ANNEXURE–F9



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:
1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS
3. TTB NOT REQUIRED IN THIS PANEL

DRAWN	R.K/A.H H.K
CHECKED	S.G/A.S
APPD.	G.S/G.N
DATE	29.04.22
SCALE	NTS

TITLE

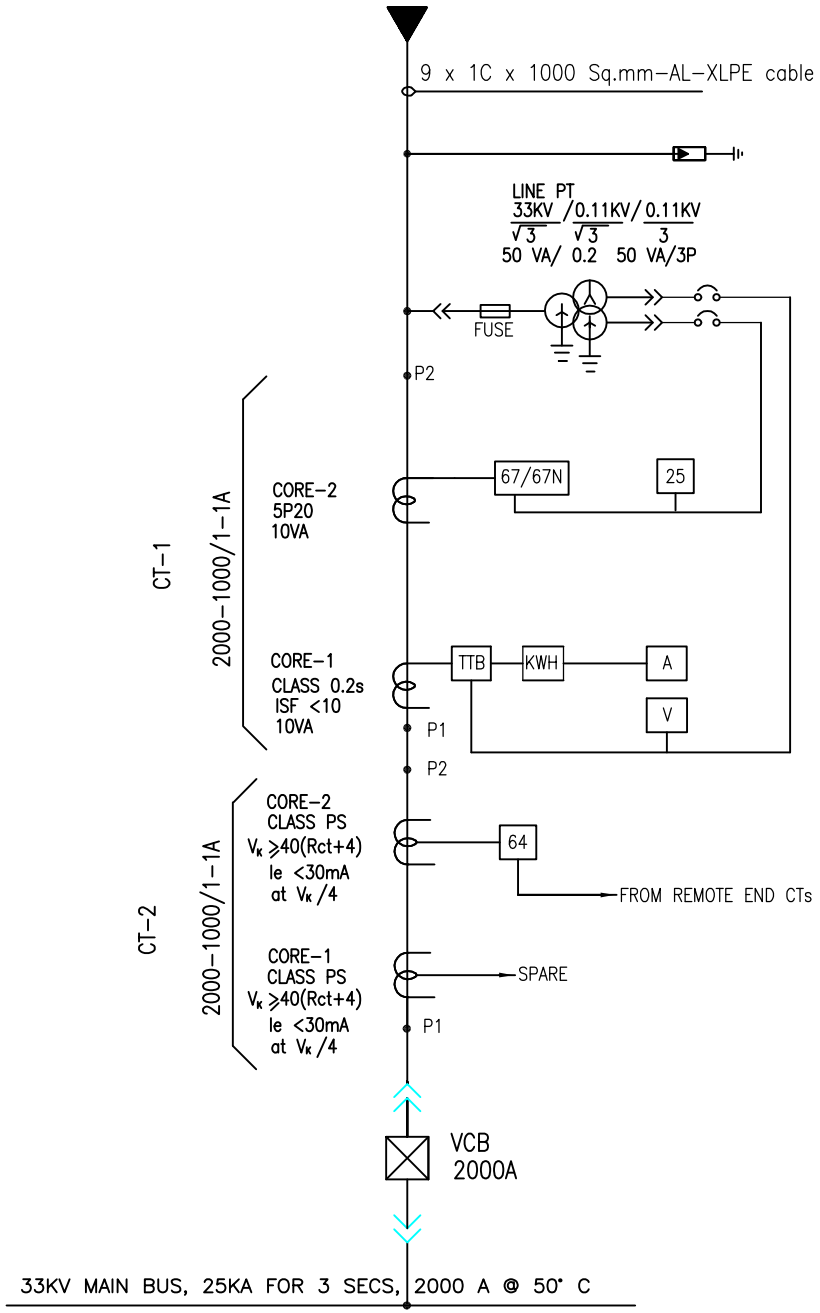
TYPICAL SLD FOR 33 KV OUTGOING FEEDER (FOR INSTALLATION AT KCC CONSUMERS PREMISES)

BSES

SPECIFICATION NO. BSES-TS-66-HTSWG-R0

SLD-SWG-33KV-04

ANNEXURE–F10



LEGEND

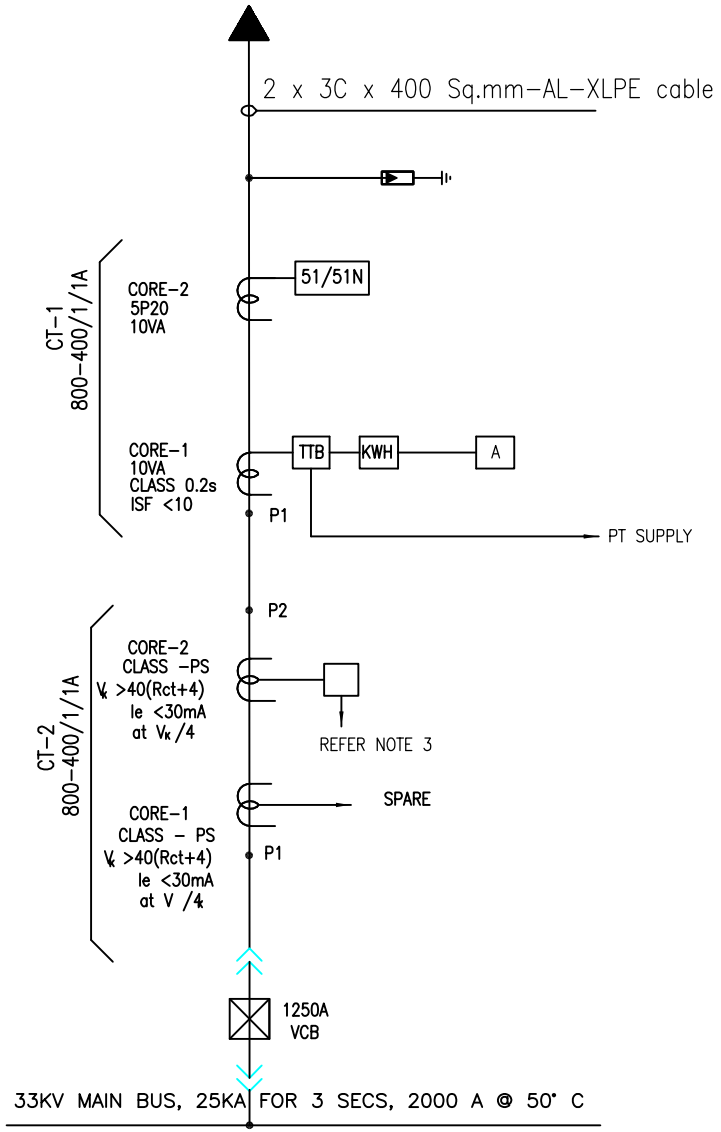
SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:
1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

DRAWN	R.K/A.H H.K	TITLE: TYPICAL SLD FOR 33KV INCOMER FROM 66/33KV AUTO TRANSFORMER	BSES
CHECKED	S.G/A.S		SPECIFICATION NO. BSES-TS-66-HTSWG-R0
APPD.	G.S/G.N		
DATE	29.04.22		SLD-SWG-33KV-05
SCALE	NTS		

ANNEXURE–F11



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:
1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS
3. LINE DIFFERENTIAL OR DISTANCE RELAY. REFER CLAUSE 16.12.1 OF SPECIFICATION

DRAWN	R.K/A.H H.K
CHECKED	S.G/A.S
APPD.	G.S/G.N
DATE	29.04.22
SCALE	NTS

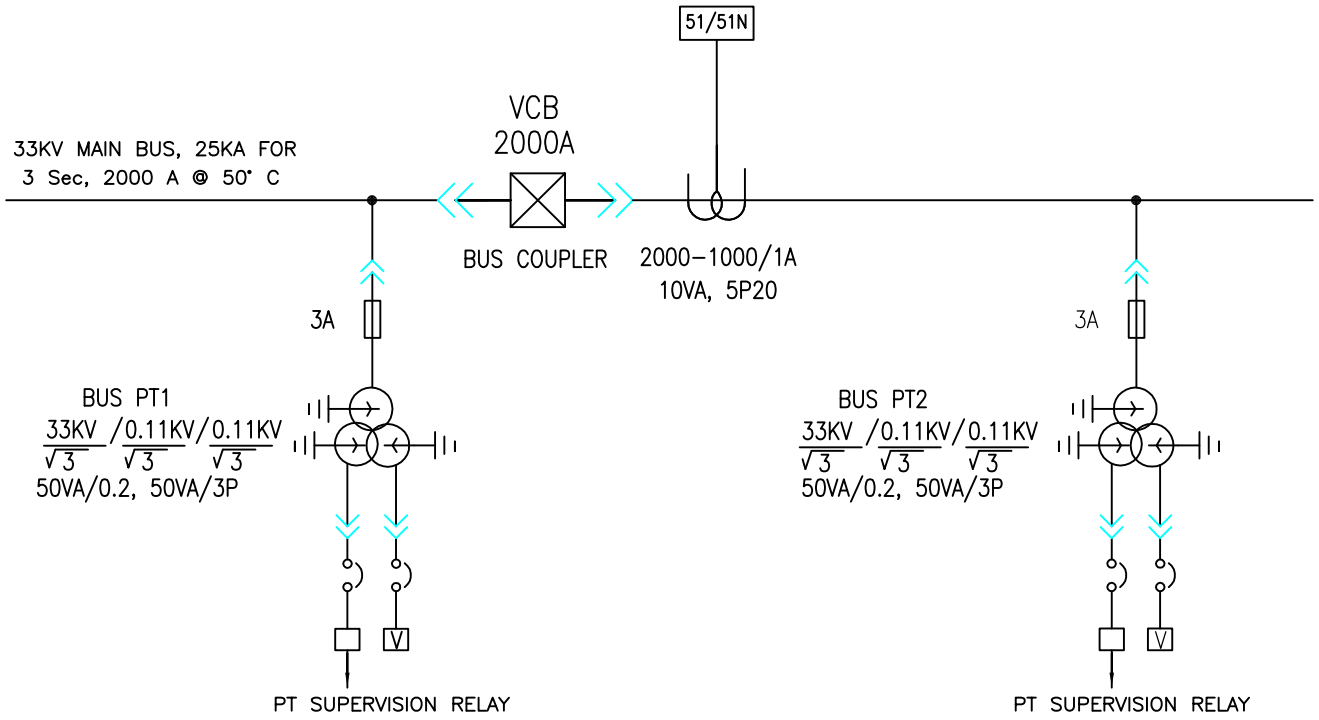
TITLE
TYPICAL SLD FOR 33KV OUTGOING FROM 66/33KV AUTO TRANSFORMER

BSES

SPECIFICATION NO. BSES-TS-66-HTSWG-R0

SLD-SWG-33KV-06

ANNEXURE–F12



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:–

1. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

DRAWN	R.K/A.H H.K
CHECKED	S.G/A.S
APPD.	G.S/G.N
DATE	29.04.22
SCALE	NTS

TITLE

TYPICAL SLD FOR BUS COUPLER CUM BUS PT PANEL FOR 33KV SWITCH BOARD OF 66/33KV AUTO TRANSFORMER

BSES

SPECIFICATION NO. BSES-TS-66-HTSWG-R0

SLD-SWG-33KV-07

Technical Specification
For Heat Shrinkable and GIS Cable Termination Kit (For 11 KV, 33 KV & 66 KV Cables)

Specification no – SP-HSGTK-04-R1

Prepared by		Reviewed by		Approved by		Rev	Date
Name	Sign	Name	Sign	Name	Sign		
AV		GS		AA		R0	02/06/2017

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, 66KV XLPE / PILC cables, shall be designed, manufactured, tested, packed and delivered by the Vendor, as per Purchaser's requirements.

2.0.0 Codes & standards

2.1.0 National Standards:

SL	Standard Number	Title
2.1.1	IS - 13573: 2011	Joints & Terminations of Polymeric Cables for working voltages from 6.6 kV up to and including 33 kV Performance Requirements and Type Tests
2.1.2	IS – 7098 Part 2 : 1985	Cross-linked Polyethylene (XLPE) Insulated PVC sheathed cables : Part 2 : For working voltages from 3.3 kV upto and including 33 kV
2.1.3	IS - 692: 1994	Paper insulated lead-sheathed cables (PILC) for rated voltages up to and including 33 kV specification
2.1.3	IS - 10810: 1984	Methods of test for cables

2.1.1 International Standards:

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

3.0.0 Cable Construction

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

XLPE type Cables: 3-core x 150, 300 & 400 sq. mm. Al
1-core x 630 or 1000 sq. mm. Al

PILC type Cables: 3-core 240 or 300 sq. mm. Al

3.1.0	Conductor	For XLPE : a) Electrolytic Grade stranded Aluminium b) Grade: H2/ H4 as per IS: 8130/84 (For Al) c) Shape: Compacted Circular d) Class 2 For PILC : a) 11 kV : sector-shaped b) 33kV: oval-shaped
3.2.0	Conductor Screen	For XLPE : Extruded Semi Conducting material For PILC : 11 kV : no conductor screen 33 kV : carbon paper
3.3.0	Insulation	For XLPE: Extruded XLPE Insulation For PILC: Layers of impregnated papers
3.4.0	Insulation Screen	For XLPE : a) Freely strippable Semi Conducting (without application of heat) for 66KV firmly bonded b) Copper Tape For PILC : a) 11 kV : absent (Belted) b) 33kV: metallised paper tape
3.5.0	Water Swellable Tape	For XLPE: Semi-conducting Water Swellable Tape shall be provided under the copper tape on each core. For PILC : not applicable
3.6.0	Filler	For XLPE: All interstices, including centre interstices filled by PP filler. For PILC : a) 11 kV : Crushed paper filler b) 33kV: Jute twine
3.7.0	Over all three cores	XLPE : Binder tape PILCA : 11 kV : belt paper 33kV: Copper Woven Fabric tape
3.8.0	Inner Sheath	For XLPE: Extruded Inner Sheath of Black PVC type ST-2. For PILC : Lead alloy sheath
3.9.0	Bedding Tape	For XLPE: not applicable For PILC: two layers of paper, followed by compounded (bituminized) cotton tape.
3.10.0	Copper Woven Fabric Tape (CWF tape)	For XLPE : not applicable For PILC : a) 11 kV : absent (Belted cable) b) 33 kV : applicable for screened cable

3.11.0	Armour	For XLPE : a) Galvanised steel flat strip armour (For 3 core cables) b) Hard drawn Aluminium Wire (For 1 core cables) c) Aluminium or lead sheathed for 66KV cable For PILC : a) 11 kV double steel tape armour
3.12.0	Binder Tape	For XLPE: Rubberised cotton tape
3.13.0	Outer Sheath	For XLPE: Extruded outer sheath of PVC (ST-2) for 11 KV/ 33 KV and HDPE for 66KV Cable with termite- repellent. For PILC : compounded (bituminised) Jute/PVC

4.0.0 Cable Termination Kits

General Technical Requirements for Cable Termination Kits are as follows:

<table>
<tr><td>4.1.0</td><td>Scope</td><td>Design, manufacture, testing and supply of Cable Termination Kits for H. T. Power Cables.</td></tr>
<tr><td>4.2.0</td><td>Functional Requirements</td><td></td></tr>
<tr><td>4.2.1.</td><td>Conductor Connection</td><td>
<table>
<tr><th>Voltage Grade</th><th>Cable Size</th><th>Application</th><th>Material of Lug</th><th>Connection Method</th></tr>
<tr><td rowspan="4">11 KV</td><td rowspan="2">3Cx 150 & 3Cx 300 sq mm</td><td>Indoor</td><td>Bi-Metal</td><td>Mechanical connector</td></tr>
<tr><td>Outdoor</td><td>Aluminium</td><td>Mechanical connector</td></tr>
<tr><td rowspan="2">1Cx1000 sq mm</td><td>Indoor</td><td>Aluminium</td><td>Crimping</td></tr>
<tr><td>Outdoor</td><td>Aluminium</td><td>Crimping</td></tr>
<tr><td rowspan="2">33 KV</td><td rowspan="2">3Cx400 sq mm</td><td>Indoor</td><td>Bi-Metal</td><td>Mechanical connector</td></tr>
<tr><td>Outdoor</td><td>Aluminium</td><td>Mechanical connector</td></tr>
<tr><td rowspan="2">66 KV</td><td rowspan="2">1Cx630 & 1Cx1000 sq mm</td><td>Indoor</td><td>Aluminium</td><td>Crimping</td></tr>
<tr><td>Outdoor</td><td>Aluminium</td><td>Crimping</td></tr>
</table>
a) For 240 sq. mm. PILC cable and 300 sq. mm. XLPE cable, the lug suitable for 300 sq. mm. XLPE cable shall be used.
b) For GIS cable termination kits: Conductor connection assembly shall be done by standard method of split, silver-plated copper cone and pressure-fit contact assembly or as per manufacturer's standard.
</td></tr>
</table>

4.2.2	Stress Control System	a) The earthed insulation screen of an XLPE cable is terminated at a suitable distance from the conductor. b) The tube is in electrical contact with insulation screen. c) Impedance of the tube shall be constant upto an operating temperature and shall be within the range $1x10^{08}$ ohm-cm to $8x10^{08}$ ohm-cm. d) Minimum length of stress control tube for 11 kV and 33 kV shall be 130 mm and 260 mm respectively. e) The physical and electrical properties shall conform to ESI 09: 13. f) For GIS cable termination kits Stress control shall be done by means of a polymeric stress cone. External profile of the cone shall match inner profile of GIS epoxy bushing. Vendor shall specify the material (EPDM / Silicone) of the cone.
4.2.3	Insulation Protection	a) XLPE insulation shall be protected by means of an outer tube, resistant to tracking and weathering. b) One end of the tube shall be coated internally with red sealant mastic for a length of 50 mm. c) Physical and Electrical properties shall conform to ESI 09: 13.
4.2.3.1	Outer Anti-tracking Tube	Outer length of the tube shall be controlled by providing creepage Extension Shed having the same material composition as the tube. These lengths are given in the table below:

Cable System		Minimum Length of tube (mm)		Creepage Extension Shed (No.) (min)	
Voltage	Cores	Indoor	Outdoor	Indoor	Outdoor
11 kV	3 - core	650	650	Nil	2
	1 - core	340	340	Nil	2
33 kV	3 - core	800	1200	2	5
	1 - core	600	600	2	5

4.2.3.3	Oil Barrier Tube (applicable for PILC cable termination)	a) Transparent tube is used for restoring the insulation provided by belt paper, which is terminated at the crotch. b) 33 kV PILC Termination: The oil barrier tube provides an oil-resistant layer to contain impregnating compound within, thus preventing anti-tracking tube coming in contact with the impregnating compound.

4.2.4	Environmental Sealing System	a) Red Sealant Mastic Tape: This tape, used for sealing at ends, shall be synthetic rubber-based and resistant to tracking and weathering. Sufficient quantity of this tape shall be provided. b) Lug-sealing Sleeve: It shall have the same material composition as outer anti-tracking tube. The sleeve shall be fully coated internally with red sealant mastic tape. Length of the sleeve shall be so as to cover half length of the lug barrel and an equal length of track-resistant tube. c) Conductive Break-out: It shall be provided over the crotch for 3-core cables. The break-out base shall overlap PVC outer sheath by a 50 mm. minimum. d) For GIS termination kits : Environmental sealing of cores below the switchgear shall be by means of a trifurcation kit, consisting of heat shrinkable conductive break-out and heat-shrinkable conductive tube of total length of 6 metres supplied in one roll.
4.2.5	Earth Bond System	a) Earth Bond Assembly shall comprise of copper braided conductors as earthing conductors, GI armour support ring (split type) and two stainless steel hose clips. b) For GIS termination kit The earthing arrangement for 3-core cables shall be the same as stated under 'a' above. c) Two nos. copper braided conductors shall be of size: 25 sq. mm. for 11 kV cables, 35 sq. mm. for 33 kV cables and 50 sq mm for 66KV. d) Length of the copper braided conductor shall be 750 mm. e) Each copper braided conductor shall be supplied with copper lug, crimped at one end. Size of lug : 70 sq. mm. for 11 kV and 120 sq. mm. for 33 kV.
4.2.6	Suppression of electrical discharges	Following materials are required for use during cable termination : a) Silicone-based compound Required for filling-in minute services/ surface cracks over XLPE insulation. b) Polymeric mastic Required for application over semiconducting screen, for, eliminating any air-entrapment at any cut point on the surface. It should have sufficient elongation and electrical properties compatible with stress control tube.
4.2.7	Installation. Instruction Sheet	It shall be in English and Hindi language and shall be provided inside every kit.
4.2.8	Identification Tag (for traceability)	a) An aluminum pouch with paper tag & sealing arrangement at one end shall be provided. b) This tag is required to be tied over the cable at one side of the joint. c) The paper tag shall give following information 1) Vendor kit designation 2) Division 3) Breakdown ID/Shutdown ID/Scheme No. 4) Cable section 5) Type of joint 6) Size of Joint 7) Make of joint

		8) Voltage class 9) Serial no. of kit 10) Vendor lot & batch no 11) Month & year of manufacturing 12) Date of installation 13) Name of jointer 14) Name of vendor supervisor 15) Name of BSES supervisor 16) Remarks
4.2.9	Paper Measuring Tap	Required for use during cable preparation / terminations.
4.3.0	Technical Particulars	Vendor shall submit Guaranteed Technical Particulars (GTP) as per Annexure A.
4.4.0	Type Tests	Termination Kit shall be of type-tested quality.
4.5.0	Testing & Inspection	
	a) Tests	All the routine and acceptance tests shall be carried out as per ESI guidelines. (Also refer Annexure -C)
	b) Inspection	1) Buyer reserves the right to witness all tests specified on individual H. S. components, Moulded components or completed Cable Termination Kit. 2)Buyer reserves the right to inspect Cable Termination Kit at the Seller's works at any time, prior to dispatch, to verify compliance with the specification. 3) In-process and final inspection call intimation shall be given in advance to purchaser.
	c) Test Certificates	Three sets of complete Test Certificates (Routine & Acceptance tests) shall be submitted along with the delivery of Cable Termination Kits.
	d) Type Test	a) End termination kit shall be of type-tested quality. b) In addition to this, vendor will be required to conduct type-testing on heat shrinkable and moulded components, stress grading mastic, etc., in line with EA TS 09-13 standard, at third party test laboratory once in every six months on randomly selected sample of each voltage rating without any commercial implication.
4.6.0	Documents	"Documents" refer to Documents, Data, Manuals, etc. (Scanned copy of signed documents also shall be part of entire soft file (e-file) or CD.)
4.6.1	Along with the Bid	Vendor shall submit signed 3 sets (plus 1 set of soft copy) of following documents: a) GTP (duly filled-in) (as per Annexure - A). b) Cross-sectional drawings for components Assembly c) Type Test Certificates d) Complete Catalogue and Instructions. e) Any other document.
4.6.2	After Award of Contract	Vendor shall submit signed 2 sets (plus 1 set of soft copy) of above mentioned documents within 15 days, for Purchaser's approval.

4.6.3	"As-Built" documents	Final signed "As-built" documents for the equipment in 3 sets (hard copy), 1 no. soft copy. These documents shall include signed Routine & Acceptance Test Certificates also.
4.7.0	Packing, Marking, Shipping, Handling and Storage	Every component/kit/box shall be properly sealed/ packed for protection against damage.
a)	Identification Label	Markings / Labels shall be on both sides of every packed box. 1) Identification number/type designation (as per manufacturer's standard) 2) Voltage grade, size, description of the Kit (including the voltage grade, size, type of the cables, for which it is to be used) 3) Batch no., lot no., etc. 4) Quantity 5) a) Purchase Order no. & date b) Purchaser's name BSES Yamuna Power Ltd c) BSES's SAP code number 6) Weights (kg) of each Cable Termination Kit and of each box containing kits. 7) Manufacturer's name 8) Month & Year of Manufacturing 9) Date of packing, shelf life (if applicable)
b)	Transit damage	The seller shall be responsible for any transit damage due to improper packing.

5.0.0 Quality Assurance (QA)

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

6.0.0 Deviations

6.1.0.	Deviations	A) Deviations from this specification can· be acceptable, only where the Seller has listed in his quotation the requirements he cannot, or does not, wish to comply with and which deviations the Buyer has agreed to in writing, before any order is placed. B) In the absence of any list of deviations from the Seller, it will be assumed by the Buyer that the Seller complies with the Specification fully.

7.0.0 Delivery

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

Annexure – A: Guaranteed Technical Particulars (GTP)

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

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

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

17	Type Test Reports (TTR) (Relevant test report no. & date, With type, size, other details of each type of Kit.) a) Prepared Joint: CPRI TTR as per BIS / IEC enclosed? b) Loose Components: CPRI TTR as per EA TS 09-13 enclosed?	 Yes/No Yes/No	
18	Printing details on each of the Heat- shrinkable and Moulded components	(Mention the text, presently printed on each of the component)	

Annexure – B: Kit Content Table (KCT)

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

A. Heading

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

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

B. Details / Parameters

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

C. Notes on the KCT

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

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

Annexure – C: Routine and Acceptance Test

A. Visual Examination
Condition of selected items / components, as per sampling method, shall be recorded. Some of the normal check-points can be as follows:
1. Every component shall be verified in quantity and description as per KCT.
2. All items shall be free from any defects, pin holes, cracks, etc.
3. Metallic components to be free from sharp edges.

B. Measurements of Dimensions
(Required / observed dimension — length, diameter, etc.)
1. Supplied dimensions
2. Recovered dimensions

C. Destructive Testing
On various heat-shrinkable / moulded components of ready Kits
(Items 3 and 4 are applicable only for heat-shrinkable components)
1. Tensile Strength
2. Wall Thickness Ratio
3. Heat Shock
4. Longitudinal Change, after full recovery
5. Ultimate Elongation
6. Low Temperature Flexibility
7. Dielectric Strength
8. Volume Resistivity

D. Routine Test Reports (RTR)
(Typical)

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

Annexure – D: Technical Deviation Sheet

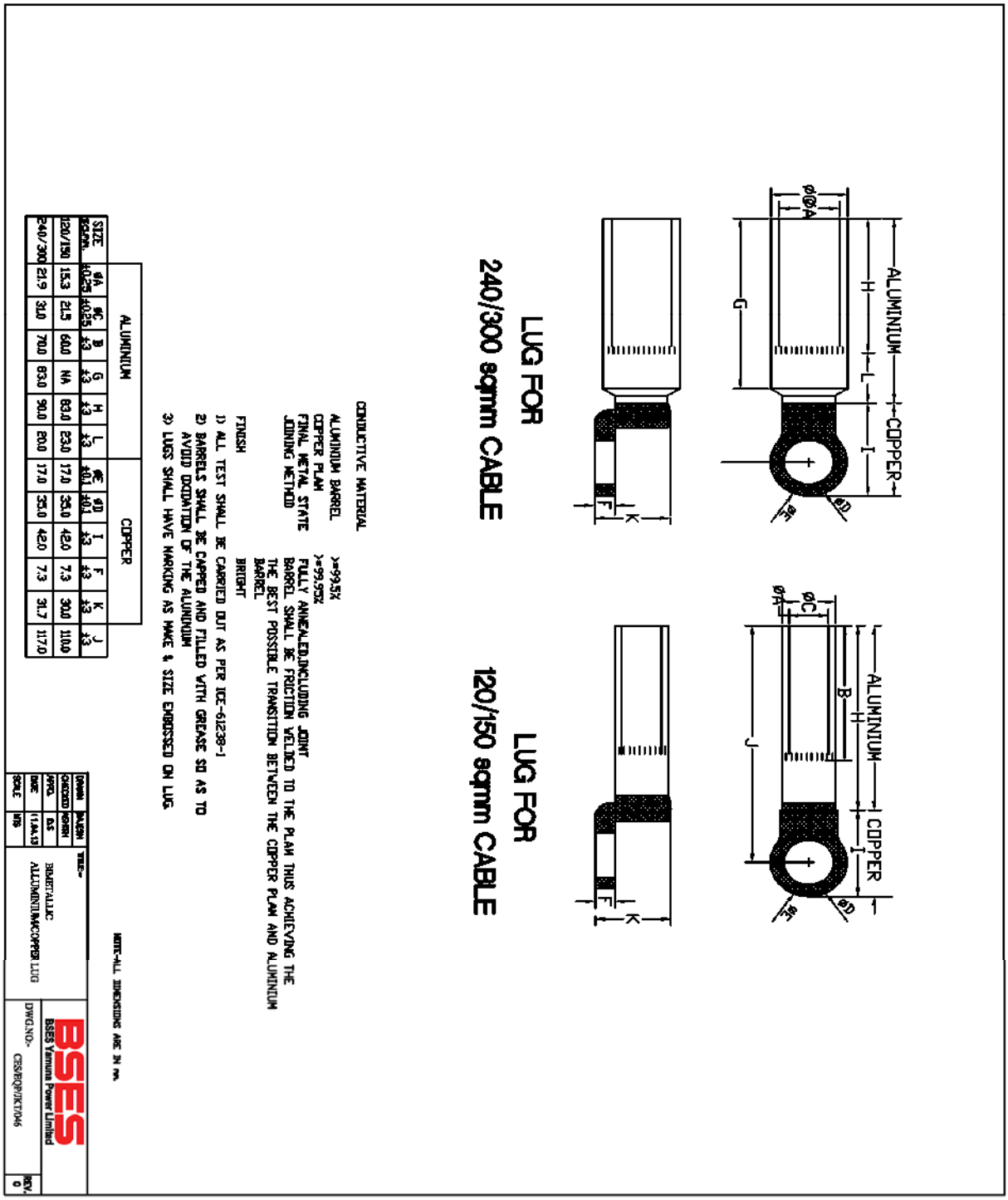
Sr No.	Clause No.	Deviation

Annexure – E: Service Conditions

(Atmospheric conditions at Site)

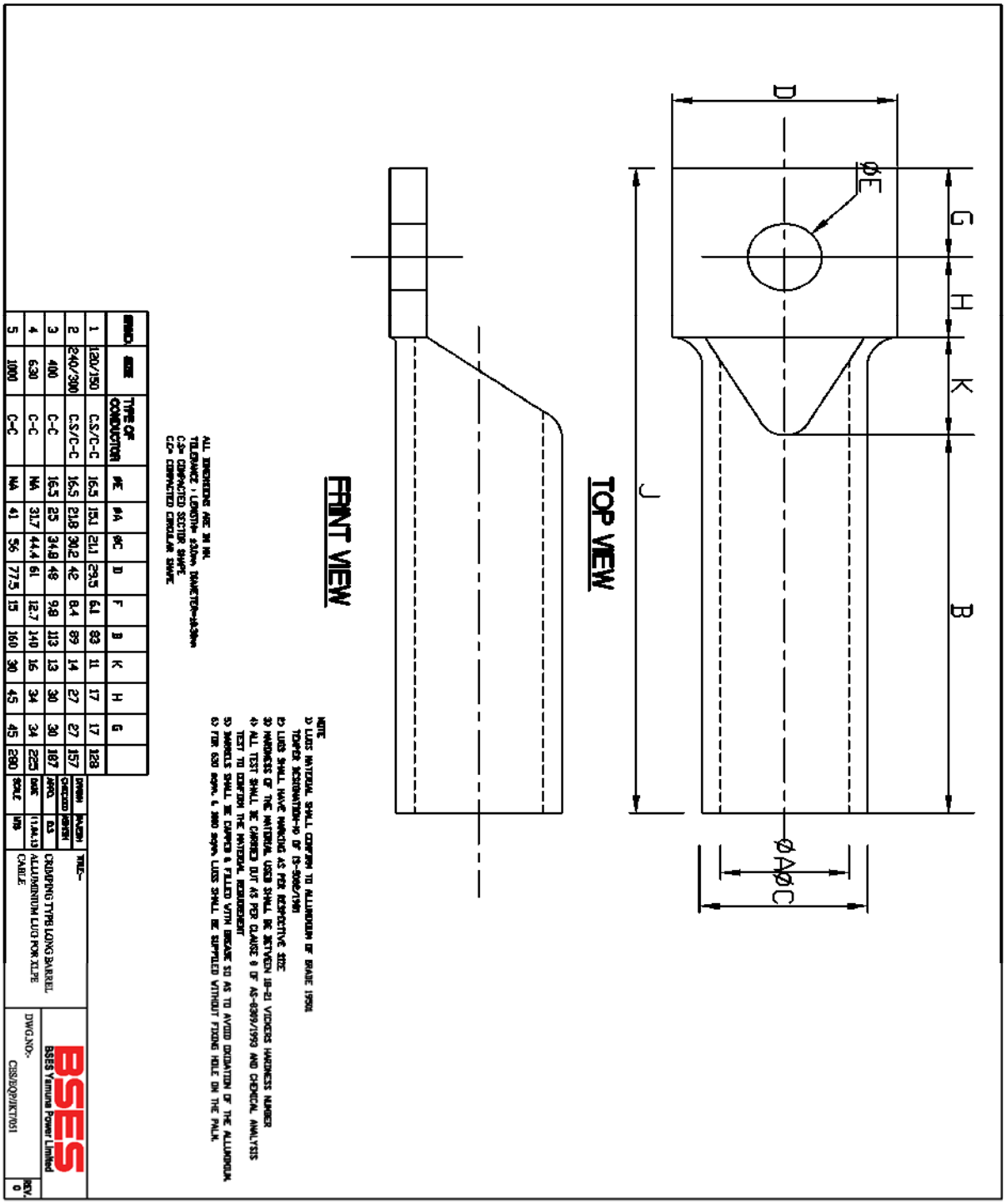
1	Delhi	
a)	Average grade Atmospheric Condition:	Heavily Polluted, Dry
b)	Maximum altitude above sea level	1000 M
c)	Ambient Air temperature	Highest 50 deg C, Average 40 deg C
d)	Minimum ambient air temperature	0 deg C
e)	Relative Humidity	90 % Max
f)	Thermal Resistivity of Soil	150 Deg. C cmm
g)	Seismic Zone	4
h)	Rainfall	750 mm concentrated in four months

Annexure – F: Bimetallic Aluminium / Copper Lug



SIZE	ALUMINIUM						COPPER				
	ØA ±0.25	ØC ±0.25	B ±3	G ±3	H ±3	L ±3	ØE ±0.1	ØD ±0.1	I ±3	F ±3	K ±3	J ±3
120/150	15.3	21.5	600	NA	83.0	230	17.0	35.0	42.0	7.3	30.0	110.0
240/300	21.9	31.0	700	83.0	90.0	200	17.0	35.0	42.0	7.3	31.7	117.0

Annexure – G: Aluminum Lug For XLPE Cable



Technical Specification
For LT Cable Joints and Terminations

Specification no – SP-LTJKT-06-R1

Prepared by		Reviewed by		Approved by		Rev	Date
Name	Sign	Name	Sign	Name	Sign		
AV		GS		AA		R1	02/06/2017

Index

Record of Revision

Cl No	Change in Specification	Approved by	Rev
1	Polyurethane type joint has been deleted	GS	R1
2	Requirement of LT outdoor termination kit has been added	GS	R1

1.0.0 Scope of supply

Design, manufacture, testing of LT jointing and termination kits (1.1 KV) at manufacturers works before dispatch, packing, delivery of material and submission of documents to purchaser.

2.0.0 Codes & standards

S No.	Title	Indian Standard
2.1	Cable accessories for extruded power cable	IS 13573 (Part 1):2011
2.2	Cross-linked Polyethylene (XLPE) Insulated PVC sheathed cables : Part 1 : For working voltages from up to and including 1.1 kV	IS – 7098 Part 1 : 1988
2.3	Methods of test for cables	IS - 10810: 1984
2.4	Ferrule	IS:8308, IS:5082
2.5	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	EA TS - 09 - 13
2.6	Test method for electric cables	IEC 885 Part 1 -3
2.7	Power cables with extruded Insulation and their accessories for rated voltages from 1kV up to 30kV.	IEC 60502-2009
2.8	Standards Methods for Liquid, Inclined -Plane Tracking and Erosion of Insulation Material.	ASTM D 2303
2.9	Specification, for 1.1 kV Cable joint & Terminations kit.	EN 50393

3.0.0 Distribution System Data

3.1	Supply	a. Single Phase 2 wire (AC) b. 3 Phase 4 Wire (AC)
3.2	Voltage	240 V ± 6% (415V Phase to phase)
3.3	Frequency	50 Hz ± 5%
3.4	System Neutral	Solidly Earthed

4.0.0 Environmental Condition Delhi

4.1	Average grade atmospheric Condition	Heavily Polluted, Dry
4.2	Maximum altitude above sea level	1000 M
4.3	Ambient Air temperature	Highest 50 Deg C, Average 40 Deg C
4.4	Minimum ambient air temperature	0 Deg C
4.5	Relative Humidity	100 % Max
4.6	Thermal Resistivity of Soil	150 Deg C cm/W
4.7	Seismic Zone	4
4.8	Rainfall	750 mm concentrated in four months

5.0.0 Cable Construction:

5.1	Size of the cables	1. 2C X 10 Sqmm – circular 2. 2C X 25 Sqmm - filler 3. 4C X 25 Sqmm 4. 4C X 50 Sqmm 5. 4C X 95 Sqmm 6. 4C X 150 Sqmm 7. 4C X 300 Sqmm
5.2	Conductor	a. Electrolytic Grade stranded Aluminum Conductor b. Grade: H2/ H4 as per IS: 8130/84 (For Al) c. Shape: compacted sector shaped stranded d. Class 2
5.3	Insulation	Extruded XLPE
5.4	Inner sheath	Extruded Inner Sheath of Black PVC type ST-2.
5.5	Armour	Galvanized steel flat strip armour GI Wire
5.6	Outdoor Sheath	Extruded outer sheath of PVC (ST-2)
5.7	Maximum Conductor Temperature	Continuous- 90 Deg C, Short Circuit- 250 Deg C

6.0.0 Cable Jointing Kits

6.1	Type	Heat Shrinkable straight through joint Kits.
6.2	Size	Suitable for cable sizes mentioned in clause no. 3.1 and Purchaser's Requisition.
6.3	Conductor Connection	a. By long barrel AL Ferrule (Please refer drawing mentioned in annexure 'x'. b. Corrosive inhibition paste (M/s Jainson or equivalent) inside the ferrule with plastic end caps. c. Ferrule shall be marked for size of the cable for which it is suitable. d. Crimping mark shall be provided on ferrule. e. Inner edge of ferrules should be chamfered for easy insertion of cable core.
6.4	Insulation	a. Heat shrinkable Insulating tubing for providing insulation over ferrule. b. The reinstated insulation of each core over conductor connector (Ferrule) shall have a single length of heat shrinkable tubing, recovered over the connector with a final minimum overlap of 30 mm on each core. The minimum recovered thickness of insulation shall be 1.5 mm.
6.4.1	Core spacers	Shall be provided.
6.5	Armour Continuity	A flexible tinned cooper conductor of braided construction shall provide electrical continuity of steel wire armour. The conductor shall be bonded to the armour wires by a combination of a galvanized steel ring inserted under the

		wires and stainless steel horse clips (steel grade SS 304). The arrangement shall ensure that temperature rise at bonding point is limited to 160 °C.
6.5.1	Conductor Size	Tinned Copper Conductor/strip/braid
6.5.2	25 Sqmm	16 sq.mm
6.5.3	50 Sqmm	30 sq.mm
6.5.4	95 Sqmm, 150 Sqmm and 300 Sqmm	50 sq.mm
6.6	Mechanical Protection:	The joint shall incorporate a steel screen surrounding the insulated core for full length of the joint. The metallic screen shall be in electrical contact with steel wire armour, but shall not be considered as forming part of armour continuity bond. The steel screen in combination with external heat shrinkable tube shall provide protection to the insulated cores from damages by impacts.
6.7	Covering over the Joints:	The Joint shall be protected from corrosion by heat shrinkable tubes internally coated with mastic or heat activated sealant to provide an environmental seal to the joint. One or two tubes shall be provided. Length of the outer sealing sleve shall be 500 mm for 25 sq.mm & shall be 1000 mm for 300 sq.mm.
6.8	Identification:	Heat shrinkable tubing shall be printed with batch no./Date/Shrinkage ratio/size etc.

7.0.0 Cable Termination Kits

7.1	Type	Heat Shrinkable outdoor termination Kits.
7.2	Size	Suitable for cable sizes mentioned in clause no. 3.1 and Purchaser's Requisition.
7.3	Conductor Connection	a. By long barrel AL Lug (Please refer drawing mentioned in annexure 'x'. b. Corrosive inhibition paste (M/s Jainson or equivalent) inside the ferrule with plastic end caps. c. Lug shall be marked for size of the cable for which it is suitable. d. Crimping mark shall be provided on ferrule. e. Inner edge of Lug should be chamfered for easy insertion of cable core.
7.4	Insulation	a. The minimum length of outer sleeve shall be shall be 1000mm. b. It shall also have UV rating to protect from direct sun light exposure. c. Each Phase and neutral tube shall have different colour for easy identification. Preferably, Red, Yellow, Blue colour to be used for Phases and Black for neutral. If the same is not possible then at least, Red colour to be used for Phases and Black for neutral.

		d. Lug seal with HMA to be provided for lug sealing.
7.4.1	Core spacers	Shall be provided.
7.5	Armour Continuity	A flexible tinned copper braid Insulated with Heat shrink tube shall provide electrical continuity of steel wire armour. The fault current capacity of copper braid should withstand the cable fault current capacity based upon different size of cable as defined in IS: 13234.The conductor shall be bonded to the armour wires by a combination of galvanized steel ring inserted under the wires and stainless steel horse clips (steel grade SS 304). The arrangement shall ensure that temperature rise at bonding points shall be limited to permissible temperature of cable. Earthing braid should be provided with length sufficient to take one complete turn on armour and then continue to the other end of the armour with one turn around, This one turn will ensure the firm contact with the armour to tighten this braid worm drive clips two per side to be provided with back up ring the remaining 70 % of braid will be insulated with heat shrink tubes to ensure the Insulated earth at Heat shrink breakout region.

8.0.0 Properties of Heat shrinkable components:

8.1	Heat Shrinkable Components General properties	Components shall be capable of being stored without deterioration within temperature range of 10 Deg C to 45 Deg. C and shall have unlimited shelf life. Sealant activated by heat shall be used in conjunction with heat shrinkable components to provide an environmental seal to the completed joint.
8.2	Electric Strength	>= 8 kV/mm
8.3	Heat shock 250 °C for 15 Min.	No splitting, dripping or flowing.
8.4	Tensile Strength	>= 12 Mpa (120 kg/sq.mm)
8.5	Elongation	>= 200%
8.6	After Thermal Ageing at 120°C for 500Hrs.	
8.7	Tensile Strength	>= 10 Mpa (100 kg/sq.mm)
8.8	Elongation	>= 100%

9.0.0 Quality Assurance, Inspection & Testing

9.1	Vendor Quality Plan	To be submitted for purchaser's approval.
9.2	Sampling methods	Sampling Method for quality checks shall be as per relevant IS/ IEC/ EA TS-09-13 guidelines and Purchaser's prior approval shall be taken for the same.
9.3	Inspection Hold- Points	To be mutually identified, agreed and approved in Quality Plan.
9.4	Type test	a. Joints and terminations shall be type tested from CPRI / ERDA as per IS 13573 -Part1. b. Randomly selected sample shall also be type tested without any commercial implication from the offered lot in the event of order. c. Loose components shall be tested as per EA TS -09-1 3.
9.5	Routine tests	As per relevant IS and EA TS -09-13
9.6	Acceptance test	a. Visual Inspection- The offered kits shall be free from any visible defects, b. Physical verification of contents - all the contents shall be checked as per kit contents list enclosed by the bidder, c. Electric Strength test for Insulation tubing. d. Elongation tests for all types of tubing. e. Wall thickness ratio f. Longitudinal change after full recovery. g. Tracking and corrosion resistance test. h. Tensile strength.
9.7	Inspection	a. Purchaser reserves the right to inspect /witness all tests on the meters at Seller's works at any time, prior to dispatch, to verify compliance with the specification/ standards. b. Manufacturer should have all the facilities/ equipments to conduct all the acceptance tests as per clause 14.3 relevant standards and tampers logics as per approved GTP. All the equipments including tamper logs kits/ jigs should be calibrated. c. In-process and / or final inspection call intimation shall be given in advance to purchaser.
9.8	Guaranteed Life	Joint shall be guaranteed for a period of 66 months against defective design & material & shall be replaced free of cost to BSES if failed due to design / material defect.

10.0.0 Packing and Marking Shipping, Handling and Storage

10.1	Packing	a. In 7 Ply corrugated box made out of 150 GSM Virgin Kraft Paper. b. Protection against shocks & vibration
10.2	Packing identification labels	Manufacturer Name, Number of items, Month & Year of manufacturing, Shelf life of Kit, Property of BSES
10.3	Corrugated Box contents	Kit components in proper packing with label indicating component name, quantity & shelf life. Bill of material sheet Instruction sheet for step by step jointing in English & Hindi

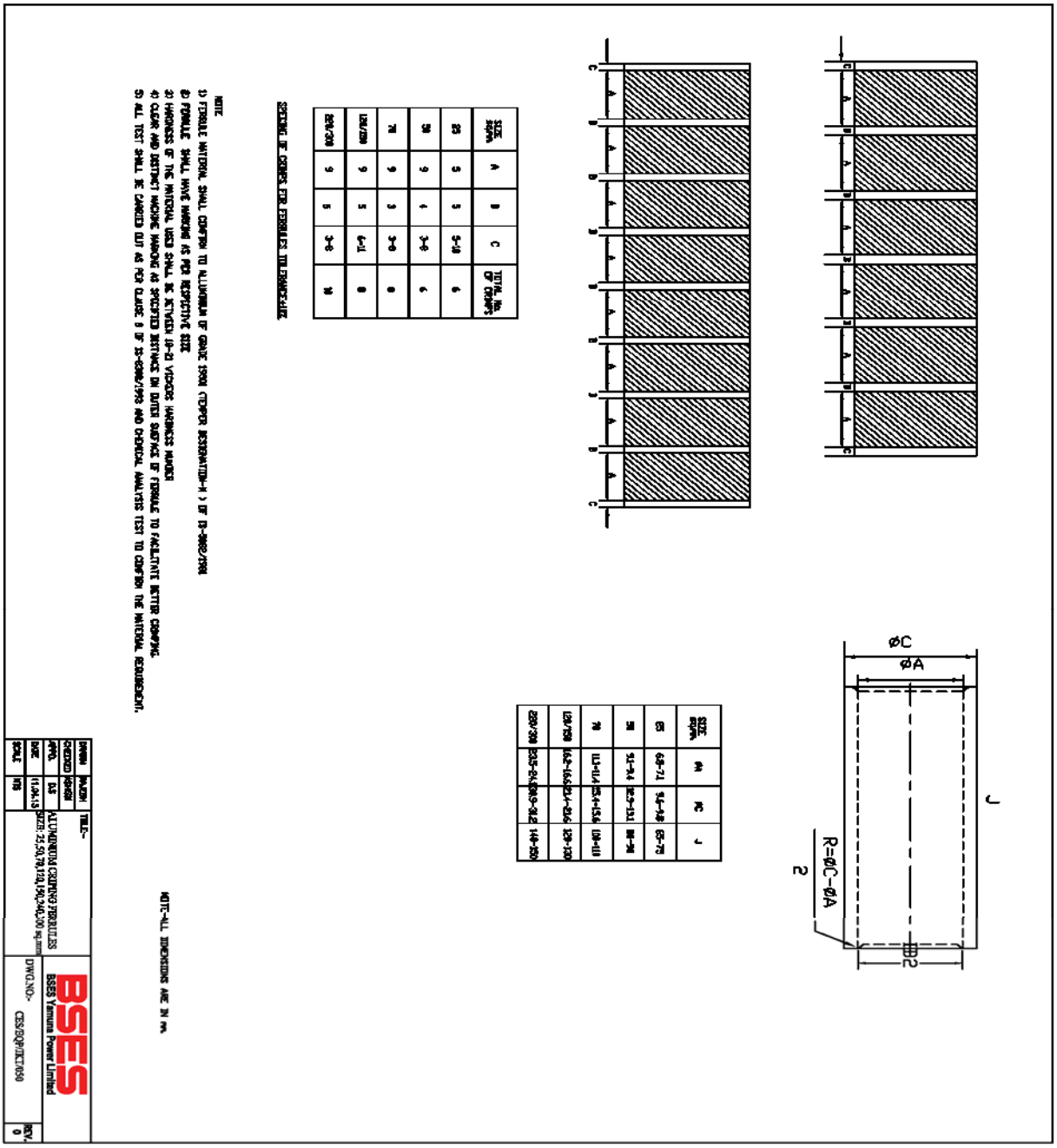
11.0.0 Deviations

12.1	Deviations to this specification to be submitted in writing by Vendor. Bidder to submit copy of this specification along with company seal & signature on each page.

12.0.0 Drawing Submission:

12.1	The seller has to submit following: along with bid
12.1.1	GTP (duly filled-in)
12.1.2	Deviation sheet, if any.
12.1.3	GA / cross sectional drawing of complete joint/ termination and individual components.
12.1.4	01 no's sample of each type of kit.
12.1.5	Detailed reference list of customers using the offered product during the last 5 years with similar design and rating
12.1.6	Manufacturer's quality assurance plan and certification for quality standards
12.1.7	Type test reports for the same type, size & rating.
12.1.8	Complete product catalogue and Manual.
12.1.9	Recommended accessories or any other hardware for five years of operation.
12.2	Seller has to submit following drawings for buyer's Approval (A) / Reference (R) After award of contract -
12.2.1	Program for production and testing (A)
12.2.3	Guaranteed Technical Particulars (A) and Kit contents.
12.2.4	GA drawing
12.2.5	Detailed installation and commissioning instructions
12.2.6	Quality plan and field quality plan.
12.3	Submittals required prior to dispatch
12.3.1	Inspection and test reports, carried out in manufacturer's works
12.3.2	Test certificates of all bought out items
12.3.5	Number of Documents required at different stages shall be per Annexure- A
12.3.6	Duly signed & stamped copies of the drawings / documentation are required to be submitted to BSES for approval.

Annexure A: Drawing of Al Crimping Ferrule



SIZE (sq.mm)	A	B	C	TOTAL NO. OF CRIMPS
25	5	5	5-10	6
50	6	4	3-8	5
70	6	3	3-8	6
95/120	6	5	4-11	8
150/185	6	5	3-8	5

SIZE (sq.mm)	A	C	J
25	6.5-7.1	9.4-9.8	65-75
50	11-11.4	12.5-13.1	80-90
70	13.1-13.4	15.3-15.6	100-110
95/120	16.4-16.9	19.4-19.6	120-130
150/185	20.5-21.1	23.8-24.2	140-150

SPECIMEN OF CRIMPS FOR FERRULES TOLERANCE ±0.2

NOTE

1) FERRULE MATERIAL SHALL CONFORM TO ALUMINIUM OF GRADE 99.6% (COPPER DESIGNATION-H) OF IS-8130/1984
2) FERRULE SHALL HAVE MARKING AS PER RESPECTIVE SIZE
3) HARDNESS OF THE MATERIAL USED SHALL BE BETWEEN 18-23 VICKERS HARDNESS NUMBER
4) CLEAR AND DISTINCT MACHINE MARKING AS SPECIFIED BESIDES ON OUTER SURFACE OF FERRULE TO FACILITATE AFTER CRIMPING.
5) ALL TEST SHALL BE CARRIED OUT AS PER CLAUSE 8 OF IS-8130/1993 AND CHEMICAL ANALYSIS TEST TO CONFIRM THE MATERIAL REQUIREMENT.

NOTE-ALL DIMENSIONS ARE IN mm.

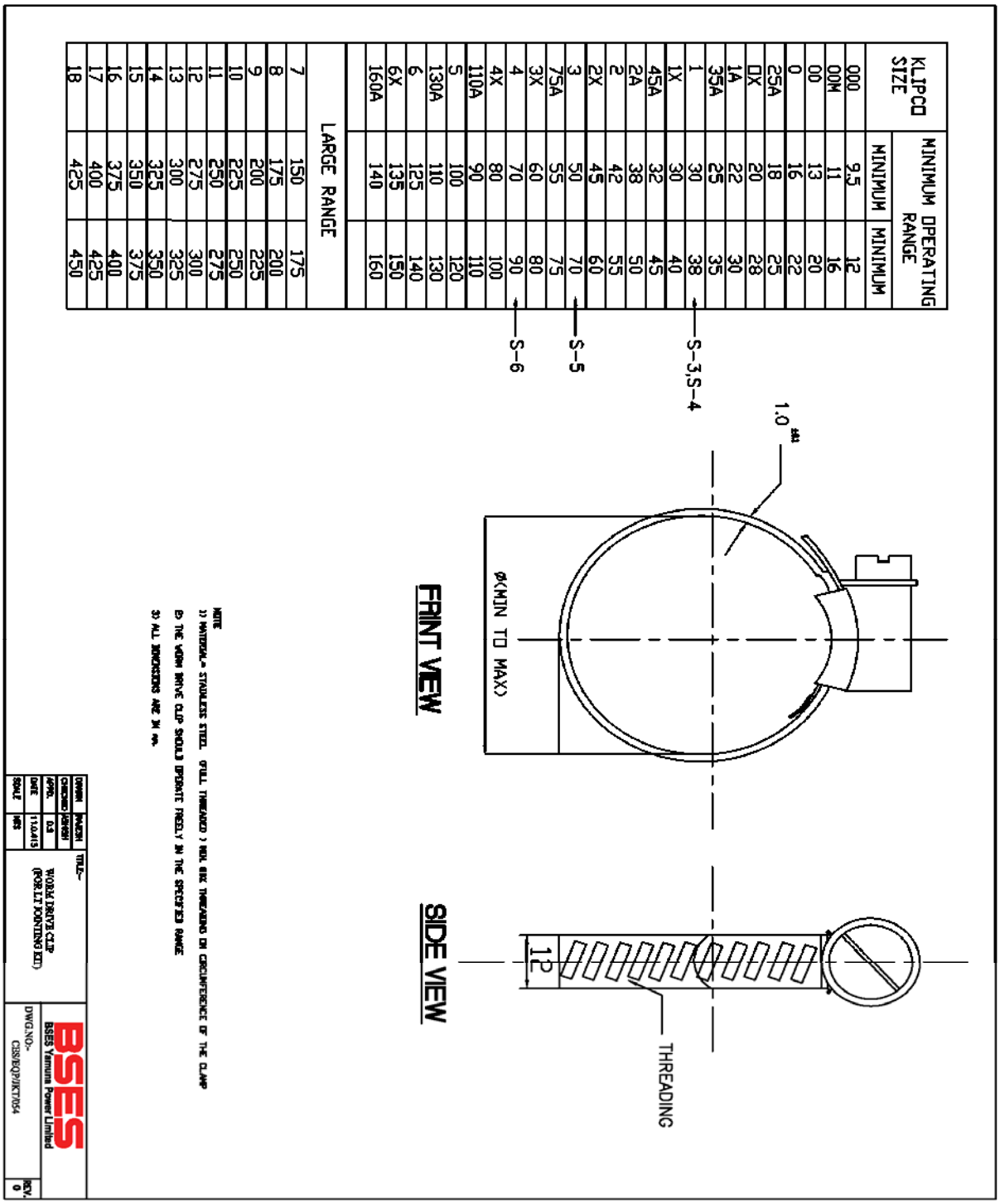
DRAWN	RAJESH	TITLE:-	
CHECKED	ASHISH		
APPD.	DJS	ALUMINIUM CRIMPING FERRULES	
DATE	11/04/13	SIZES: 25,50,70,95,120,150,185,240,300 sq.mm	
SCALE	NTS		

BSES Yamuna Power Limited

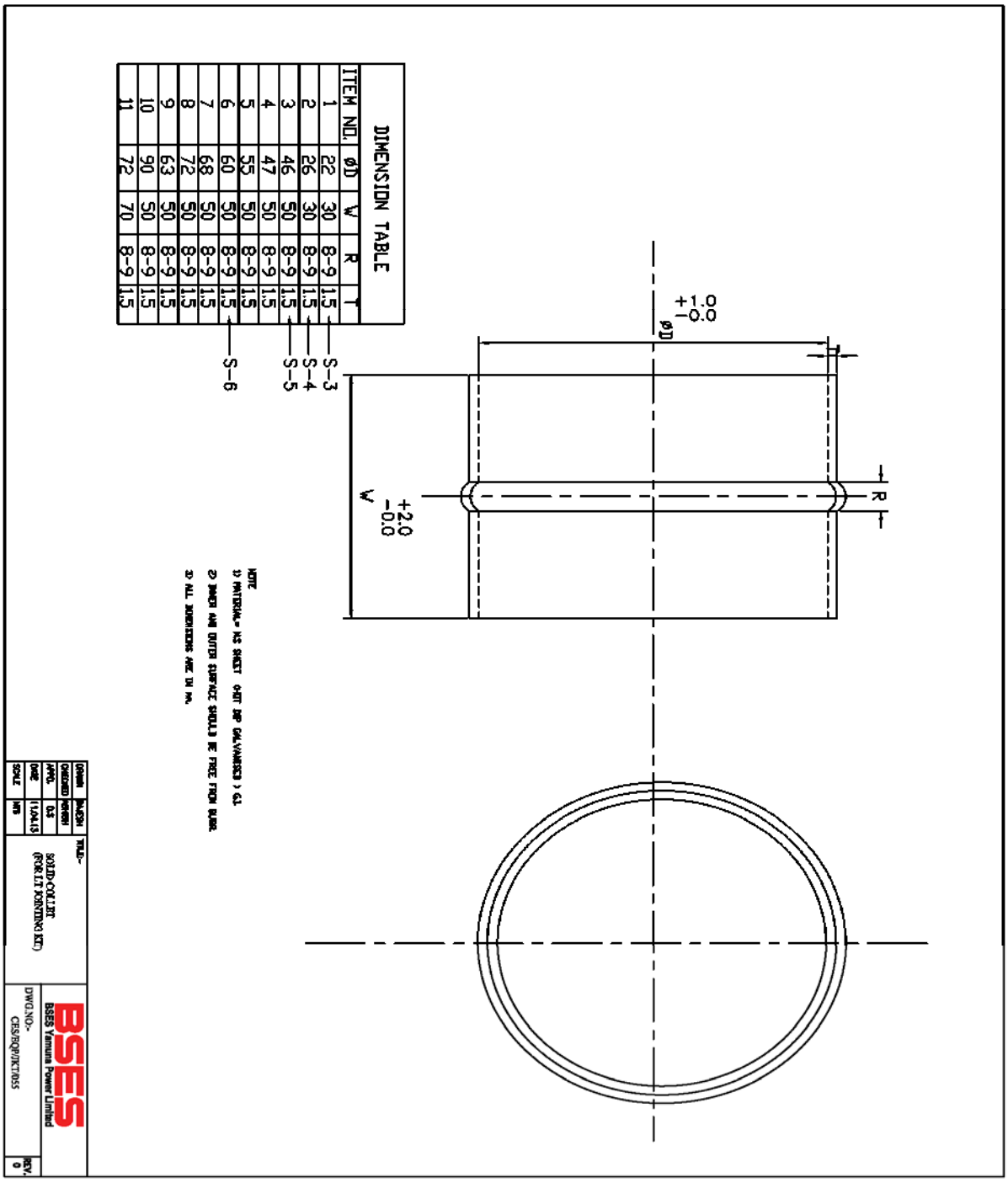
DWG.NO:- CESS/DQP/JCT/050

REV. 0

Annexure B: Drawing of Worm Drive Clip

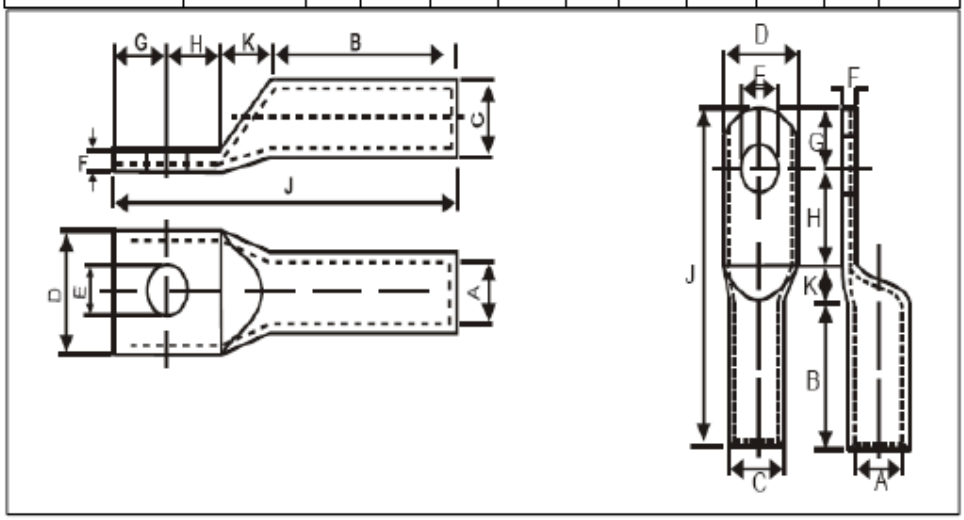


Annexure C: Drawing of Solid Collet



Annexure D: Drawing of Aluminum Lug

Cable Size											
Cable details	Conductor shape	E	A	C	D	F	B	K	H	G	J
CABLE ARM XLPE 1.1KV 4C 300MM2 AL	SECTOR SHAPE	17	23.5 - 24.1	30.9 - 31.2	44.2 - 45.2	7 - 7.5	89	14	27	27	157
CABLE ARM XLPE 1.1KV 4C 150MM2 AL	SECTOR SHAPE	13	16.2 – 16.6	21.4 - 21.6	30.6 - 31.2	4.7 - 5.3	83	11	17	17	128



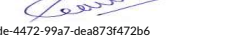
NOTE: ALL DIMENSIONS ARE IN MM

TECHNICAL SPECIFICATION

OF

11kV & 33kV CABLE

Specification No. : SP-HT-180-R0

Rev 01	*Date 16 March 2021*	*No. of Page 41*
Prepared by	Ankita Arora	ankita arora a1877a0d-ff71-43f8-8a8f-f1ebbc3d489f
	Abhishek Vashistha	Abhishek Vashistha 7a74fd4f-a398-49df-bd05-e398d5a949f0
Reviewed by	Puneet Duggal	Puneet Duggal 404db803-a91f-4234-85f0-0b2b5098ec32
Approved by	Gaurav Sharma	 23dc2de2-95de-4472-99a7-dea873f472b6

DocUUID : 66adbb4f-29d8-42d0-95d7-1be2058c492d

INDEX

1.0 SCOPE OF SUPPLY

The specification covers design, manufacture, testing, packing and delivery of 11000 & 33000 Volts grade, Aluminium conductor, and XLPE insulated single core & multi core power cables.

2.0 STANDARDS & CODES

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	PVC insulation & sheath of electric cables.
IS 10810	Methods of test for cables.
IS 8130	Conductors for insulated electric cables and flexible cords.
IS 3975	Mild steel wires, formed wires and tapes for armouring of cables.
IS 10462 (Part 1)	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

DocUUID : 66adbb4f-29d8-42d0-95d7-1be2058c492d

3.0 CABLE, CONSTRUCTION OF CABLE & TESTING

This Specification covers following types of XLPE insulated 11 kV & 33 kV Power Cables used in BYPL network in Delhi , mostly under-ground (buried, with chances of flooding by water) or for laying on racks, in ducts, trenches, conduits etc.

Sr. No.	Description	Conductor Material	Cable Code
1.	11 kV, 3C x300 sqmm.	Al	A 2X W Y
2.	11 kV, 3C x 150 sqmm.	Al	A 2X W Y
3.	11 kV, 1C x 1000 sqmm.	Al	A 2X Wa Y
4.	33 kV, 3C x400 sqmm.	Al	A 2X W Y
5.	33 kV, 1C x1000 sqmm.	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.

3.1	**CONSTRUCTIONAL REQUIREMENT**	
3.1.1	**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) 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.
3.1.2	**Conductor Screen**	Extruded semi-conducting material. (Also refer Cl. 3.1.3.) (Tapes are not acceptable)
3.1.3	**Insulation**	a) Extruded XLPE (Cross-Linked Poly-Ethylene) Insulation, with water tree retardant property (WTR). b) The required compound used shall be from BSES-approved sub-vendors (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
3.1.4	**Insulation Screen**	a) Freely-strippable semi-conducting screen, which should not require application of heat for its removal. 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.
3.1.4.1	Extrusion	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.
3.1.4.2	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 BYPL, prior to sourcing the compounds and taking up manufacturing of cable.
3.1.5	**Water-Swellable 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.
3.1.6	**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 manufacturer permanently printed at close intervals; this is to provide additional identification of manufacturer of the cable.
3.1.7	**Copper Tape**	Copper Tape shall be applied helically over the layer formed after application of insulation screen, water-swellable tape and identification strip.

DocUUID : 66adbb4f-29d8-42d0-95d7-1be2058c492d

3.1.8	**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.
3.1.9	**Binder Tape**	As per manufacturer's standard
3.1.10	**Inner Sheath**	Extruded Inner Sheath of Black PVC type ST-2 (IS 5831)
3.1.11	**Armour**	a) For 3-core Cables : Galvanized Steel round wire armour b) For 1-core Cables : Aluminium round wire armour c) Minimum area of coverage of armouring shall be 90 % (min.). At any time, the gap between any two adjacent armour wires shall not be more than the diameter of wire. d) Zero negative tolerance is for : • Diameter of armour wire e) Fault current carrying capacity of armour shall be as following: i. For 11 kV Cable – Min 11 kA for 1 sec. ii. For 33 kV Cable – Min 15 kA for 1 sec.
3.1.12	**Binder Tape**	Rubberised cotton tape
3.1.13	**Outer Sheath**	a) Extruded outer sheath of PVC (ST-2 as per IS 5831) with termite-repellant and anti-rodent

		properties.
		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 with following minimum text : 1. The voltage designation 2. Type of construction / cable code (A2XWY) 3. Manufacturer's Name and Trade-mark 4. Number of cores and nominal cross-sectional area of conductor 5. 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. 6. Name of buyer / purchaser, BYPL 7. Month & Year of manufacturing 8. IS reference, i.e. IS : 7098 (II) 9. 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.) 10. Purchase Order Number & date 11. Drum number
3.1.14	**Pulling-eye Assembly**	a) A cable pulling-eye assembly shall be provided

	and **Sealing-end Cap** (for Cables)	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. b) Other end (inner end) of the cable shall be sealed. 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.
3.2	**Inspection & Testing**	Tests shall be carried out in accordance with IS 7098 (Part-2).
	a) Type Tests	1. Cables must be of type tested from CPRI/ERDA. Type Test Reports shall be submitted for the type, size and rating of cable offered in the bid. Any cable without type test from CPRI/ERDA shall not be acceptable. 2. Bidder supplying cable to BSES for the first time shall have to conduct type test on sample randomly selected from lot in event of order from CPRI/ERDA.
	b) BSES QAP	In general, all tests mentioned in the BSES QAP (Characteristics – Typical) mentioned in Annexure-E shall be included in the Routine Tests, Type Tests and Acceptance Tests.
	c) Routine Tests	1. Measurement of Electrical Resistance 2. HV Test with power frequency AC voltage 3. PD 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). Test results from the above tests must appear in the documents forwarded by the vendor for Inspection call.
	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 sufficiently in advance to the purchaser. 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 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. b) "Void-and-contamination Test" for the Insulation c) "Strippability Test" at both the ends of cable for each drum, to check freely-strippable property of the Insulation Screen (outer semi-con). d) Internal type test shall be carried out once against each every BYPL PO, on sample basis at manufacturer lab (if required, which shall be

		decided by BSES).
3.3	**Drum length & tolerance**	Cable length per drum
3.3.1	a) 11kV, Three core b) 11kV, Single core c) 33kV, Three core d) 33kV, Single core	a) 300 mtr +/- 5 % b) 500 mtr +/- 5% c) 300 mtr +/- 5% d) 500 mtr +/- 5%
3.3.2	Overall tolerance	+/- 2 % for the total cable length for the entire order.
3.3.3	Short length of cables	Manufacturer shall take prior approval from Purchaser for any supply of short length cables. For 33kV & 11kV, 3-core cable, minimum acceptable short length shall be 150 meter. Similarly, for 33 kV & 11kV single core cables, minimum acceptable short length cables can be 250 meter and only one short length drum shall be acceptable in last lot. In any case, manufacturer shall not put two cable pieces of different short lengths in same cable drum.
3.4	**Packing, Shipping, Handling & Storage**	
	a) Packing	1. Both the ends of the cables shall be properly sealed to prevent any deterioration of the cable, due to ingress of water, etc. 2. Cable inner end (starting end) shall project, outside the completely wound cable, by sufficient length enabling verify cable details, including the initial length marking. 3. 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.

		4. 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. Alternatively PP sheets can be put as protective covers. 5. 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. 1. Drum identification number 2. Cable voltage grade 3. Cable code (e.g. A2XFY, etc.) 4. Number of cores and cross sectional area 5. Cable quantity, i.e. cable length (meter) 6. Purchase order number & date 7. SAP item code 8. Total weight of cable and drum (kg) 9. Manufacturer's Name 10. Buyer's name 11. Month & Year of Manufacturing 12. Direction of rotation of drum 13. 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) 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.
3.5	**Quality Assurance Plan (QAP)**	
3.5.1	Quality Assurance Plan	As per Annexure attached for QAP. In event of order manufacturer has to submit the signed copy of QAP
3.5.2	Inspection Points	As per QAP.
3.6	**Deviation**	Deviations from this Specification shall be stated in writing with the tender by reference to the specification clause/GTP/Drawing and a description of the alternative offer. In absence of such a statement, it will be assumed that the bidder complies fully with this specification. No deviation will be acceptable post order.

ANNEXURE – A : DOCUMENT SUBMISSION MATRIX

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

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

S No.	Description	Bid	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	
5	Type test reports for the offered type and rating of cable	Required		
6	Make of Raw Materials	Required	Required	
7	Cable de-rating factors	Required	Required	
8	Manufacturer's Quality Assurance Plan		Required	
9	Program for production and testing/ Production and Testing Timeline		Required	
10	Detailed installation & commissioning instructions		Required	
11	Test certificates of all raw materials			Required
12	Inspection and routine test reports, carried out in manufacturer's works			Required

DocUUID : 66adbb4f-29d8-42d0-95d7-1be2058c492d

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)			
	11 kV, 3c x 300 sq. mm.	A2XWY		
	11 kV, 3c x 150 sq. mm.	A2XWY		
	11 kV, 1c x 1000 sq. mm.	A2XWaY		
	33 kV, 3c x 400 sq. mm.	A2XWY		
	33 kV, 1c x 1000 sq. mm.	A2XWaY		
6.0	**Voltage Grade**			
	11 kV, 3C or 1C	6.35 / 11	kV	
	33 kV, 3C or 1C	19/33	kV	
7.0	Maximum Conductor temperature			
A	Continuous	90	deg. C	
B	Short time	250	deg. C	
8.0	**Conductor**			
A	Material and Grade	As per Cl. 3.1.1		
B	Size	As per clause 5.0 of GTP		
C	Wires in each conductor	As per Table 2 of IS 8130	Nos.	
D	Conductor Shape	As per Cl. 3.1.1		

E	Dia. of wires in each conductor before compaction	Manufacturer Standard	Mm	
F	Diameter over conductor		Mm	
G	Maximum Conductor resistance at 20 ° C			
	11 kV, 3c x 300 sq. mm.	0.1000	ohm/km	
	11 kV, 3c x 150 sq. mm.	0.2060	ohm/km	
	11 kV, 1c x 1000 sq. mm.	0.0291	ohm/km	
	33 kV, 3c x 400 sq. mm.	0.0778	ohm/km	
	33 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. 3.1.2		
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. 3.1.3		
B	Nominal thickness			
	11 kV, 3c or 1C	3.6	mm	
	33kV, 3C or 1C	8.8		
C	Minimum thickness (at a point)			
	11 kV, 3c	3.14	mm	
	33kV, 3C or 1C	7.82		
D	Diameter over Insulation (Approx.)		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. 3.1.4 (Yes / No)		
	iv) Ovality of the core	As per IEC Standards	%	
b.	Diameter over Insulation Screen (apprx.)		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%	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 (apprx.)		mm	

12.0	**Filler** (Material and type)	As per Cl. 3.1.8 (Specify no. & size of filler at center & core interstices)		
	11 kV, 3c x 300 sq. mm.			
	11 kV, 3c x 150 sq. mm.			
	11 kV, 1c x 1000 sq. mm.			
	33 kV, 3c x 400 sq. mm.			
	33 kV, 1c x 1000 sq. mm.			
13.0	**Binder Tape**	over laid-up cores		
14.0	**Inner Sheath**			
A	Material and type	As per Cl. 3.1.10		
B	Minimum thickness			
	11 kV, 3c x 300 sq. mm.	0.7	mm	
	11 kV, 3c x 150 sq. mm.	0.6	mm	
	11 kV, 1c x 1000 sq. mm.	0.7	mm	
	33 kV, 3c x 400 sq. mm.	0.7	mm	
	33 kV, 1c x 1000 sq. mm.	0.7	mm	
C	Approx. dia. over inner sheath		mm	
15.0	**Armour**	as per purchaser's site-specific requirements		
A	Material			
	11 kV, 3C	Round Wire	No.	
	33 kV, 3C	Round Wire	No.	
	11kV or 33kV, 1C	Non-magnetic wire armour (Aluminium wire)	No.	
B	Armour – Wires a) Diameter of wire b) Number of wires(min.) c) SC calculation submitted	To meet S.C capacity as per following: For 11kV cable – 11kA for 1sec (min) For 33kV cable - 15kA for 1sec (min)	mm Number. Yes/No	
C	Approx. Equivalent Area		sq. mm.	

D	Area covered by armour	Min. 90 % Calculation shall be attached.	%	
E	Dia. over armour - apprx.		mm	
F	Fault current carrying capacity of armour	Calculation sheet shall be attached.	10 kA For 1 sec.	
16.0	**Outer Sheath**			
A	Material and type	PVC Compound , ST-2, as per IS 5831:1984		
B	Thickness (min.)	3		
	11 kV, 3c x 300 sq. mm.		mm	
	11kV, 3C x 150 sqmm		mm	
	11kV, 1C x 1000 sqmm		mm	
	33kV, 3C x 400 sqmm		Mm	
	33kV, 1C x 1000 sqmm		Mm	
C	Color	Blue		
D	Embossing (details as per Cl. 3.1.13)	Yes / No		
E	FRLS Properties	As per customer's requirement		
17.0	Approx. overall diameter		Mm	
18.0	Standard drum length with tolerance			
	11 kV, 3C x 300 sqmm	As per Clause 3.3	meters	
	11kV, 3C x 150 sqmm			
	11kV, 1C x 1000sqmm			
	33kV, 3C x 400 sqmm			
	33kV, 1C x 1000sqmm			
18A	Overall order tolerance	+ / - 2 % for the total cable length for the entire order.		
19.0	**Cable Drum**			
a.	Type of drum	Steel/Wooden (Specify the relevant IS / IEC followed for drum design)		
b.	Markings on the drum (as per Cl. 3.4)	On both faces		
20.0	**Cross-Sectional Drawing**	Is drawing submitted, showing every		

		feature of constructions? (Yes / No)		
21.0	**a. Pulling-eye Assembly** (provided at one running end)	Is manufacturer's / Sub-vendor's drawing submitted? (Yes / No)		
	b. Sealing-end Cap (provided at the other end)	Is manufacturer's / Sub-Vendor's drawing submitted? (Yes / No)		
22.0	**Weights**			
	a) Net weight of cable (apprx.)		kg / km	
	b) Weight of empty drum		Kg	
	c) Weight of Cable with drum		kg	
23.0	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	
24.0	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	
25.0	Recommended minimum bending radius	--- x O. D.	mm	
26.0	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			
27.0	Group factor for following numbers of cables laid :	Touching Trefoil		
	a) 3 Nos.			
	b) 4 Nos.			
	c) 5 Nos.			
	d) 6 Nos.			
28.0	Recommended pressure for laying cable using power winch	30 N / mm2	N / sq. mm.	
29.0	Process of Cross-linking of Polyethylene	Dry Cure		
30.0	**Type test** (TTR - Type Test Report)	Is copy of latest valid TTR for respective sizes enclosed? (Yes / No)		
31.0	**Quality Assurance Plan** (QAP)	Is QAP Format (Annexure-E), duly signed and enclosed? (Yes / No)		
32.0	**List of Sub-Vendors** for construction items (Annexure-C)	Is this list enclosed for BSES approval? (Yes / No)		

ANNEXURE – C : LIST OF SUB-VENDORS

Sl. No.	Raw Materials		Name of the Suppliers
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 / powder	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)
6.	PE Compound	1	Borealis
		2	Shakun
		3	Kalpana

ANNEXURE - D : SERVICE CONDITIONS

(Atmospheric / Soil conditions at Site)

S No.	Parameter	BYPL Requirement	Bidder's Reply
3.1	Max Ambient Temperature	50 deg C	
3.2	Max Daily average ambient temp	40 deg C	
3.3	Min Ambient Temp	0 deg C	
3.4	Maximum Humidity	95%	
3.5	Minimum Humidity	10%	
3.6	Maximum annual rainfall	750 mm	
3.7	Average no of rainy days per annum	60	
3.8	Rainy months	June to Oct	
3.9	Altitude above MSL	300 M	
3.10	Seismic Zone	IV	

ANNEXURE – E : QUALITY ASSURANCE PLAN (QAP)

DocUUID : 66adbb4f-29d8-42d0-95d7-1be2058c492d

ANNEXURE – E QUALITY ASSURANCE PLAN (QAP)

FOR 11KV & 33KV HT CABLE

SN	Component & Operation	Characteristic	Class	Check		Reference	Acceptance Norms	Record Format	Agency			Remark
				Type	Quantum				SV	MFR	BYPL	
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	

ANNEXURE – E QUALITY ASSURANCE PLAN (QAP)

FOR 11KV & 33KV HT CABLE

SN	Component & Operation	Characteristic	Class	Check		Reference	Acceptance Norms	Record Format	Agency			Remark
				Type	Quantum				SV	MFR	BYPL	
		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 tape	a) Dimensions	Minor	Physical	Sample	MPS	MPS	Reg./Sheet	P	P/V	V	
		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	

ANNEXURE – E QUALITY ASSURANCE PLAN (QAP)

FOR 11KV & 33KV HT CABLE

SN	Component & Operation	Characteristic	Class	Check		Reference	Acceptance Norms	Record Format	Agency			Remark
				Type	Quantum				SV	MFR	BYPL	
		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	Cable Pulling eye	a) Dimensions & Material	Major	Meas.	1 sample per size	Purchase order	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	-	
		c) Tension test on pulling eye	Major	Physical	1 sample per size	Pulling eye subjected to load		-	P	P	-	
10	Binder tape	a) Dimensions & material	Minor	Physical	Sample	MPS	MPS	-	P	P	-	
11	Polypropylene filler	a) Size	Minor	Physical	Sample	Purchase order	Purchase order	-	P	P	-	
12	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		--	-	P	-	

ANNEXURE – E QUALITY ASSURANCE PLAN (QAP)

FOR 11KV & 33KV HT CABLE

SN	Component & Operation	Characteristic	Class	Check		Reference	Acceptance Norms	Record Format	Agency			Remark
				Type	Quantum				SV	MFR	BYPL	
						from defects						
		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 applicatio
		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	-	

ANNEXURE – E QUALITY ASSURANCE PLAN (QAP)

FOR 11KV & 33KV HT CABLE

SN	Component & Operation	Characteristic	Class	Check		Reference	Acceptance Norms	Record Format	Agency			Remark
				Type	Quantum				SV	MFR	BYPL	
		d) Printing on outer semi-conducting layer	Major	Visual	100 %	"DO NOT HEAT, FREELY STRIPPABLE"		-	-	P	-	n of heat.
		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	
		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-	a) Dimensions	Minor	Physical	Sample	Tech. Data	Tech. Data Sheet	-	-	P	-	

ANNEXURE – E QUALITY ASSURANCE PLAN (QAP)

FOR 11KV & 33KV HT CABLE

SN	Component & Operation	Characteristic	Class	Check		Reference	Acceptance Norms	Record Format	Agency			Remark
				Type	Quantum				SV	MFR	BYPL	
	conducting					Sheet						
		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	Tech. Data Sheet	-	-	P	-	

ANNEXURE – E QUALITY ASSURANCE PLAN (QAP)

FOR 11KV & 33KV HT CABLE

SN	Component & Operation	Characteristic	Class	Check		Reference	Acceptance Norms	Record Format	Agency			Remark
				Type	Quantum				SV	MFR	BYPL	
						Sheet						
		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	-	

ANNEXURE – E QUALITY ASSURANCE PLAN (QAP)

FOR 11KV & 33KV HT CABLE

SN	Component & Operation	Characteristic	Class	Check		Reference	Acceptance Norms	Record Format	Agency			Remark
				Type	Quantum				SV	MFR	BYPL	
		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	
		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/2	IS 7098/II/2011	Test Report	-	P	V	

ANNEXURE – E QUALITY ASSURANCE PLAN (QAP)

FOR 11KV & 33KV HT CABLE

SN	Component & Operation	Characteristic	Class	Check		Reference	Acceptance Norms	Record Format	Agency			Remark
				Type	Quantum				SV	MFR	BYPL	
						011						
		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 BYPL 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	IS/IEC	Test Report	-	P	W	

ANNEXURE – E QUALITY ASSURANCE PLAN (QAP)

FOR 11KV & 33KV HT CABLE

SN	Component & Operation	Characteristic	Class	Check		Reference	Acceptance Norms	Record Format	Agency			Remark
				Type	Quantum				SV	MFR	BYPL	
						Sheet						
3	Acceptance tests	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	
		g) Tensile strength & Elongation at break of insulation & outer sheath	Major	Physical		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/2	IS 7098/II/2011	Test Report	-	P	W	

ANNEXURE – E QUALITY ASSURANCE PLAN (QAP)

FOR 11KV & 33KV HT CABLE

SN	Component & Operation	Characteristic	Class	Check		Reference	Acceptance Norms	Record Format	Agency			Remark
				Type	Quantum				SV	MFR	BYPL	
						011						
		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	Each Lot Sample Basis	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	

ANNEXURE – E QUALITY ASSURANCE PLAN (QAP)

FOR 11KV & 33KV HT CABLE

SN	Component & Operation	Characteristic	Class	Check		Reference	Acceptance Norms	Record Format	Agency			Remark
				Type	Quantum				SV	MFR	BYPL	
		q) Water Penetration test (WPT) on core (i.e.Logitudinal Water Blocking Test) [One sample per RC]	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	As per data sheet & FS	Test Report	-	P	W	

ANNEXURE – E QUALITY ASSURANCE PLAN (QAP)

FOR 11KV & 33KV HT CABLE

SN	Component & Operation	Characteristic	Class	Check		Reference	Acceptance Norms	Record Format	Agency			Remark
				Type	Quantum				SV	MFR	BYPL	
						sheet & FS						
		x) Cable pulling eye strength test on one sample [One sample per RC]	Major	Physical		As per data sheet & FS	As per data sheet & FS	Test Report	-	P	W	
		y) Flammability test	Major	Physical		As per IS-78098/II/2011	As per IS-78098/II/2011	Test Report	-	P	W	
		z)Impulse withstand test [One sample per RC]	Critical	Electrical		IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	W	
		z1) Ageing & Water absorptiontest(Gravimetric) on Insulation & Outer sheath [One sample per RC]	Major	Physical		IS 5831/84	IS 5831/84	Test Report	-	P	W	
		z2) Heating Cycle with Potential [One sample per RC]	Critical	Electrical	sample basis, once per PO			Test Report	-	P	W	
		z3) Raw Material Verification in all aspects	Major	Physical	Each Lot					P	W	
4	Type tests at vendor's works	a) Tests on conductor			One sample per order							Verification of process
		i) Annealing test for copper	Major	Physical		IS 8130/84	IS 8130/84	-	-	P	V	
		ii) Tensile test for aluminium	Major	Physical		IS 8130/84	IS 8130/84	-	-	P	V	

ANNEXURE – E QUALITY ASSURANCE PLAN (QAP)

FOR 11KV & 33KV HT CABLE

SN	Component & Operation	Characteristic	Class	Check		Reference	Acceptance Norms	Record Format	Agency			Remark
				Type	Quantum				SV	MFR	BYPL	
		iii) Wrapping test for aluminium	Major	Physical		IS 8130/84	IS 8130/84	-	-	P	V	records. Tests N/A on finished conductor.
		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.	IS 7098/II/2011 & Tech. Data sheet	Test Report	-	P	W	

ANNEXURE – E QUALITY ASSURANCE PLAN (QAP)

FOR 11KV & 33KV HT CABLE

SN	Component & Operation	Characteristic	Class	Check		Reference	Acceptance Norms	Record Format	Agency			Remark
				Type	Quantum				SV	MFR	BYPL	
						Data sheet						
		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		IS 7098/II/2011	IS 7098/II/2011	Test Report	-	P	W	
		e) Physical tests for outer sheath									W	
		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	

ANNEXURE – E QUALITY ASSURANCE PLAN (QAP)

FOR 11KV & 33KV HT CABLE

SN	Component & Operation	Characteristic	Class	Check		Reference	Acceptance Norms	Record Format	Agency			Remark
				Type	Quantum				SV	MFR	BYPL	
		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	

ANNEXURE – E QUALITY ASSURANCE PLAN (QAP)

FOR 11KV & 33KV HT CABLE

SN	Component & Operation	Characteristic	Class	Check		Reference	Acceptance Norms	Record Format	Agency			Remark
				Type	Quantum				SV	MFR	BYPL	
		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
		b) Pulling eye at leading end	Major	Visual	100 %	As per agreement	As per agreement	-	-	P	W/V	

ANNEXURE – E QUALITY ASSURANCE PLAN (QAP)

FOR 11KV & 33KV HT CABLE

SN	Component & Operation	Characteristic	Class	Check		Reference	Acceptance Norms	Record Format	Agency			Remark
				Type	Quantum				SV	MFR	BYPL	
		b) Stencilling/Marking on drum	Minor	Visual	100 %	IS 7098(Part 2):2011/ Agreement	IS 7098(Part 2):2011/ Agreement	-	-	P	V	selected drums.

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. BYPL may witness Raw material and in process inspection in addition to Routine/Acceptance tests at any time/stage of manufacturing.
5. BYPL's Inspector may randomly select a cable drum for type testing at vendor's works.
6. For each of the offered lot for inspection, BYPL may randomly select one cable drum for testing of end cap "Destructive testing" to verify adhesion of sealing cap to cable outer sheath. Similarly, pulling eye shall be tested with 30N/mm^2 pressure.
7. All factory Type Tests shall be Witnessed by BYPL

Legend:
SV – Sub-vendor of cable manufacturer, MFR – Cable manufacturer, BYPL – BSES Yamuna Power Limited, PS – Purchaser specification of cable vendor, P – Perform, V – Verify, W – Witness, RC – Rate Contract

TECHNICAL SPECIFICATION

FOR

FRLS CONTROL CABLE

SPECIFICATION NO. – SP-FRLSCC-184-R0

Prepared by	Reviewed by	Approved by	Rev	Date
Jeena Borana	Gaurav Sharma	Ashwani Aggarwal		
			R0	30.06.2020

INDEX

1.0 SCOPE

The scope of supply includes Design, Manufacture, Testing at manufacturer's works before dispatch, packing, delivery including unloading and stacking at site/store of Control Cable complete with all accessories.

2.0 STANDARDS & CODES

Materials, equipments and methods used in the manufacture of Cable shall conform to the latest edition of following:

S No.	STANDARD	DESCRIPTION
2.1	IS- 1554 Part-1	PVC insulated Cables
2.2	IS- 5831 : 1984	PVC insulation & sheath of electric cables.
2.3	IS- 10810 : 1984	Methods of test for cables.
2.4	IS- 8130 : 1984	Conductors for insulated electric cables and flexible cords.
2.5	IS- 3961 Part 2	Recommended current ratings for PVC insulated and PVC sheathed heavy duty Cables
2.6	IS- 3975 : 1999	Mild steel wires, formed wires and tapes for armouring of cables.
2.7	IS- 10418 : 1982	Drums for Electric Cables
2.8	IEC 60228 Ed.3.0 b	Conductors of insulated cables.
2.9	IEC 60332-3-21 Ed.1.0 b	Tests on electric cables under fire conditions. Part 3-21. Tests on bunched wires or cables.
2.10	IEC 60502-1 Ed. 2.1 b	Power cables with extruded insulation and their accessories for rated voltage from 1kV up to 30kV –Part 1: cables for rated voltages of 1kV and 3kV
2.11	IEC 60811	Common test methods for insulating and sheathing materials of electric cables.
2.12	IEC 60885 Ed.1.0 b	Electric test methods for electric cables.
2.13	IEC 60227	PVC insulated cables of rated voltages up to and including 450/750 V.
2.14	IEC 60028 Ed. 2.0 b	International Standard of Resistance for Copper
2.15	ASTMD 2843	Standard Test Method for density of Smoke from the burning or decomposition of cables
2.16	ASTM 2863	Standard Test Method for measuring of minimum oxygen concentration
2.17	IEC 60754-1	Test on gases evolved during combustion of materials for cables. Part 1 – Determination of the Halogen Acid gas Content

3.0 SERVICE CONDITIONS

Control Cables to be supplied against this specification shall be suitable for satisfactory operation under the following conditions-

3.1	Average grade atmosphere	Heavily polluted, Dry
3.2	Maximum altitude above sea level	1000M
3.3	Relative Humidity	100%
3.4	Ambient air temperature	Highest 50 Deg C Average 40 Deg C Minimum 0 Deg C
3.5	Operating temperature	0 Deg C - 50 Deg C
3.6	Rainfall	750mm concentrated in four months

4.0 DESIGN FEATURES

(Refer Annexure – "A")

S No.	Parameters	Technical Requirements
4.1	Cable construction Features	Size & dimensions of each item mentioned under this clause shall be followed as detailed out in GTP, refer Annexure A
4.2	Conductor	• Stranded, plain copper, circular • Shall be made from high conductivity copper rods
4.3	Insulation	Extruded PVC Insulation Type A as per IS 5831
4.4	Core Identification	Each core shall have different color of insulation
4.5	Inner Sheath	Extruded Inner Sheath of Black PVC type ST-2 as per IS 5831
4.6	Armour	• As per Clause 13.2 of IS 1554 Part-1: Galvanized steel round wire armour. • Minimum area of coverage of armouring shall be not less than 90 %. (refer Annex C of IS 1554-part 1 for % calculation)

S No.	Parameters	Technical Requirements
4.7	Outer Sheath	a) Extruded outer sheath of PVC type ST-2 as per IS 5831 having FRLS properties b) Color : Black c) The Outer Sheath shall be embossed with: • The voltage designation • Type of construction / cable code (for e.g. AYWY) • Manufacturers Name or Trade mark • Number of Cores and nominal cross sectional area of conductors • The drum progressive length of cable at every meter. (By Printing) • Name of buyer i.e. BSES • Month & Year of Manufacturing • P.O. No. and P.O. Date
4.8	FRLS Properties	a) Oxygen Index : Not less than 29% as per ASTM 2863 b) Temperature Index: shall be 21 at a temperature of 250℃. (when tested as per ASTM D 2863) c) Max Acid Gas Generation – Not more than 20% as per IEC -60754-1 d) Light Transmission - Minimum 40% when tested as per ASTMD 2843 (Smoke Density rating shall be max 60%) e) Flammability Test – As per IEC 60332-III, Cat – B, IEC 60332- I, IS- 10810 – Part 53, IS:10810 – Part 61 & 62 (Category A)
4.9	Sealing of cable end	Both ends of the cable shall be sealed with PVC Cap.
4.10	Drum length & tolerance	500 mtr (+/- 5%)
4.11	Overall tolerance in cable length	- 2 %
4.12	Short length of cables	a) Minimum acceptable short length shall be above 100 meters. Manufacturer shall be required to take prior approval from engineering for any short length supply. b) Manufacturer shall not be allowed to put two cable pieces of different short lengths in same cable drum. c) Only 1% of the total ordered quantity.

5.0 QUALITY ASSURANCE PLAN, INSPECTION AND TESTING

S No.	Parameters	Technical Requirements
5.1	Quality Assurance Plan	QAP Shall be submitted by vendor for approval. Inspection and testing of the material shall be carried out accordingly.
5.2	Type test	a) Cables must be of type tested as per relevant IS/IEC/ASTM. Type test conducted either from CPRI/ERDA will be treated as valid. b) Type test reports shall be submitted for the type, size & rating of cable offered along with bid.
5.3	Routine test	Each drum length of cable shall be subjected to the tests as mentioned in IS 1554 part -1
5.4	Acceptance Tests	The sampling & acceptance tests Shall be conducted, as per IS 1554 Part-1 and approved QA plan, for each lot of cable during the inspection of lot at manufacturer's works.
5.5	Inspection	a) The buyer reserves the right to inspect cables at the Seller's works at any time prior dispatch, to verify compliance with the specifications. b) In-process and final inspection call intimation shall be given in 15 days advance to purchaser.
5.6	Test certificates	Test certificates (routine and acceptance) shall be submitted along with the dispatch documents.

6.0 PACKING, SHIPPING, HANDLING & SITE SUPPORT

6.1	Packing	The cable shall be wound on wooden drums (with anti termite treatment and M.S. spindle plate with nut-bolts). Cable should be packed conforming to Indian / international standards. The drum shall be fully enclosed by suitable packing preferably PP sheeting.
6.2	Drum identification label	The following information shall be marked on the drum: a) Drum identification number b) Trade name or trade mark; if any c) Name of manufacturer d) Name of buyer i.e. BYPL e) Cable voltage grade f) Cable code (e.g. YWY) g) Number of cores and cross sectional area h) Purchase order number with SAP item code i) Year and month of manufacturing j) Direction of rotation of drum (an arrow) k) Net weight of cable in drum and gross weight of cable with drum l) Batch no or Lot no. m) Cable length initial reading & end reading shall be marked on drum. Cable starting end shall be taken out from winding to read this drum reading with proper sealing to protect against external damage.
6.3	Shipping	The seller shall give complete shipping information concerning the gross weight, size of each packing.
6.4	Handling & Storage	Manufacturer instruction shall be followed. Detail handling & storage instruction sheet/manual needs to be furnished before commencement of supply.
6.5	Transit damage	The seller shall be responsible for any transit damage due to improper packing.

7.0 DEVIATIONS

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

8.0 DOCUMENT SUBMISSION MATRIX

- Document checklist for each stage is given in table below.
- Document check sheet compliance shall be the first sheet for each submission stage i.e. Technical bid, Drawing Approval, Pre Dispatch, Pre closure.
- No submission is acceptable without check list compliance.
- Deficient/ improper document/ drawing submission shall be liable for rejection.
- Order of documents shall be strictly as per the check list.
- Any drawing not included in the below table but necessary for detailed engineering shall be deemed to be included in bidder's scope.

S No.	Description	Technical Bid	Drawing Approval	Pre Dispatch	Pre Closure
8.1	Tender No.	required			
8.2	Communication details				
8.2.1	Name of the Bidder	required			
8.2.2	Name of Authorized contact person	required			
8.2.3	Contact No. of Authorized contact person	required			
8.2.4	E-mail id of Authorized contact person	required			
8.3	Document Submission Format				
8.3.1	Index of documents with page numbers for each document	required			
8.3.2	Separator with document description shall be provided before each document	required			
8.4	Qualifying Requirement Compliance				
8.4.1	Summary of compliance of qualifying criteria in tabular form along with summary of documentary proof provided	required			
8.4.2	Detailed Documents supporting compliance of qualifying criteria	required			

S No.	Description	Technical Bid	Drawing Approval	Pre Dispatch	Pre Closure
8.5	Drawings/ Documents as per Technical Specification				
8.5.1	Signed copy of technical specification	required			
8.5.2	Type Test reports of offered model/ type/ rating	required	required		
8.5.3	Deviation Sheet	required	required		
8.5.4	Detailed Drawings	required	required		
8.5.5	Other drawing/ documents mentioned in technical specification	required	required		
8.5.6	Make of raw Materials				
8.5.7	Design Calculation		required		
8.5.8	Manufacturer's quality assurance plan		required		
8.5.9	GTP		required		
8.5.10	Inspection and routine test reports, carried out in manufacturer's works			required	
8.5.11	Detailed installation & commissioning instructions			required	
8.6	BIS Certificate	required			
8.7	Soft Copy of all the documents mentioned in table				
8.7.1	In Pen drive	required			
8.7.2	Through Mail		required	required	required

Annexure – A: Guaranteed Technical Particulars (Data by Supplier)

(Standard Cable sizes are 6C X 2.5 and 10C X 2.5 mm^2)

For each size separate GTP need to be furnished

***For any size other than standard sizes mentioned, GTP should be as per IS or requirement whichever applicable**

Sr.	Description	Buyer's requirement	Vendor's Data
	Purchase Req. No.	….	
	Guarantee Period: 5 Years	60/66 Months	
1.0	Make	To be specified by vendor	
2.0	Type (AS PER IS 1554 part -1)	YWY	
3.0	Voltage Grade (KV)	1.1	
4.0	Maximum Conductor temperature		
a)	Continuous (° C)	70℃	
b)	Short time (° C)	160℃	
5.0	Conductor		
a)	Size (mm^2)	2.5	
b)	No. of wires in each conductor	As per Manufacturer standard	
c)	Dia. of wires in each conductor before compaction (mm)	As per Manufacturer standard	
d)	Shape of Conductor	As per Clause 4.2.0 of specification	
e)	Diameter over conductor mm	To be specified by vendor	
f)	Maximum Conductor resistance at 20 ° C (Ohm/Km)	As per Table 2 of IS 8130	
6.0	Insulation	As per Table 1 of IS:5831 – 1984	
a)	Nominal thickness (mm)	As per Clause 4.3.0 of specification & Table 2 of IS 1554(Part-1)	
b)	Minimum thickness (mm)		
c)	Core Identification	Color of all the cores shall be different	

Sr.	Description	Buyer's requirement	Vendor's Data
d)	Approx. dia. over Insulation (mm)	To be specified by vendor	
7.0	Inner Sheath	As per Table 2 of IS:5831 – 1984	
a)	Minimum thickness (mm)	As per Table 4 of IS 1554(Part-1)	
b)	Approx. dia. Over sheath (mm)	To be specified by vendor	
8.0	Galvanized Steel Armour	As per IS 1554-part 1	
a)	Number of armour wire	As per Manufacturer Std.	
b)	Nominal dia. of Round Wire	As per Table 5 of IS 1554(Part-1)	
c)	Dia. over armour – approx.	To be specified by vendor	
d)	Lay Ratio	To be specified by vendor	
e)	Confirm minimum 90% coverage (submit calculation)		
9.0	Outer Sheath (FRLS)	As per Table 2 of IS:5831 – 1984	
a)	Thickness (min)	As per Table 7 of IS 1554(Part-1)	
b)	Color	Black	
10.0	Approx. overall dia. (mm)	To be specified by vendor	
11.0	Drum length & tolerance	As per clause 4.10.0 of specification	
12.0	End Cap	Required	
13.0	Drums provide with MS Spindle plate & Nut bolts arrangement	Required	

Sr.	Description	Buyer's requirement	Vendor's Data
14.0	Net Weight of cable (Kg/Km.) – approx.	To be specified by vendor	
15.0	Continuous current rating for standard I.S. condition laid Direct		
a)	In ground 30° C Amps	To be specified by vendor	
b)	In duct 30° C Amps	To be specified by vendor	
c)	In Air 40° C Amps	To be specified by vendor	
16.0	Short circuit current for 1 sec of conductor. (KAmp)	To be specified by vendor	
17.0	Electrical Parameters at Maximum Operating temperature:		
a)	Resistance (Ohm/Km) (AC Resistance)	To be specified by vendor	
b)	Reactance at 50 C/s (Ohm/Km)	To be specified by vendor	
c)	Impedance (Ohm/Km)	To be specified by vendor	
d)	Capacitance (Micro farad / KM)	To be specified by vendor	
18.0	Recommended minimum bending radius	…. x O/D	
19.0	FRLS Properties		
a)	Oxygen Index	To be specified by vendor	
b)	Temperature Index	To be specified by vendor	
c)	Max Acid Gas Generation	To be specified by vendor	
d)	Light Transmission / Smoke Density	To be specified by vendor	

TECHNICAL SPECIFICATION
FOR
LT POWER CABLE
(Single & Multi-Core)
Specification No. : SP-LTPC-63-R1

Rev 01	*Date 19 March 2021*	*No. of Page 40*
Prepared by	Ankita Arora	ankita arora a1877a0d-ff71-43f8-8a8f-f1ebbc3d489f
	Abhishek Vashistha	Abhishek Vashistha 7a74fd4f-a398-49df-bd05-e398d5a949f0
Reviewed by	Puneet Duggal	Puneet Duggal 404db803-a91f-4234-85f0-0b2b5098ec32
Approved by	Gaurav Sharma	 23dc2de2-95de-4472-99a7-dea873f472b6

DocUUID : e6022208-f862-4c5f-a3ac-ff072829f226

Contents

1.0 SCOPE OF SUPPLY

The specification covers design, manufacture, shop testing, packing and delivery of 1100 Volts grade, Aluminium conductor, and XLPE insulated multi core power cables.

2.0 CODES & STANDARDS

The cables shall be designed, manufactured and tested in Accordance with the following Indian & IEC standards.

2.1	IS- 7098 (Part-1)	Cross linked polyethylene insulated PVC sheathed cables for working voltages upto and including 1100V.
2.2	IS- 6474	Polyethylene insulation & sheath of electric cables.
2.3	IS- 5831	PVC insulation and sheath of electrical cables.
2.4	IS : 10810	Methods of tests for cables.
2.5	IS : 8130	Conductors for insulated electrical cables and flexible cords.
2.6	IS : 3975	Low carbon galvanized steel wires, formed wires and tapes for armouring of cables.
2.7	IS- 4026	Aluminum ingots, billets and wire bars (EC grade)
2.8	IS-5484	EC Grade aluminium rod produced by continuous casting and rolling
2.9	IS : 10418	Specification for drums for electric cables.
2.10	IS : 3961	Recommended current ratings for cables.
2.11	IS:1255	Installation and Maintenance of power cables upto and including 33 kV rating.
2.12	IS:4826	Specification for hot-dipped galvanized coatings on round steel wires
2.13	IS:1717	Metallic Materials – Wire – Simple torsion test
2.14	IEC 60331	Fire resisting characteristics of electric cables.
2.15	IEC 60332 - 3	Tests on electric cables under fire conditions. Part 3: Tests on bunched wires or cables.

DocUUID : e6022208-f862-4c5f-a3ac-ff072829f226

2.16	IEC 60502	Extruded solid dielectric insulated power cables for rated voltages from 1kV to 30 kV.
2.17	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.
2.18	IEC 60811	Common test methods for insulating and sheathing materials of electric cables.
2.19	IEC 60885	Electric test methods for electric cables.
2.20	IEC 60304	Standard colours for insulation for low frequency cables and wires.
2.21	IEC 60227	PVC insulated cables of rated voltages up to and including 450/750 V.
2.22	IEC 1034	Measurement of smoke density of electric cables burning under defined conditions.

3.0 CABLE DESIGN

Cable design shall be in accordance with IS 7098 Part-1

3.1	Conductor	a) Electrolytic Grade Stranded Aluminium Conductor b) Grade: H2 as per IS:8130/1984 c) Class 2 d) Chemical composition as per IS 4026 e) Shape : i) Compacted Circular for sizes up to 16 sqmm and for Single core cables. ii) Sector shaped for sizes above and including 25Sqmm
3.2	Insulation	Extruded XLPE Insulation as per IS:7098 Part-1

3.3	Core Identification	Coloured XLPE insulation as per Cl.10.1 (b) of IS 7098 Part-1
3.4	Inner Sheath	Extruded Inner Sheath of Black PVC type ST-2 IS:5831-1984)
3.5	Armour	a) For 2CX10Sqmm - Galvanized Steel Wire b) For all sizes above 10Sqmm – Galvanized Steel Strip. c) Not required for Single core cables of sizes i.e. 25, 95, 300, 630 & 1000 sq mm d) Minimum area of coverage of armouring shall be 90% e) The breaking load of armour joint shall not be less than 95% of that of armour wire/strip. f) Zero negative tolerance for thickness of armour strip as per IS:3975 g) Zinc rich paint shall be applied on strip/wire and its joint surface. If the armour breaks or the lot finished then they start the new lot and join the two ends for continuation process.

3.6	Outer Sheath	a) Extruded outer sheath of PVC (ST-2) shall be as per IS:5831. b) Colour : Yellow (For Multi core cables) Black (For Single core cables) c) Outer sheath of all the LT cables shall be UV resistant; as these cables are laid in air exposed to sun. Bidder to ensure the same for these requirements supported by required test of any lot of the order d) Shape of the cable over the outer sheath shall be circular, when manufactured /completed. Regular Ovality check shall be carried out at Factory, to detect any abnormality. Manufacturing quality shall be such that cable will retain its circular shape, even after it is laid at site. e) The Outer Sheath shall be embossed with following minimum text: (i) The voltage designation (ii) Type of construction / cable code (iii) Manufacturers Name / Trade mark (iv) Number of Cores and nominal cross sectional area of conductor. (v) Progressive (Sequential) length of cable at every meter, starting from zero for every drum. Colour filled in for the progressive marking, shall be with proper contrast in colouring. (vi) Name of buyer i.e. BYPL (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 (xii)Drum Number The embossing shall be progressive, automatic, in line and marking shall be legible and indelible.

3.7	FRLS Properties	Outersheath of the power cable shall have following FRLS Properties **for cable sizes; 2Cx10sqmm, 2Cx25sqmm, 4Cx25sqmm & 4Cx50sqmm Only** a) Oxygen Index : Not less than 29% as per ASTM 2863 b) Temperature Index: shall be 21 at a temperature of 250°C. (when tested as per ASTM D 2863) c) Max Acid Gas Generation – Not more than 20% as per IEC -60754-1 d) Light Transmission - Minimum 40% when tested as per ASTMD 2843 (Smoke Density rating shall be max 60%) e) Flammability Test – As per IEC 60332-III, Cat – B, IEC 60332- I, IS- 10810 – Part 53, IS:10810 – Part 61 & 62 (Category A) f) Anti- termite and rodent property test
3.8	Bending Radius	Bending Radius of cable shall comply to IS:1255.
3.9	Sealing of Cable end	Both ends of the cable shall be sealed by means of non-hygroscopic heat shrinkable HDPE caps.

4.0 CABLE DRUM

4.1	Reference Standard	Cable drums shall comply with IS: 10418.
4.2	Type of Drum	Wooden drums with anti termite treatment. (The drums shall be provided with M.S. spindle plate and nut-bolts arrangement as per IS:10418).
4.3	Drum Length & Tolerance	500 +/ - 5% Mtr
4.4	Overall Tolerance	+/-2 % for the total cable length for the entire order.
4.5	Short Length of Cables	a) Minimum acceptable short length (Maximum is 525 mtr) shall be 1% of the total ordered quantity and no length shall be less than 250Mtrs. Manufacturer shall be required to take prior approval from Engineering for any short length supply. Short length will be accepted in last lot. b) Manufacturer shall not be allowed to put two cable pieces of different short lengths in same

		cable drum.
4.6	Preventive Measure for Cable Drum	a) The surface of the drum and the outer most cable layer shall be covered with water proof layer. b) Ferrous part of wooden drum shall be treated with suitable rust preventive paint/coating to minimize rusting during storage.
4.7	Drum Identification Labels	a) Drum identification number b) Cable voltage grade c) Cable code (eg. A2XFY/A2XWY) d) Number of cores and cross sectional area e) Cable quantity i.e. cable length (Meters) f) Purchase order number, date and SAP item code g) Total weight of cable and drum (kg) h) Manufacturer's and Buyer's name i) Month & year of manufacturing j) Direction of rotation of drum; An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled. k) Cable length final end-markings (i.e. reading at the inner end and reading at the outer end, just before packing shall be marked on the drum).

5.0 PACKING, SHIPPING, HANDLING & STORAGE

5.1	Packing	The cable shall be wound on wooden drums (with anti termite treatment and M.S. spindle plate with nut-bolts). Cable should be packed conforming to Indian / international standards. The drum shall be fully enclosed by suitable packing preferably PP sheeting.
5.2	Shipping Information	The seller shall give complete shipping information concerning the weight, size of each package.
5.3	Transit Damage	The seller shall be held responsible for all transit damage due to improper packing.
5.4	Cable Drum Handling	The drums shall be with M.S spindle plate (with nut-bolts) of adequate size to suit the spindle rods, normally required for handling the drums, according to expected weight of the cable drums as per IS:10418
5.5	Handling & Storage	Manufacturer instruction shall be followed. Detail handling & storage instruction sheet/manual needs to be furnished before commencement of supply.

6.0 QUALITY ASSURANCE, TESTING & INSPECTION

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

6.1	**Quality Assurance Plan**	As per Annexure – E. In event of order Manufacturer has to submit the signed copy of QAP.
6.3	**Routine Test**	a) Measurement of Electrical Resistance b) HV test with power frequency AC voltage

6.4	**Type Test**	a) Cables must be of type tested quality. Cable design not type tested shall not be considered. Type test reports shall be submitted for the same or higher type, size and rating of cable offered along with bid. b) Bidder supplying 1.1 kV cable to BSES for the first time shall have to conduct type test on sample randomly selected from lot in event of order from CPRI/ERDA without any price implication to BSES. c) UV resistance test to be carried out on one sample randomly selected from any one lot to be supplied against Rate Contract. Testing shall be carried out from CPRI/ERDA as per ASTM standard (sample shall meet minimum 80% retention after exposure of 21 days as per ASTM standard). Test reports must have PO number, drum no., photograph details of the inspected item.

6.5	**Acceptance Test** **(Shall be conducted as per IS 7098 Part-1 for each lot of cable)**	a) **For cable sizes upto 50sqmm** – one sample for chemical composition and purity test of aluminium shall be conducted per 100km of ordered quantity and multiple thereof. b) **For cable sizes above 50sqmm** – one sample for chemical composition and purity test of aluminium shall be conducted per 50km of ordered quantity and multiple thereof. c) Chemical composition and purity test of aluminium shall be conducted from the lot offered to BSES on each size involved in the purchase order. Test shall be carried out at NABL accredited third party laboratory without any price implication to BSES. Test reports must have PO number, drum no., photograph details of the inspected item. d) The sample will be selected either during acceptance test or after receipt of cable in BSES stores.
6.6	**Inspection**	a) The buyer reserves the right to inspect cables at the Seller's works at any time prior dispatch, to verify compliance with the specifications. b) In-process and final inspection call intimation shall be given in 15 days advance to purchaser. c) In the event of any discrepancy in the test reports i.e. test reports not acceptable or any type tests (including special /additional tests, if any) not carried out, same shall be carried out without any cost implication to BSES before dispatch of cable.
6.7	**Test Certificates**	Complete test certificates (routine & acceptance tests) need to be submitted along with the delivery of cables.

7.0 DEVIATIONS

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

8.0 DOCUMENT SUBMISSION MATRIX

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

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

S No.	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

ANNEXURE – A

GUARANTEED TECHNICAL PARTICULARS (Multi-core)

(Standard Cable sizes are 2Cx10, 2Cx25 For each size /rating separate GTP need to be furnished)

S.No.	Description	Buyer's Requirement	Seller's data
1	**Make**	….	
2	**Type (as required by purchaser)**		
A	For 2CX10Sqmm	A2XWY	
B	For Sizes above 10Sqmm	A2XFY	
3	**Voltage Grade (kV)**	1.1	
4	**Maximum Conductor temperature**		
A	Continuous	90°C	
B	Short time	250°C	
5	**Conductor**		
A	Material and Grade	As per Cl.3.1	
B	Make of Al	Ref Annexure D	
C	Size (mm^2)	…… sq mm	
D	Min no. of wires in each conductor (Nos.)	As per Manufacturer Standard	
E	Min Dia. of wires in each conductor before compaction (mm)	As per Manufacturer Standard	
F	Shape of Conductor	As per Cl.3.1 (e)	

S.No.	Description	Buyer's	Seller's data
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 manufacturer's standard and as per purchaser's site - specific condition	
A	Material		
a)	**For 2CX10Sqmm**	G.I.Wire	
(i)	Wire Dia (mm)	1.4+/-0.040	
(ii)	No. of wires	As per Manufacturer Standard	
b)	**For sizes above 10Sqmm**	G.I.Strip	
(i)	Strip size (Width and Thickness)	4x0.8 (Zero negative tolerance for thickness)	
(ii)	No. of Strips	As per Manufacturer Standard	

S.No.	Description	Buyer's	Seller's data
B	Area covered by Armour	Min 90% and calculations shall be strictly as per Annexure D	
C	Dia. over Armour – Approx.	……	
9	**Outer Sheath**		
A	Material and Type	As per Cl. 3.6	
B	Minimum Thickness	As per Table 8 of IS 7098 Part-1	
C	Colour	Yellow	
D	Embossing Details	As per Cl.3.6 (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	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.		

S.No.	Description	Buyer's	Seller's data
b)	4 Nos.		
c)	5 Nos.		
d)	6 Nos.		
21	**Process of Cross linking of Polyethylene**		
22	**Type test**	Is copy of latest valid TTR for respective sizes enclosed? Yes / No	

ANNEXURE – B

GUARANTEED TECHNICAL PARTICULARS (Multi-core)

Standard Cable sizes are 4Cx25, 4Cx50, 4Cx95, 4Cx150, 4Cx300 & 4Cx400sqmm

S.No.	Description	Buyer's Requirement	Seller's data
1	**Make**	….	
2	**Type (as required by purchaser)**		
A	For 4Cx25 to 4Cx400sqmm	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)	…… sq mm	
D	Min no. of wires in each conductor (Nos.)	As per Manufacturer Standard	
E	Min Dia. of wires in each conductor before compaction (mm)	As per Manufacturer Standard	
F	Shape of Conductor	As per Cl.3.1 (e)	

S.No.	Description	Buyer's	Seller's data
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 manufacturer's standard and as per purchaser's site - specific condition	
A	Material		
b)	**For sizes above 10Sqmm**	G.I.Strip	
(i)	Strip size (Width and Thickness)	4x0.8 (Zero negative tolerance for thickness)	
(ii)	No. of Strips	As per Manufacturer Standard	
B	Area covered by Armour	Min 90% and calculations shall be strictly as per Annexure D	
C	Dia. over Armour – Approx.	……	

S.No.	Description	Buyer's	Seller's data
9	**Outer Sheath**		
A	Material and Type	As per Cl. 3.6	
B	Minimum Thickness	As per Table 8 of IS 7098 Part-1	
C	Colour	Yellow	
D	Embossing Details	As per Cl.3.6 (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	

S.No.	Description	Buyer's	Seller's data
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**		

S.No.	Description	Buyer's	Seller's data
22	**Type test**	Is copy of latest valid TTR for respective sizes enclosed? Yes / No	

ANNEXURE - C

GUARANTEED TECHNICAL PARTICULARS (Single Core)

(Separate GTP needs to be furnished for 1Cx25, 1Cx95, 1Cx300, 1Cx630 & 1Cx1000 sqmm cables)

S.No.	Description	Buyer's Requirement	Seller's data
1	**Make**	.....	
2	**Type**	A2XY (Unarmoured)	
3	**Voltage Grade (kV)**	1.1 kV	
4	**Maximum Conductor temperature**		
A	Continuous	90°C	
B	Short time	250°C	
5	**Conductor**		
A	Material and Grade	As per Cl.2.1.1	
B	Size (mm^2)	25/95/300 / 630 / 1000 sqmm	
C	Min no. of wires in each conductor (Nos.)	As per Manufacturer Standard	
D	Min Dia. of wires in each conductor before compaction (mm)	As per Manufacturer Standard	
E	Shape of conductor	Compacted Circular	
F	Diameter over conductor	.....	
G	Maximum Conductor resistance at 20 ° C (Ohm/Km)	As per Table 2 of IS 8130	
H	Make of Al	Ref Annexure-F	

6	**Insulation**	As per Table 3 of IS 7098 Part-1	
A	Insulation Material	As per Cl. 3.2	
B	Nominal thickness		
(i)	For 1Cx500sqmm	2.2mm	
(ii)	For 1Cx630sqmm	2.4mm	
C	Diameter over Insulation (mm) Approx.	.....	
D	Make of insulation compound	Refer Annexure-F	
7	**Inner Sheath**	Not applicable	
8	**Armour**	Not applicable	
9	**Outer Sheath**		
A	Material and Type	As per Cl. 3.6	
B	Minimum Thickness	As per Table 8 of IS	
C	Colour	Black	
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 &	

C	Marking on Drum	As per Spec.Cl. 4.7	
D	Drums provide with MS Spindle plate & nut-bolts arrangement (as per IS:10418)	Required	
13	**End Cap**	Required	
14	**Weights**	….	
a)	Net Weight of cable (Kg/Km.) – Approx		
b)	Weight of empty drum	Kg	
c)	Weight of cable with drum	Kg	
15	**Continuous current rating for standard I.S condition laid direct**		
a)	In ground 30° C	Amps	
b)	In duct 30° C	Amps	
c)	In Air 40° C	Amps	
16	**Short circuit current for 1 sec of Conductor (KAmp)**	……	
17	**Electrical Parameters at Maximum Operating temperature**		
A	AC Resistance	Ohm/Km	
B	Reactance at 50 C/s	Ohm/Km	
C	Impedance	Ohm/Km	
D	Capacitance	Micro farad / Km	
18	**Recommended minimum bending radius**	..... x O/D	
19	**Derating factor for following Ambient temperature in**	Ground / Air	

a)	At 30° C		
b)	At 35° C		
c)	At 40° C		
d)	At 45° C		
e)	At 50° C		
20	**Group factor for following Nos. of Cables laid**	Touching / Trefoil	
a)	3 Nos.		
b)	4 Nos.		
c)	5 Nos.		
d)	6 Nos.		
21	**Process of Cross linking of Polyethylene**		

ANNEXURE - D

List of Sub-Vendors For critical items

S. No.	Description of Material	Sub-Vendors
1	E.C Grade Aluminium Rod	Bharat Aluminium Co. Ltd. (BALCO) Hindustan Aluminium Co. Ltd. (HINDALCO) National Aluminium Co. Ltd. (NALCO)
2	XLPE Compound	KKalpena Industries Ltd. KLJ Polymers and Chemicals Ltd. Dow Chemical, U.S.A Borealis, Sweden Hanwha, Seoul, South Korea

ANNEXURE - E

QUALITY ASSURANCE PLAN FOR XLPE INSULATED 1.1KV LT POWER CABLE											
Sl. No.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REF. DOCUMENT	ACCEPTANCE STANDARDS	FORMAT OF RECORD	AGENCY		REMARKS
									M	B	
1	2	3	4	5	6	7	8	9	10	11	12
A)	**Raw Material**										
1)	Aluminum Rod	a) Make / Type / Grade	Maj.	Vis.	100%	BSES Approved Documents/ Specifications	BSES Approved Documents/ Specifications	Reg./Sheet	P	V	
		b) Tensile strength	Cri.	Physical	1 Sample/lot	IS:5484	IS:5484	Int. Test Records	P	V	
		c) Elongation	Cri.	Physical	----do---	-- do --	-- do --	-- do --	P	V	
		d)Resistivity/Conductivity	Cri.	Elec.	----do---	-- do --	-- do --	-- do --	P	V	On drawn Wire
		e) Diameter	Cri.	Physical	100%	-- do --	-- do --	-- do --	P	V	
		f) Purity	Cri.	Chemical	1 Sample/lot	-- do --	-- do --	-- do --	V	V	Manufacturer's test

											certificate
		g) Surface Finish	Cri.	Vis.	100%	Smooth Surface	Smooth Surface	T.C	P	V	
2)	XLPE Compound	a) Visual checks on packing	Maj.	Vis.	100%	BSES Approved Documents /Specifications	BSES Approved Documents/ Specifications	Reg./Sheet	P	V	
		b) Hot set	Maj.	Physical	1sample/lot	IS:7098-1/88	IS:7098-1/88	-- do --	P	V	
		c) Tensile strength	Maj.	Physical	-- do --	-- do --	-- do --	-- do --	P	V	
		d) Elongation	Maj.	Physical	-- do --	-- do --	-- do --	-- do --	P	V	
		e) Volume resistivity	Maj.	Electrical	-- do --	-- do --	-- do --	-- do --	P	V	
		f) Specific gravity	Maj.	Physical	-- do --	-- do --	-- do --	-- do --	P	V	
3)	Armour Wires / Strips (G.S)	a) Dimension	Maj.	Physical	1sample / lot	IS:3975 & Data Sheet	IS:3975 & Data Sheet	Reg./Sheet	P	V	
		b) T.S & Elongation	Maj.	Physical	-- do --	IS:3975	IS:3975	-- do --	P	V	
		c) Mass & Uniformity of zinc coating	Maj.	Chemical	-- do --	IS:3975 / IS:4826	IS:3975 / IS:4826	-- do --	P	V	

		d) Torsion / winding test	Maj.	Physical	-- do --	IS:3975	IS:3975	-- do --	P	V	
		e) Wrapping test	Maj.	Physical	-- do --	IS:3975	IS:3975	-- do --	P	V	
4)	PVC Compound	a) Make / Type / Grade	Maj.	Physical	100%	BSES Approved Documents/ Specifications	BSES Approved Documents/ Specifications	Reg./Sheet	P	V	
		b) T.S & Elongation	Maj.	Physical	1sample / lot	IS:5831/84	IS:5831/84	-- do --	P	V	
		c) Thermal Stability	Maj.	Physical	-- do --	IS 5831 & IS 10810 (Part-60)	IS 5831 & IS 10810 (Part-60)	-- do --	P	V	
		d) Specific Gravity	Maj.	Chemical	-- do --	IS:5831/84	IS:5831/84	-- do --	P	V	
5)	Wooden Drum	a) Dimension	Maj.	Physical	1sample / lot	IS:10418	IS:10418	Reg./Sheet	P	V	
		b) Anti-termite treatment	Maj.	Chemical	Plant standard	Plant standard	Plant standard	-- do --	P	V	

B)	**Process & Stage Inspection**										
1)	Wire Drawing	a) Diameter	Maj.	Physical	Sample	IS:8130/84	IS:8130/84	Reg./Sheet	P	V	
		b) Surface Finish	Maj.	Vis.	100%	Smooth Surface	Smooth Surface	T.C	P	V	
		c) Tensile Strength	Maj.	Physical	1sample / lot	IS:8130/84	IS:8130/84	Reg./Sheet	P	V	
		d) Elongation test	Maj.	Physical	-- do --	IS:8130/84	IS:8130/84	-- do --	P	V	
		e) Wrapping Test	Maj.	Physical	-- do --	IS:8130/84	IS:8130/84	-- do --	P	V	
2)	Stranding	a) No. / dia of wires	Maj.	Count	At the time of m/c setting	IS:8130/84	IS:8130/84	Reg./Sheet	P	V	
		b) Diameter of conductor	Maj.	Physical	At the time of m/c setting and once in each shift	-- do --	-- do --	-- do --	P	V	
		c) Lay Length	Maj.	Physical	During m/c setting	-- do --	-- do --	-- do --	P	V	
		d) Direction of Lay	Maj.	Physical	One sample/Setting of each size	-- do --	-- do --	-- do --	P	V	

		e) Weight	Maj.	Physical	Each unloaded reel	-- do --	-- do --	-- do --	P	V	
		f) Surface Finish	Maj.	Vis.	100%	No surface defects and free from sharp edges, scratches, grease, oil etc.		T.C	P	V	
		g) Resistance	Cri.	Physical	1 sample from starting & finishing end of each length	IS:8130/84	IS:8130/84	-- do --	P	V	
3)	Insulation	a) Material	Maj.	Physical	During m/c setting	IS:7098-1/88	IS:7098-1/88	Reg./Sheet	P	V	
		b) Thickness	Cri.	Physical	During m/c setting and at standard	-- do --	-- do --	-- do --	P	V	

					length						
		c) Surface Finish	Maj.	Vis.	100%	Surface shall be smooth and free from defects		T.C	P	V	
		d) Spark Testing	Cri.	Electrical	100%	IS:7098-1/88	IS:7098-1/88	Reg./Sheet	P	V	
		e) Colour of Cores	Maj.	Vis.	100%	-- do --	-- do --	-- do --	P	V	
		f) Thermal Stability	Cri.	Chemical	One sample/Setting of each size	-- do --	-- do --	-- do --	P	V	
		g) Core Identification	Maj.	Vis.	10%	-- do --	-- do --	-- do --	P	V	
		h) Hot set test	Maj.	Physical	1sample / lot	-- do --	-- do --	-- do --	P	V	
		i) Diameter	Maj.	Physical	-- do --	-- do --	-- do --	-- do --	P	V	
		j) Resistance	Cri.	Physical	-- do --	-- do --	-- do --	-- do --	P	V	
		k) Curing	Maj.	Vis.	100%	-- do --	-- do --	-- do --	P	V	
4)	Laying up	a) Identification of cores	Maj.	Vis.	During m/c setting	IS:7098-1/88	IS:7098-1/88	Reg./Sheet	P	V	

		b) Direction of lay & core sequence	Maj.	Vis.	-- do --	-- do --	-- do --	-- do --	P	V	
		c) Lay length	Minor	Vis.	-- do --	Once in a shift.	Once in a shift.	-- do --	P	V	
		d) Shape of laid up assembly	Minor	Vis.	-- do --	Reasonable circular	Reasonable circular	-- do --	P	V	
		e) Dia. Over laid up assembly	Maj.	Physical	-- do --	Once in a shift.	Once in a shift.	-- do --	P	V	
5)	Innersheath	a) Material & type	Maj.	Vis.	During m/c setting	BSES specifications/ IS:7098-1/88	BSES specifications/ IS:7098-1/88	Reg./Sheet	P	V	
		b) Thickness	Maj.	Physical	During m/s setting & at std. length	BSES specifications/ IS:7098-1/88	BSES specifications/ IS:7098-1/88	-- do --	P	V	
		c) Dia. Over sheath	Maj.	Physical	During m/c setting	BSES specifications/ IS:7098-1/88	BSES specifications/ IS:7098-1/88	-- do --	P	V	
		d) Surface finish	Minor	Vis.	100%	Surface shall be smooth and free from defects		T.C	P	V	

6)	Armouring	a) Dimension of armour wires/strips	Maj.	Physical	At the time of m/c setting	BSES specifications/ IS:7098-1/88	BSES specifications/ IS:7098-1/88	Reg./Sheet	P	V	
		b) No. of wires/strips	Maj.	Count	At the time of m/c setting	BSES specifications/ IS:7098-1/88	BSES specifications/ IS:7098-1/88	-- do --	P	V	
		c) Direction of lay	Maj.	Vis.	One sample/Setting of each size	IS:7098-1/88	IS:7098-1/88	-- do --	P	V	
		d) Surface finish	Maj.	Vis.	100%	Surface shall be smooth and free from defects		T.C	P	V	
		e) Lay Length	Minor	Vis.	At the time of m/c setting	IS:7098-1/88	IS:7098-1/88	Reg./Sheet	P	V	
		f) Coverage & quality of armouring	Maj.	Vis.	100%	IS:7098-1/88 and IS:3975	IS:7098-1/88 and IS:3975	-- do --	P	V	

7)	Outer Sheath	a) Material & type	Maj.	Vis.	During m/c setting	BSES specifications/ IS:7098-1/88	BSES specifications/ IS:7098-1/88	Reg./Sheet	P	V	
		b) Thickness	Maj.	Physical	During m/s setting & at std. length	BSES specifications/ IS:7098-1/88	BSES specifications/ IS:7098-1/88	-- do --	P	V	
		c) Overall diameter	Maj.	Physical	During m/s setting & at std. length	Measurement	Measurement	-- do --	P	V	
		d) Surface finish	Maj.	Vis.	100%	Surface shall be smooth and free from defects		T.C	P	V	
		e) Embossing/Marking quality	Maj.	Vis.	100%	BSES specifications/ IS:7098-1/88	BSES specifications/ IS:7098-1/88	Reg./Sheet	P	V	

		f) Colour of sheath	Maj.	Vis.	During m/c setting	BSES specifications/ IS:7098-1/88	BSES specifications/ IS:7098-1/88	-- do --	P	V	
		g) Sequential marking	Maj.	Vis.	Full Length	BSES specifications/ IS:7098-1/88	BSES specifications /IS:7098-1/88	-- do --	P	V	
C)	**Final Inspection**										
1)	Routine Tests	a) Conductor Resistance	Maj.	Elec.	100%	IS:7098-1/88	IS:7098-1/88	Test Report	P	V	
		b) High Voltage Test	Maj.	Elec.	100%	IS:7098-1/88	IS:7098-1/88	Test Report	P	V	
2)	Acceptance Tests										

	Acceptance test shall be carried out for each type and size of the cables on the cable drums randomly selected as per sampling plan mentioned in IS:7098 Part-1.										
i)	For Conductor	a) Tensile Test (for Aluminium)	Cri.	Elec.	As per IS:7098-1/88	As per IS:7098-1/88	As per IS:7098-1/88	Test Certificate	P	W	
		b) Wrapping Test (for Aluminium)	Cri.	Elec.	-- do --	-- do --	-- do --	-- do --	P	W	
		c) Resistance Test	Cri.	Elec.	-- do --	-- do --	-- do --	-- do --	P	W	
ii)	For armour wire/formed wire (as applicable)	a) Measurement of Dimensions	Cri.	Measurement	One sample of each offered lot of all offered sizes	As per IS:7098-1/88 and IS:3975	As per IS:7098-1/88 and IS:3975	Test Certificate	P	W	
		b) Tensile Test	Cri.	Physical	-- do --	-- do --	-- do --	-- do --	P	W	
		c) Elongation Test	Cri.	Physical	-- do --	-- do --	-- do --	-- do --	P	W	
		d) Torsion Test (for round wires only)	Cri.	Physical	-- do --	-- do --	-- do --	-- do --	P	W	
		e) Wrapping Test	Cri.	Physical	-- do --	-- do --	-- do --	-- do --	P	W	
		f) Resistance Test	Cri.	Electrical	-- do --	-- do --	-- do --	-- do --	P	W	
		g) Mass of zinc coating	Cri.	Chemical	-- do --	-- do --	-- do --	-- do --	P	W	
		h) Uniformity of zinc coating	Cri.	Chemical	-- do --	-- do --	-- do --	-- do --	P	W	
		I) Adhesion Test	Cri.	Physical	-- do --	-- do --	-- do --	-- do --	P	W	
		j) Freedom from defects	Cri.	Visual	-- do --	-- do --	-- do --	-- do --	P	W	

iii)	For XLPE Insulation and PVC sheath	a) Test for thickness	Cri.	Measurement	One sample of each offered lot of all offered sizes	As per IS:7098-1/88 and IS:1554-1/88	As per IS:7098-1/88 and IS:1554-1/88	Test Report	P	W	
		b) Hot set test (for insulation)	Cri.	Electrical	-- do --	-- do --	-- do --	-- do --	P	W	
		c) Tensile strength and Elongation at break	Cri.	Physical	-- do --	-- do --	-- do --	-- do --	P	W	
		d) Thermal Stability Test (for PVC sheath)	Cri.	Chemical	-- do --	-- do --	-- do --	-- do --	P	W	
iv)	For Completed Cables	a) High Voltage Test	Cri.	Electrical	-- do --	As per IS:7098-1/88 and IS:1554-1/88	As per IS:7098-1/88 and IS:1554-1/88	-- do --	P	W	
		b) Insulation Resistance Test (Volume Resistivitty Method)	Cri.	Electrical	-- do --	-- do --	-- do --	-- do --	P	W	
		c) Flammability Test	Cri.	Electrical	-- do --	As per IEC-332(3) Category (B)/IS:7098-1/88	As per IEC-332(3) Category (B)/IS:7098-1/88	-- do --	P	W	
		d) Surface Finish	Maj.	Physical	One length of each size	Surface shall be smooth and free from defects		T.C	P	W	

		e) Length Measurement (Rewinding)	Maj.	Physical	1 drum per lot	BSES specifications/ IS:7098-1/88	BSES specifications/IS:7098-1/88	-- do --	P	W	
		f) Armour Coverage	Maj.	Physical	-- do --	BSES specifications/ IS:7098-1/88	BSES specifications/IS:7098-1/88	-- do --	P	W	
3)	Type Tests	As per IS:7098-1/88							Review and verification of type test clearance from BSES Engg.		
D	**Packing & Marking**	a) End Sealing	Maj.	Visual	100%	BSES specifications/ IS:7098-1/88	BSES specifications/ IS:7098-1/88	———— –	P	—— –	
		b) Stenciling/Marking	Mino r	Visual	100%	BSES specifications/ IS:7098-1/88	BSES specifications/ IS:7098-1/88	———— –	P	—— –	
		c) Packing	Maj.	Visual	100%	BSES specifications/ IS:7098-1/88	BSES specifications/ IS:7098-1/88	———— –	P	—— –	

Note:-

1. BSES may witness raw material and in process inspection in addition to routine / acceptance / type test at any time or stage of manufacturing.

2. Checks specified above for Raw material, In process and Final inspection shall be as relevant to the specific cable construction.

Abbreviations used in the above Quality Plan :-

M	Manufacturer	P	Perform
B	BSES	V	Verification
Vis.	Visual	W	Witness
Maj.	Major	T.C	Test Certificates
Cri.	Critical	Reg.	Register
Elec.	Electrical		

Technical Specification

Of

Cable Sealing System

Specification no – BSES-TS-69-CSS-R0

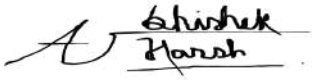
Rev:		0
Page:		1 of 8
Date:		29 Apr 2022
Prepared by	Abhishek Harsh	 3267d7c3-82b5-46cb-b5a6-867ee7820a34
Reviewed by	Srinivas Gopu	 5d32525e-ed3a-4f41-b1c7-b8a5e77d1519
Approved by	Gaurav Sharma	 23dc2de2-95de-4472-99a7-dea873f472b6

TABLE OF CONTENT

DocUUID : e8072e3e-592f-49aa-8770-7b3c516b5525

1.0 SCOPE

- This specification covers the design, manufacture, testing, supply, erection & commissioning of Cable Sealing System and its accessories.
- Scope also includes
  - Supply of Modular Cable Sealing System including its transportation to BYPL Sites.
  - Installation testing commissioning of Modular Cable Sealing Solution with all the accessories including civil work if any.

2.0 CODES & STANDARDS

- Material, equipment and methods used in the manufacturing of Cable Sealing System shall confirm to the latest edition of following standard

Standard Name / No	Standard's Description
Indian Electricity Act	Latest Edition
CBIP manual	Latest Edition
BS476 Part 20	Fire tests on building materials and structures. Method for determination of the fire resistance of elements of construction (general principles)

3.0 SERVICE CONDITIONS

3.1	Max Ambient Temperature	50 deg C
3.2	Max Daily average ambient temp	40 deg C
3.3	Min Ambient Temp	0 deg C
3.4	Maximum Humidity	95%
3.5	Minimum Humidity	10%
3.6	Maximum annual rainfall	750 mm
3.7	Average no of rainy days per annum	60
3.8	Rainy months	June to Oct
3.9	Altitude above MSL	300 M

DocUUID : e8072e3e-592f-49aa-8770-7b3c516b5525

3.10	Seismic Zone	IV

4.0 GENERAL FEATURES

4.1	Multi-cable transit system	Consisting of transit frames
4.1.1	Material	Stainless Steel of Grade 304
4.2	Multi-layered Insert blocks with Accessories	
4.2.1	Characteristic	Peelable,Tearable and adjustable
4.2.2	Material	Lycron or EPDM based halogen free rubber low-smoke index rubber
4.2.3	Filling of usable insert blocks for the future use	For Uncovered space left
4.2.4	Spare Capacity	30%
4.3	Retainer Plate	Required
4.4	End Packing	Required
4.5	Lubricant	Required
4.6	Stay Plates	For separating Flexible multi-layered Insert blocks
4.6.1	Material	Stainless Steel of Grade 304
4.7	Press Wedge	
4.7.1	Material	EPDM based halogen free low-smoke index rubber
4.8	Special Tool	For opening the cable sealing system
4.9	Fire insulation	3 Hours
4.10	Tests	
4.10.1	Type test as per BS476 Part 20 or UL-1479 or NBC-2016.	Required
4.10.2	Water Tightness (3 Bar) Type Test	Required
4.10.3	Smoke Tighness (2.5 Bar)	Required
4.10.4	Protection against Vermin	Required
4.11	IP Protection	IP67
4.12	Shelf Life	25 Years
4.13	Solubility in Water	Insoluble
4.14	Make	Roxtec, MCT brattberg

DocUUID : e8072e3e-592f-49aa-8770-7b3c516b5525

- Note- Any other make other than specified in above table shall be subject to BSES Approval.

5.0 DEVIATIONS

- Deviation from this specification shall be stated in writing with the tender by reference to the specification clause/ GTP/ Drawing and description of alternative offer. In absence of such a statement, it shall be assumed by the buyer that the seller complies fully with this specification.

6.0 QUALITY, INSPECTION & TESTING

6.1	Vendor quality plan	To be submitted for purchaser approval
6.2	Inspection points	To be mutually identified & agreed in quality plan
6.3	Type test	Equipment shall be type tested from CPRI/ERDA/NABL accreted lab as per IEC/IS/UL standard.
6.4	Routine test	As per relevant standard
6.5	Acceptance test	To be performed in presence of Owner at manufacturer works shall be as per approved QAP

7.0 GTP

- Vendor must submit clause wise compliance against specification at the time of drawing approval.

8.0 DRAWING AND DATA SUBMISSION MATRIX

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
8.1	Contact Person Name, Email ID and Mobile Number	Required	Required		
8.2	Deviation Sheet (as per “Deviations” Clause)	Required			
8.3	GTP	Required	Required		

DocUUID : e8072e3e-592f-49aa-8770-7b3c516b5525

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
8.4	Relevant Type Test as per IS/IEC/UL	Required	Required		
8.5	Manufacturer's quality assurance plan and certification for quality standards		Required		
8.6	Sizing Calculation of Associated Equipment		Required		
8.7	Recommended Spares for five years of operation)		Required		
8.8	Drawings	Required	Required		
8.9	QAP		Required		
8.10	BOQ		Required		
8.11	Make of all Component as per specification		Required		
8.12	Installation, erection and commissioning manual		Required		
8.13	Inspection Reports			Required	
8.14	As manufacturing Drawings			Required	
8.15	Operation and Maintenance Manual			Required	
8.16	Trouble shooting manual			Required	
8.17	As built Drawings				Required

9.0 PACKING

9.1	Packing Protection	Against corrosion, dampness, heavy rains, breakage and vibration. During transportation/ transit and storage, module may be subjected to outdoor conditions. Hence, packing of each panel shall be weatherproof.
9.2	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection & identification Label

DocUUID : e8072e3e-592f-49aa-8770-7b3c516b5525

9.3	Packing Identification Label to be provided on each packing case with the following details
9.3.1	Individual serial number
9.3.2	Purchaser's name
9.3.3	PO number (along with SAP item code, if any) & date
9.3.4	Equipment Tag no. (if any)
9.3.5	Destination
9.3.6	Project Details
9.3.7	Manufacturer / Supplier's name
9.3.8	Address of Manufacturer / Supplier / it's agent
9.3.9	Description and Quantity
9.3.10	Country of origin
9.3.11	Month & year of Manufacturing
9.3.12	Case measurements
9.3.13	Gross and net weights in kilograms
9.3.14	All necessary slinging and stacking instructions

10.0 SHIPPING

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

11.0 HANDLING AND STORAGE

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

DocUUID : e8072e3e-592f-49aa-8770-7b3c516b5525

Technical Specification

For

Fire Retardant Coating on Cables

Specification no – BSES-TS-88-FRCC-R0

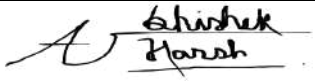
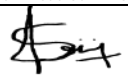
Rev:		0
Page		1 of 8
Date:		06 May 2022
Prepared by	Abhishek Harsh	 3267d7c3-82b5-46cb-b5a6-867ee7820a34
Reviewed by	Srinivas Gopu	 5d32525e-ed3a-4f41-b1c7-b8a5e77d1519
Approved by	Gaurav Sharma	 23dc2de2-95de-4472-99a7-dea873f472b6

TABLE OF CONTENT

DocUUID : cd001bd0-2887-4154-9da5-199811202a68

1.0 SCOPE

- This specification covers the design, manufacture, testing, supply, erection & commissioning of Fire retardant coating on cables and its accessories.

2.0 CODES & STANDARDS

- Material, equipment and methods used in the manufacturing of fire retardant coating on cables shall confirm to the latest edition of following standard

Standard Name / No	Standard's Description
Indian Electricity Act	Latest Edition
CBIP manual	Latest Edition
IEC 60331-11	Tests for electric cables under fire conditions – Circuit integrity – Part 11: Apparatus – Fire alone at a flame temperature of at least 750 degree C
IEEE 383	IEEE Standard for Qualifying Electric Cables and Splices for Nuclear Facilities
IEC 60754-1	Test on gases evolved during combustion of materials from cables
ASTM D2843	Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics
ASTM D2863	Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)

3.0 SERVICE CONDITIONS

3.1	Max Ambient Temperature	50 deg C
3.2	Max Daily average ambient temp	40 deg C
3.3	Min Ambient Temp	0 deg C
3.4	Maximum Humidity	95%
3.5	Minimum Humidity	10%
3.6	Maximum annual rainfall	750 mm
3.7	Average no of rainy days per annum	60
3.8	Rainy months	June to Oct
3.9	Altitude above MSL	300 M
3.10	Seismic Zone	IV

DocUUID : cd001bd0-2887-4154-9da5-199811202a68

4.0 GENERAL FEATURES

4.1	Base Type	Water based Intumescent coating
4.2	Color	Off white
4.3	Density	1.3 ± 0.05 g/cc
4.4	Mix ratio by weight	Single component
4.5	Solids by weight	64 ± 2 %
4.6	ph	8
4.7	Toxicity	Non-toxic, asbestos and lead free
4.8	DFT	1.6 mm
4.9	Coverage	3.2kg±0.10 kg/m² @1.6mm DFT
4.10	Drying time	Surface dry in 30 mins
4.11	Functional Cure Time	48 hours
4.12	Application temperature	10-30^{0}C
4.13	Temperature endurance	>1100^{0}C
4.14	Application method	Brushing, Airless spraying
4.15	Fire Rating	2 Hours
4.16	Features	
4.16.1	Solvent free	Required
4.16.2	Eco friendly	Required
4.16.3	Free of any fibers including asbestos	Required
4.16.4	Single component, ready to apply/use	Required
4.16.5	Easy to apply using a paint brush/spray	Required
4.16.6	No de-rating effect on cables	Required
4.16.7	Added fire protection for existing cables	Required
4.16.8	Compatible with different sheathing chemistries of electrical cables	Required
4.17	Test	
4.17.1	Fire Resistance/Circuit Integrity	As per IEC 60331-11
4.17.2	Flame Retardance	As per IEEE 383
4.17.3	Flammability	As per IS 10810 (P-53)
4.17.4	HCL	As per IEC 60754-1
4.17.5	Smoke density	As per ASTM D2843
4.17.6	Limiting oxygen index	As per ASTM D2863
4.18	Make	Stanvac/3M/Demech

- Note- Any make other than specified in table above shall be subject to BSES Approval.

5.0 DEVIATIONS

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

6.0 QUALITY, INSPECTION & TESTING

6.1	Vendor quality plan	To be submitted for purchaser approval
6.2	Inspection points	To be mutually identified & agreed in quality plan
6.3	Type test	Equipment shall be type tested from CPRI/ERDA/NABL accreted lab as per IEC/IS/UL standard.
6.4	Routine test	As per relevant standard
6.5	Acceptance test	To be performed in presence of Owner at manufacturer works shall be as per approved QAP

7.0 GTP

Vendor must submit clause wise compliance against specification at the time of drawing approval.

8.0 DRAWING AND DATA SUBMISSION MATRIX

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
8.1	Contact Person Name, Email ID and Mobile Number	Required	Required		
8.2	Deviation Sheet (as per “Deviations” Clause)	Required			
8.3	GTP	Required	Required		
8.4	Relevant Type Test as per IS/IEC/UL	Required	Required		

DocUUID : cd001bd0-2887-4154-9da5-199811202a68

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
8.5	Manufacturer's quality assurance plan and certification for quality standards		Required		
8.6	Sizing Calculation of Associated Equipment		Required		
8.7	Recommended Spares for five years of operation)		Required		
8.8	Drawings	Required	Required		
8.9	QAP		Required		
8.10	BOQ		Required		
8.11	Make of all Component as per specification		Required		
8.12	Installation, erection and commissioning manual		Required		
8.13	Inspection Reports			Required	
8.14	As manufacturing Drawings			Required	
8.15	Operation and Maintenance Manual			Required	
8.16	Trouble shooting manual			Required	
8.17	As built Drawings				Required

9.0 PACKING

9.1	Packing Protection	Against corrosion, dampness, heavy rains, breakage and vibration. During transportation/ transit and storage, module may be subjected to outdoor conditions. Hence, packing of each panel shall be weatherproof.
9.2	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection & identification Label

9.3	Packing Identification Label to be provided on each packing case with the following details
9.3.1	Individual serial number
9.3.2	Purchaser's name
9.3.3	PO number (along with SAP item code, if any) & date
9.3.4	Equipment Tag no. (if any)
9.3.5	Destination
9.3.6	Project Details
9.3.7	Manufacturer / Supplier's name
9.3.8	Address of Manufacturer / Supplier / it's agent
9.3.9	Description and Quantity
9.3.10	Country of origin
9.3.11	Month & year of Manufacturing
9.3.12	Case measurements
9.3.13	Gross and net weights in kilograms
9.3.14	All necessary slinging and stacking instructions

10.0 SHIPPING

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

11.0 HANDLING AND STORAGE

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

Technical Specification

For

415 V AC Distribution Board

Specification no – BSES-TS-70-ACDB-R0

Rev		0
Page		1 of 17
Date		05 May 2022
Prepared by	Jeena Borana	b8b1c444-d6e3-4459-b793-d46d1e00a2fc
	Abhishek Harsh	3267d7c3-82b5-46cb-b5a6-867ee7820a34
Reviewed by	Srinivas Gopu	5d32525e-ed3a-4f41-b1c7-b8a5e77d1519
Approved by	Gaurav Sharma	23dc2de2-95de-4472-99a7-dea873f472b6

INDEX

DocUUID : 418842ef-48e6-4373-8932-04bd42bceccc

1 SCOPE

This specification covers the design, engineering, manufacture, assembly and testing at manufacturer's works and supply of 415V AC Distribution board (ACDB)along with all hardware and accessories required for installation and operation.
Specification covers Type 1 and Type 2 ACDB. Type 1 ACDB is for Grid Substations while Type 2 ACDB is for BSES HT Customers.

2 STANDARDS & CODES

2.1	IS:8623	Specification for factory built assemblies of switchgear & control gear for voltages up to and including 1000V AC/1200 V DC.
2.2	IS 60947-1	Specification for Low-voltage Switchgear and Control gear - Part 2 : Circuit Breakers
2.3	IS:10118	Code of practice for selection, installation and maintenance switchgear and controlgear
2.4	IS:2705	Current Transformers
2.5	IS:3231	Electrical relays for power system protection
2.6	IS:1248	Electrical Indicating instruments
2.7	IS:4794	Switches and push buttons
2.8	IS:6005	Code of practice of phosphating iron and steel
2.9	IS:5082	Wrought Aluminum and aluminum alloys for electrical purposes
2.10	IS 3043	Code of practice for Earthing

3 SERVICE CONDITIONS

3.1	System Configuration	3 Phase 4 Wire with neutral solidly grounded
3.2	Supply Voltage	415 volt +/- 10%
3.3	Supply frequency	50Hz
3.4	Location	Indoor
3.5	Average grade atmosphere	Heavily polluted, Dry
3.6	Maximum altitude above sea level	1000M
3.7	Ambient air temperature	Highest 50Deg C Average 40Deg C
3.8	Minimum ambient air temperature	0 Deg C
3.9	Relative Humidity	100%
3.10	Rainfall	750mm concentrated in four months

DocUUID : 418842ef-48e6-4373-8932-04bd42bceccc

4 ACB CONFIGURATION

4.1 TYPE 1 ACDB CONFIGURATION

4.1.1	Incomers	a. Two incomers, each having Motorized 630A MCCB. MCCBs shall have microprocessor based over current and earth fault release. b. Auto changeover shall be provided between the two incomers c. Manual castle key interlock required between two incomers d. Castle key for Local /Remote operation
4.1.2	Outgoing feeders	a. The number of outgoing feeders from AC boards shall be such that each substation equipment is fed by separate feeder (refer below). b. Utilization category of MCBs shall be C.

	Application	Type of Switchgear	No of Poles	Rating (A)	Quantity
4.1.3	Transformer Oil filtration	MCB	4	200	2
4.1.4	Welding(Outdoor)	MCB	2	63	4
4.1.5	Power Socket(Indoor)	MCB	4	32	5
4.1.6	Outdoor Lighting	MCB	4	32	2
4.1.7	Indoor Lighting	MCB	4	32	2
4.1.8	Battery Charger	MCB	4	63	2
4.1.9	BMK	MCB	4	32	8
4.1.10	Marshalling Box(PTR)	MCB	4	32	3
4.1.11	AC Supply	MCB	4	32	2
4.1.12	UPS	MCB	2	16	1
4.1.13	11kV Switchgear	MCB	2	32	3
4.1.14	CRP	MCB	2	32	2
4.1.15	RTU/SCADA	MCB	2	16	2
4.1.16	Fire Fighting	MCB	2	16	2
4.1.17	EPAX	MCB	2	16	1

4.1.18	Power Socket (Outdoor)	MCB	2	16	4

4.2 TYPE 2 ACDB CONFIGURATION

4.2.1	Incomers	a. Two incomers, each having Motorized 400 A MCCB. b. Auto changeover shall be provided between the two incomers c. Manual castle key interlock required between two incomers d. Castle key for Local /Remote operation			
4.2.2	Outgoing feeders	a. The number of outgoing feeders from AC boards shall be such that each substation equipment is fed by separate feeder (refer below). b. Utilization category of MCBs shall be C.			
	Application	**Type of Switchgear**	**No of Poles**	**Rating (A)**	**Quantity**
4.2.3	Welding	MCB	2	63	1
4.2.4	Power Socket	MCB	4	32	3
4.2.5	Outdoor Lighting	MCB	4	16	2
4.2.6	Indoor Lighting	MCB	4	16	2
4.2.7	Battery Charger	MCB	4	32	2
4.2.8	AC Supply	MCB	4	32	2
4.2.9	Switchgear	MCB	2	32	2
4.2.10	RTU/SCADA	MCB	2	16	2
4.2.11	Fire Fighting	MCB	2	16	2

5 CONSTRUCTION

5.1	General construction	a. Board shall be of modular construction with provision for compartmentalization for Incomer and non-compartmentalization for outgoing feeders. b. It shall be free-standing type comprising dust-tight and vermin-proof sheet steel cabinets suitable for indoor installation with IP-54 degree of protection. c. Necessary busbar support insulators, cable glands, cable supports and terminal blocks etc. The board shall be of single front type.

DocUUID : 418842ef-48e6-4373-8932-04bd42bceccc

5.2	Material	The Board shall be made out of at least 2.5 mm thick cold rolled steel sheet (CRCA), suitably reinforced to provide flat level surfaces. No welds, rivets, hinges or bolts shall be visible from outside.
5.3	Equipment Mounting	a) All switches provided on the distribution board shall be on front side of the cabinets, operable from outside. b) All MCBs shall be flush mounted operable from front side of ACDB. c) All instruments and control devices shall be mounted on the front of cabinets and fully wired to the terminal blocks.
5.4	Operating Height	$\leq$ 1.6 meter
5.5	Busbar housing	a) The busbars shall be housed in totally enclosed busbar chambers. b) Incoming connections from the busbar to various feeders shall be designed so as not to disturb cable connections. c) Busbar arrangement should ensure safety of the operation/maintenance personnel and facilitate working on any outgoing module without the need for switching off in-feed to the adjacent modules, as far as possible
5.6	Outgoing Cable Termination	For Outgoing cable termination, vertical arrangement of Terminal Blocks shall be provided with ratings in descending order.
5.7	Cable glands	Compression type cable glands shall be provided to hold the cables to avoid any pressure or tension on the terminal block connections.
5.8	Gland Plate	Gland plate shall be 3.0mm thick with metallic knockout punches
5.9	Doors	a) The doors of cable cabinets shall be lockable hinged type b) Doors shall be fitted with double lipped gaskets. c) Bus bar side shall have bolted doors.
5.10	Drawing Pocket	Shall be Provided to keep “As Built Drawings”

DocUUID : 418842ef-48e6-4373-8932-04bd42bceccc

6 BUSBAR

6.1	Material	Busbar shall be of aluminum.
6.2	Size (phase and neutral)	a) Main busbar - 80x10 sqmm for Type 1 ACDB b) Main busbar – 50X10 sqmm for Type 2 ACDB c) Busbar dropper size Incomers - MCCB-80x10 sqmm for Type 1 ACDB d) Busbar dropper size Incomers - MCCB-50x10 sqmm for Type 2 ACDB
6.3	Supports	The busbar shall be supported by means of durable non-hygroscopic, non-combustible and non-tracking polyester fiberglass material or porcelain. Supports shall be capable of withstanding the maximum short circuit stresses
6.4	Sleeves and shrouds	Busbars shall be encased in heat-shrinkable sleeves of insulating material which shall be suitable for the operating temperature of busbars during normal service. The busbar joints shall be provided with removable thermosetting plastic shrouds.

7 MCCB

7.1	MCCB type	4 pole
7.2	MCCB design ambient temperature	50deg C
7.3	MCCB Housing	Thermoplastic material resistant to fire & abnormal heat , non hygroscopic
7.4	MCCB Terminal	Silver coated copper with phase barriers, spreader terminals & shrouds
7.5	De-rating at 50Deg ambient temperature	No derarting (0%)
7.6	MCCB rated 3 phase short circuit breaking capacity Ics = Icu	36kA minimum at 415v and 50Hz
7.7	MCCB rated 3 phase short circuit withstand capacity, Icw	8kA for 1sec
7.8	MCCB SC making current capacity	75kA peak
7.9	MCCB rated insulation level	1000V
7.10	MCCB mechanical & electrical endurance	As per IS 13947 / IEC
7.11	MCCB utilization category	B as per IS / IEC 947
7.12	MCCB indications	ON, OFF & TRIP
7.13	MCCB protection	MCCBs shall have microprocessor based over current and earth fault release.

DocUUID : 418842ef-48e6-4373-8932-04bd42bceccc

7.14	Tripping characteristic required	
7.14.1	Overload setting	Range 60-100%In (Set on 95%)
7.14.2	Short Circuit setting	Range 200-1200%In (Set on 300%)
7.14.3	Earth fault setting	To be provided
7.15	MCCB Clearances in air	As per table XIII of IS 13947-1
7.16	MCCB temperature rise limits	As per table 2 & 3 of IS 13947-1
7.17	MCCB Ingress Protection	IP2X Minimum (pollution degree minimum 2)
7.18	MCCB additional features	Sealing/padlocking of operating knob in OFF position Sealing/padlocking of operating knob in OFF position isolation suitable with positive contact

8 CURRENT TRANSFORMER

8.1	Type	Cast-resin type, Class-E insulation, rated for 120% current continuous
8.2	Provision	Shall be provided in incomer for metering. Separate Neutral CT shall be connected in the neutral for detecting earth fault for both the incomer.
8.3	Secondary current	5A
8.4	Metering CT Class	1.0
8.5	Burden	Based on requirement

9 TERMINALS AND WIRING

9.1	Secondary Wiring	
9.1.1	Grade and type	1100 V grade, PVC insulated, FRLS type stranded flexible copper wire.
9.1.2	Ferruling	Each wire shall bear an identifying ferrule or tag at each end or connecting point.
9.1.3	Size	Appropriate size copper based on rated current and application subject to a minimum of 2.5sqmm copper
9.2	Terminals	Terminals of appropriate size shall be provided inside each cabinet for incoming and outgoing cables.
9.2.1	Grade	1100 V grade, molded piece terminals complete with insulated barriers, washers, nuts and lock nuts.
9.2.2	Power Terminals type	Stud type, nut driver operated

9.2.3	Control terminals type	Stud type, screw driver operated suitable for minimum 6sqmm wire.
9.2.4	Spare terminals	20% spare terminals should be provided in each terminal block.
9.2.5	Accessibility	Placement of terminals shall enable proper cable termination. Terminals shall be readily accessible for inspection and maintenance.
9.2.6	Marking	The terminals shall be serially numbered to facilitate installation and maintenance.
9.3	Cable troughs	Shall be provided for wiring of each terminal block with 50% spare capacity

10 METERS, INDICATIONS AND PUSH BUTTONS

10.1	Meters	
10.1.1	Multifunction Meter	For incomer feeders. Meter should have facility to store peak load current in memory.
10.1.2	Type	Digital with inbuilt phase selector
10.1.3	Communication Protocol	RS485 on MODBUS
10.1.4	Accuracy Class	1.0
10.1.5	Auxiliary supply	240VAC with 10% tolerance
10.2	Indicating lamps	Indicating lamps shall be of low wattage cluster LED type.
10.2.1	Incomer/ Outgoing On	Red
10.2.2	Incomer/ Outgoing Off	Green
10.2.3	Incomer/ Outgoing Trip	Amber
10.3	Push buttons	For manual operation of incomer

11 NAME PLATES & MARKINGS

11.1	Panel nameplate	Panel shall have a nameplate clearly indicating the following: a) Manufacturer's Name & Country: b) Panel Serial No.: c) Customer Name: BSES Yamuna / Rajdhani Power Ltd d) PO No. & date: e) Type of Panel: f) Current rating: g) Rated Voltage and Frequency: h) Month and year or Manufacture: MM/YYYY i) Guarantee period:

11.2	Feeder nameplate	Large and bold name plate carrying the feeder identification shall be provided on the top of each module. Blank insert type name plates shall be provided on each outgoing feeder.
11.3	Equipment nameplate	a) All equipment mounted on front side as well as equipment mounted inside the panels shall be provided with individual name plates with equipment designation engraved. b) All front mounted equipment shall also be provided at the rear with individual name plates engraved with tag numbers corresponding to the one shown in the panel internal wiring to facilitate easy tracing of the wiring.
11.4	Danger plate	Panel shall have a danger plate of anodized aluminum clearly indicating the danger logo and voltage details.
11.5	Material	Non-rusting metal or 3 ply lamicoid. Nameplates shall be black with white engraving lettering. Stickers are not allowed.
11.6	Fixing	All nameplates/rating plates shall be riveted to the panels at all four corners. Bolting/screwing is not acceptable.
11.7	Markings	Each switch shall bear clear inscription identifying its function. Similar inscription shall also be provided on each device whose function is not otherwise identified. If any switch or device does not bear this inscription separate nameplate giving its function shall be provided for it. Switch shall also have clear inscription for each position indicating e.g. Trip-Neutral close, ON-OFF etc.

12 FINISHING

12.1	Primer	Two coats
12.2	Finish	Powder Coating
12.3	Colour shade	RAL 7032 (Siemens Grey)
12.4	Paint thickness	70 microns (minimum)

13 APPROVED MAKE OF COMPONENTS

13.1	Switch	Siemens / L&T (Salzer)
13.2	HRC Fuse Links	GE/ Siemens/ L&T
13.3	Meters	Rishabh/Schneider/AE
13.4	AC Contractors	L&T/Siemens/Telemechanique/GE/ABB
13.5	Terminals	Connectwell/Elmex/Wago/Phoenix
13.6	Push buttons / Actuator	L&T/Siemens/Vaishno/Schneider
13.7	MCCB	L&T/Siemens/ ABB/GE/Schneider
13.8	MCB	Datar/Legrand/Hager/Schneider/ABB
13.9	Indicating lamps	Vaishno/Binay/Teknic/Siemens/Mimic/C&S

DocUUID : 418842ef-48e6-4373-8932-04bd42bceccc

14 QUALITY ASSURANCE PLAN, INSPECTION AND TESTING

S No.	Parameters	Technical Requirements
14.1	Quality Assurance Plan	QAP Shall be submitted by vendor for approval. Inspection and testing of the material shall be carried out accordingly.
14.2	Type test	Equipment should be of type tested quality only, type test certificate to be submitted along with offer. Test reports from CPRI/ERDA accredited laboratory only acceptable.
14.3	Routine /Acceptance test	As per relevant Indian standard
14.4	Inspection	a) The buyer reserves the right to inspect equipment at the Seller's works at any time prior dispatch, to verify compliance with the specifications. b) In-process and final inspection call intimation shall be given in 15 days advance to purchaser. c) In the event of any discrepancy in the test reports i.e. test reports not acceptable or any type tests (including special /additional tests, if any) not carried out, same shall be carried out without any cost implication to BSES before dispatch of equipment.
14.5	Test certificates	Test certificates (routine and acceptance) shall be submitted along with the dispatch documents.

15 PACKING, SHIPPING, HANDLING & SITE SUPPORT

15.1	Packing Protection	The packing shall be fit to withstand rough handling during transit and storage at destination. The test set should be properly protected against corrosion, dampness & damage.
15.2	Packing for accessories and spares	Robust non-returnable packing case with all the above protection & identification Label. The bidder should get the packing list approved before dispatching the material.
15.3	Packing Identification Label	On each packing case, following details are required: a) Individual serial number b) Purchaser's name c) PO number (along with SAP item code, if any) & date d) Equipment Tag no. (if any) e) Destination f) Manufacturer / Supplier's name g) Address of Manufacturer / Supplier / it's agent h) Description i) Country of origin j) Month & year of Manufacturing

		k) Case measurements l) Gross and net weight m) 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	Manufacturer instruction shall be followed.
15.6	Detail handling & storage instruction sheet / manual to be furnished before commencement of supply.	

16 DEVIATIONS

16.1	Deviation	Deviations from this Specification shall be stated in writing with the tender by reference to the Specification clause/GTP/Drawing and a description of the alternative offer. In absence of such a statement, it will be assumed that the bidder complies fully with this specification. No deviation will be acceptable post order.

17 DOCUMENT SUBMISSION MATRIX

Drawing submission shall be as per the matrix given below.

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

S No.	Documents to be submitted	Bid	Approval	Pre Dispatch
17.1	Guaranteed Technical Particulars (GTP)	Required	Required	
17.2	Deviation Sheet, if any	Required	Required	
17.3	GA drawing, SLD, Wiring Diagram	Required	Required	

DocUUID : 418842ef-48e6-4373-8932-04bd42bceccc

S No.	Documents to be submitted	Bid	Approval	Pre Dispatch
17.4	Type test reports(not more than 5 years old) from CPRI/ERDA	Required	Required	
17.5	Reference List of major customers using the offered product from last 5 years	Required		
17.6	Performance certificates executed in last 5 years			
17.7	Make of Raw Materials	Required	Required	
17.8	Manufacturer's Quality Assurance Plan		Required	
17.9	Complete product catalogue and Manual		Required	Required
17.10	Test certificates of all raw materials			Required
17.11	Inspection and routine test reports, carried out in manufacturer's works			Required

DocUUID : 418842ef-48e6-4373-8932-04bd42bceccc

ANNEXURE A GUARANTEED TECHNICAL PARTICULARS

S. No.	Description	Specification requirement	Vendor Data
1.0	**GENERAL FEATURES**		
1.1	Make		
1.2	Type		
1.3	Reference Standard		
1.4	Rated Operational voltage	415V AC ± 10%	
1.5	Rated Nominal Current	630A	
1.6	Rated frequency	50 Hz (+3%, -5%)	
1.7	Rated Insulation voltage	1100V	
1.8	Rated Impulse withstand voltage	8kV	
1.9	Service supply for heating, lighting and power sockets	240VAC±10%,	
1.10	Mounting	Floor (Free standing)	
1.11	Connections	Cable entry – Bottom	
1.12	Configuration	Single front	
1.13	Enclosure thickness		
1.13.1	Load Bearing Member	>=2.5mm	
1.13.2	Doors and Covers	>=2 mm	
1.14	Enclosure Material	CRCA Sheet/GI	
1.15	Enclosure degree of protection	IP 54	
1.16	Mechanical safety interlocks	As specified in technical specification	
1.17	Incomer Power Cable Termination	2Rx4Cx300sqmm	
	Outgoing Cable Termination	a) 200A MCB- 4Cx150sqmm b) 63A MCB- 4Cx50sqmm c) 32A MCB- 4Cx25 sqmm d) 16A MCB- 2Cx10 sqmm	
	Cable Termination Type	From Bottom of Panel	
	Clearance	150 mm clearance to be maintained from the bottom of the TB and the gland plate	
1.18	Paint shade	RAL 7032 (Siemens Grey)	
1.19	Typical vertical section (Overall dimension (mm) and weight (Kg))	Required	
1.19.1	Incomer		
1.19.2	Outgoings		
1.20	Dimensions of the ACDB Panel	L (mm) X D (mm) X H (mm)	

S. No.	Description	Specification requirement	Vendor Data
1.21	Weights of the ACDB Panel	(in kg.)	
1.22	Marking on the panel	As per the specification	
2.0	**INCOMER MCCB**		
2.1	Make & Model of MCCB	Required	
2.2	Catalogue of MCCB	Required	
2.3	Continuous Current at 40 deg C/ 50 deg C	630A	
2.4	Rated ultimate breaking capacity at rated voltage	50kA	
2.5	Rated service breaking capacity Ics	Ics = 100% Icu at rated voltage	
2.6	Rated making current	Icm = 220% Icu	
2.7	Utilization Category	A	
2.8	Overload setting	50 -100% (Inverse time characteristics)	
2.9	Overcurrent setting	200-1000% (Instantaneous characteristics)	
2.10	Earthfault setting	20-100% (Instantaneous)	
2.11	Dimension(HxWxD)	Required	
2.12	Weight	Required	
3.0	**BUS AND BUS TAPS**		
3.1	Make		
3.2	Material and grade of buses and joints	High conductivity electrolytic grade aluminum	
3.3	Reference standard		
3.4	Continuous Current (at site condition, 50°C ambient) within cubicle	630A	
3.5	Cross sectional Area		
3.6	DC resistance	ohm/m/ph	
3.7	Skin-effect ratio		
3.8	Reactance	ohm/m/ph	
3.9	Losses-middle phase	w/m/ph	
3.10	Minimum clearance of bus bar and joints	Required	
3.10.1	Phase to phase (mm)		
3.10.2	Phase to earth (mm)		
3.11	Bus bar insulation	a. Heat shrinkable sleeves rated for maximum operating voltage b. Cast resin shrouds for joint	

DocUUID : 418842ef-48e6-4373-8932-04bd42bceccc

S. No.	Description	Specification requirement	Vendor Data
3.12	Bus joints	Silver	
3.13	Bus bar support insulator	Required	
3.13.1	Spacing (mm)		
3.13.2	Make		
3.13.3	Type		
3.13.4	Reference standard		
3.13.5	Voltage class (kV)		
3.13.6	Minimum creepage distance (mm)		
3.13.7	Cantilever strength (Kg/sq.cm.)		
4.0	**CURRENT TRANSFORMER**		
4.1	Make		
4.2	Type	Resin Cast	
4.3	Reference standard		
4.4	CT ratios		
4.5	Class of Insulation	Class-E	
4.6	Protection class	5P20	
4.7	Metering class	5	
4.8	VA burden for Relaying CT-Incomer	Based on requirement.	
5.0	**AMMETERS/MULTIFUNCTION METERS AND VOLTMETERS**		
5.1	Make & Model no.		
5.2	Type	Digital with inbuilt phase selector	
5.3	Communication Protocol	RS485 on MODBUS	
5.4	Accuracy class	1	
6.0	**CONTROL & INDICATIONS**		
6.1	Push button		
6.1.1	Make and model no.		
6.1.2	Type	Flush mounted type with touch proof terminals	
6.2	LEDs		
6.2.1	Make & Model no.		
6.2.2	Type	Flush mounted type with touch proof terminals	
7.0	**TERMINAL BLOCKS**		
7.1	Make & Model no.		
7.2	Spare terminals	Equal to 20% of active terminals in each TB	
7.3	Power terminals	Stud type, screw driver operated	

S. No.	Description	Specification requirement	Vendor Data
7.4	Control terminals	Stud type, screw driver operated suitable for minimum 6sqmm wire.	
8.0	**TESTS**		
8.1	Confirmation of routine tests to be performed as per IS 60947	Yes/No	
8.2	IP 55 test shall be carried out during inspection	Yes/No	
8.3	Confirmation of Type tests to be performed (or report submitted) as per IS 60947	Type test report no./date	
8.4	Confirmation of Acceptance tests to be performed during inspectionas per IS 60947	Yes/No	
8.5	Temperature rise test to be carried out at NABL accredited lab.	Yes/No	
9.0	Deviation sheet against each clause of the specification	To be submitted	

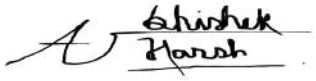
DocUUID : 418842ef-48e6-4373-8932-04bd42bceccc

Technical Specification

Of

Direct Current Distribution Board

Specification no – BSES-TS-71-DCDB-R0

Rev:		0
Pages:		1 of 16
Date:		02 May 2022
Prepared by	Abhishek Harsh	 3267d7c3-82b5-46cb-b5a6-867ee7820a34
Reviewed by	Srinivas Gopu	 5d32525e-ed3a-4f41-b1c7-b8a5e77d1519
Approved by	Gaurav Sharma	 23dc2de2-95de-4472-99a7-dea873f472b6

INDEX

1 SCOPE

This specification covers the design, engineering, manufacture, assembly and testing at Manufacturer's works and supply of 220 VDC/50 VDC Distribution board (DCDB) along with all hardware and accessories required for installation and operation.
Specification covers Type 1 and Type 2 DCDB. Type 1 DCDB is for Grid Substations while Type 2 DCDB is for BSES HT Customers.

2 STANDARDS AND CODES

2.1	IS:8623	Specification for factory built assemblies of switchgear & control gear for voltages up to and including 1000V AC/1200 V DC.
2.2	IS 60947-1	Specification for Low-voltage Switchgear and Controlgear - Part 2 :Circuit Breakers
2.3	IS:10118	Code of practice for selection, installation and maintenance switchgear and control gear
2.4	IS:2705	Current transformers
2.5	IS:3231	Electrical relays for power system protection
2.6	IS:1248	Electrical Indicating instruments
2.7	IS:4794	Switches and push buttons
2.8	IS:6005	Code of practice of phosphating iron and steel
2.9	IS:5082	Wrought Aluminium and aluminum alloys for electrical purposes
2.10	IS 3043	Code of practice for Earthing

3 SERVICE CONDITION

3.1	Location	Indoor
3.2	Average grade atmosphere	Heavily polluted, Dry
3.3	Maximum altitude above sea level	1000M
3.4	Ambient air temperature	Highest 50Deg C Average 40Deg C
3.5	Minimum ambient air temperature	0 Deg C
3.6	Relative Humidity	100%

DocUUID : f95933cb-c64c-4d46-b917-21c1b07d42ba

3.7	Rainfall	750mm concentrated in four months
3.8	Seismic Zone	IV

4 CONSTRUCTION

4.1	General construction	It shall be free-standing type comprising dust-tight and vermin-proof sheet steel cabinets suitable for indoor installation with IP-54 degree of protection. Necessary busbar support insulators, cable glands, cable supports and terminal blocks etc. The board shall preferably be of single front type.
4.2	Material	The Board shall be made cold rolled steel sheet having Thickness of 2.5 mm of load bearing member and 2 mm for Doors and covers , suitably reinforced to provide flat level surfaces. No welds, rivets, hinges or bolts shall be visible from outside.
4.3	Equipment Mounting	All switches provided on the distribution board shall be on front side of the cabinets, operable from outside. All instruments and control devices shall be mounted on the front of cabinets and fully wired to the terminal blocks.
4.4	Busbar housing	The busbars shall be housed in totally enclosed busbar chambers. Incoming connections from the busbar to various feeders shall be designed so as not to disturb cable connections. Busbar arrangement should ensure safety of the operation/maintenance personnel and facilitate working on any outgoing module without the need for switching off in-feed to the adjacent modules, as far as possible
4.5	Cable alleys	A cable alley preferably 230 mm wide shall be provided in each vertical section for taking cables into the compartments. Cable alleys shall be provided on sides of busbar chamber.
4.6	Cable entry	Cable entry should be from bottom
4.7	Cable glands	Compression type cable glands shall be provided to hold the cables to avoid any pressure or tension on the terminal block connections.
4.8	Gland Plate	Gland plate shall be 3.0mm thick.
4.9	Doors	The doors of cabinets shall be lockable and shall be fitted with double lipped gaskets.
4.10	Gasket	All doors, removable covers and panels shall be gasketed all around with neoprene gaskets. Gaskets shall be embedded through machine only.
4.11	Ventilating louvers	Ventilating louvers shall have screens and filters. The screens shall be made of either brass or GI wires mesh.

DocUUID : f95933cb-c64c-4d46-b917-21c1b07d42ba

4.12	Foundation	The panels shall be fixed on the embedded foundation channels with intervening layers anti vibration strips made of shock absorbing materials.
4.13	Base Frame	Base frames shall be supplied along with panels. 100mm channel painted black.
4.14	Mounting	Equipment on front of panel shall be flush mounted. No equipment shall be mounted on the doors.
4.15	Working level	The center lines of switches, push buttons and indicating lamps shall not be less than 750mm and higher than 1600mm from panel base.
4.16	Dimension	500(L)X500(D)X1800(H) mm^3

5 CONFIGURATION

5.1	Incomers	One incomers having Double Pole DC MCB with Aux Switch.
5.2	Outgoing feeders	All outgoing feeders shall have MCB. Number of outgoing feeders shall be as per table attached

Application	No of Poles	Type-1		Type-2	
		Rating of MCB (In Amp)	Quantity	Rating of MCB (In Amp)	Quantity
Incomer	2	100	1	50	1
Emergency Lighting DB	2	32	1	16	1
Fire Alarm System	2	32	1	16	0
SCADA	2	32	2	16	1
CRP/33 kV/66 kV Switchgear	2	32	4	16	1
11 kV Switchgear	2	32	4	16	0
Testing Purpose	2	32	1	16	1
NIFPS	2	32	4	16	0
Spare 1	2	100	1	50	1
Spare 2	2	32	4	16	2

DocUUID : f95933cb-c64c-4d46-b917-21c1b07d42ba

6 BUSBARS

6.1	Material	Busbar shall be of tinned electrolytic copper or Aluminium
6.2	Size	Suitable for carrying the rated continuous current of 100 A and short circuit current of 15 kA. Busbars shall be continuous throughout the panel. Temperature rise should be limited to 40 degrees over ambient.
6.3	Supports	The busbar shall be supported by means of durable non-hygroscopic, non-combustible and non-tracking polyester fiberglass material or porcelain. Supports shall be capable of withstanding the maximum short circuit stresses.
6.4	Sleeves and shrouds	Busbars shall be encased in heat-shrinkable sleeves of insulating material which shall be suitable for the operating temperature of busbars during normal service. The busbar joints shall be provided with removable thermosetting plastic shrouds.

7 TERMINALS AND WIRING

7.1	Wiring	
7.1.1	Grade and type	1100 V grade, PVC insulated, FRLS type stranded flexible copper wire.
7.1.2	Ferruling	Each wire shall bear an identifying ferrule or tag at each end or connecting point.
7.1.3	Spare	20% Spare Wiring
7.2	Terminals	Terminals of appropriate size shall be provided inside each cabinet for incoming and outgoing cables.
7.2.1	Grade	1100 V grade, moulded piece terminals complete with insulated barriers, washers, nuts and lock nuts.
7.2.2	Power Terminals type	Stud type, nut driver operated
7.2.3	Control terminals type	Stud type, screw driver operated
7.2.4	Spare terminals	20% spare terminals should be provided in each terminal block.
7.2.5	Accessibility	Placement of terminals shall enable proper cable termination. Terminals shall be readily accessible for inspection and maintenance.
7.2.6	Marking	The terminals shall be serially numbered to facilitate installation and maintenance.

DocUUID : f95933cb-c64c-4d46-b917-21c1b07d42ba

8 METERS, INDICATIONS, PUSH BUTTONS & HEATERS

8.1	Meters	
8.1.1	Ammeter	DC Moving coil ammeter of size 96 sq.mm. with external shunt. Rating of Ammeter shall be 0-100A DC.
8.1.2	Voltmeter	DC Moving coil voltmeter of size 96.sq.mm to read the DC Bus voltage. Rating of Voltmeter shall be 0-300VDC
8.1.3	Type	Digital type, connected through instruments transformers of suitable rating.
8.2	Indicating lamps	Indicating lamps shall be of low wattage cluster LED type.
8.2.1	Incomer/ Outgoing On	Red
8.2.2	Incomer/ Outgoing Off	Green
8.2.3	Incomer/ Outgoing Trip	Amber
8.3	Push buttons	For manual operation of incomer MCB
8.4	Heaters	Cubicle space heater having rating of 100W. Thermostat for space heater shall be provided with temperature range $0\text{-}90^0$
8.5	CFL	Cubicle lamp shall be provided in DCDB having rating of 11 W.

9 NAME PLATES & MARKINGS

9.1	Panel nameplate	Panel shall have a nameplate clearly indicating the following: a. Panel Serial No.- b. Customer Name - BSES Yamuna/Rajdhani Power Ltd c. PO No. & date - d. Type of Panel - e. Current rating - f. Guarantee period -
9.2	Feeder nameplate	Large and bold name plate carrying the feeder identification shall be provided on the top.
9.3	Equipment nameplate	a. All equipment mounted on front side as well as equipment mounted inside the panels shall be provided with individual name plates with equipment designation engraved. b. All front mounted equipment shall be also provided at the rear with individual name plates engraved with tag numbers corresponding to the one shown in the

DocUUID : f95933cb-c64c-4d46-b917-21c1b07d42ba

		panel internal wiring to facilitate easy tracing of the wiring.
9.4	Material	Non-rusting metal or 3 ply lamicoid. Nameplates shall be black with white engraving lettering. Stickers are not allowed.
9.5	Fixing	All nameplates/rating plates shall be riveted to the panels at all four corners. Bolting/screwing is not acceptable.
9.6	Markings	Each switch shall bear clear inscription identifying its function. Similar inscription shall also be provided on each device whose function is not other wise identified. If any switch or device does not bear this inscription separate nameplate giving its function shall be provided for it. Switch shall also have clear inscription for each position indicating e.g. Trip-Neutral close, ON-OFF etc.

10 FINISH

10.1	Primer	Two coats
10.2	Paint	Two finishing coats of epoxy based paint of Shade RAL 7032 with glossy finish.
10.3	Paint thickness	50 microns (minimum)

11 APPROVED MAKES OF COMPONENTS

11.1	Switch	Siemens / L&T (Salzer)
11.2	HRC Fuse Links	GE/ Siemens/ L&T
11.3	Meters	Rishabh/Schneider/AE
11.4	Terminals	Connectwell/Elmex/Wago/Phoenix
11.5	Push buttons / Actuator	L&T/Siemens/Vaishno/Schneider
11.6	MCB	Datar/Legrand/Hager/Schneider/ABB
11.7	Indicating lamps	Vaishno/Binay/Teknic/Siemens/Mimic/C&S

DocUUID : f95933cb-c64c-4d46-b917-21c1b07d42ba

12 INSPECTION AND TESTING

12.1	Type test	Equipment should be of type tested quality only, type test certificate to be submitted along with offer. If the manufacturer's lab is accredited by govt. / authorized body then it shall be acceptable for type testing.
12.2	Acceptance & Routine tests	As per relevant Indian standard

13 PACKING, SHIPPING, HANDLING AND SITE SUPPORT

13.1	Packing Protection	The packing shall be fit to withstand rough handling during transit and storage at destination. The test set should be properly protected against corrosion, dampness & damage.
13.2	Packing for accessories and spares	Robust non-returnable packing case with all the above protection & identification Label. The bidder should get the packing list approved before dispatching the material.
13.3	Packing Identification Label	On each packing case, following details are required:
13.3.1	Individual serial number	
13.3.2	Purchaser's name	
13.3.3	PO number (along with SAP item code, if any) & date	
13.3.4	Equipment Tag no. (if any)	
13.3.5	Destination	
13.3.6	Manufacturer / Supplier's name	
13.3.7	Address of Manufacturer / Supplier / it's agent	
13.3.8	Description	
13.3.9	Country of origin	
13.3.10	Month & year of Manufacturing	
13.3.11	Case measurements	
13.3.12	Gross and net weight	

DocUUID : f95933cb-c64c-4d46-b917-21c1b07d42ba

13.3.13	All necessary slinging and stacking instructions	
13.4	Shipping	The seller shall be responsible for all transit damage due to improper packing.
13.5	Handling and Storage	Manufacturer instruction shall be followed.
13.6	Detail handling & storage instruction sheet / manual to be furnished before commencement of supply.	

14 DEVIATIONS

14.1	Deviation	Deviations from this Specification shall be stated in writing with the tender by reference to the Specification clause/GTP/Drawing and a description of the alternative offer. In absence of such a statement, it will be assumed that the bidder complies fully with this specification. No deviation will be acceptable post order.

15 DOCUMENT SUBMISSION

Drawing submission shall be as per the matrix given below. All documents/ drawing shall be provided on A3/A4 sheet in box file with separators for each section. Also provide USB containing pdf with bid for soft copy. Language of the documents shall be English only. Deficient/ improper document/ drawing submission may liable for rejection

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
15.1	Contact Person Name, Email ID and Mobile Number	Required			
15.2	Deviation Sheet	Required	Required		
15.3	Type Test	Required			
15.4	Any Technological Advancement in DCDB	Required			
15.5	Manufacturer's quality assurance plan and certification for quality standards				
15.6	General Arrangement		Required		
15.7	Door Layout		Required		
15.8	Internal Layout		Required		

DocUUID : f95933cb-c64c-4d46-b917-21c1b07d42ba

15.9	SLD		Required		
15.10	Schematic Circuit diagram		Required		
15.11	Bus Bar Arrangement		Required		
15.12	Cable Alley Arrangement		Required		
15.13	GTP	Required	Required		
15.14	QAP		Required		
15.15	BOQ		Required		
15.16	Foundation diagram		Required		
15.17	TB Detail		Required		
15.18	Name Plate Detail		Required		
15.19	Make of all Component as per specification		Required		
15.20	Inspection Report			Required	
15.21	As manufacturing Drawings			Required	
15.22	Operation and Maintenance Manual			Required	Required
15.23	Trouble shooting manual			Required	Required
15.24	As built Drawings				Required
15.25	Test Report				Required

16 GUARANTEED TECHNICAL PARTICULARS

Vendor must submit clause wise compliance in Excel sheet against specification at the time of drawing approval clearly highlighting the deviations from specification against each clause.

S. No.	Description	Specification requirement	Bidder's Data
16.1	**GENERAL FEATURES**		
16.1.1	Make		
16.1.2	Type		
16.1.3	Reference Standard		
16.1.4	Rated Operational voltage	220 VDC/50 VDC	

DocUUID : f95933cb-c64c-4d46-b917-21c1b07d42ba

16.1.5	Rated Nominal Current	100	
16.1.6	Rated Insulation voltage	1100V	
16.1.7	Rated Impulse withstand voltage	8kV	
16.1.8	Service supply for heating, lighting and power sockets	240VAC±10%	
16.1.9	Mounting	Floor (Free standing)	
16.1.10	Connections	Cable entry – Bottom	
16.1.11	Configuration	Single front	
16.1.12	Enclosure thickness		
a	Load Bearing Member	>=2.5mm	
b	Doors and Covers	>=2 mm	
c	Gland Plate	3 mm	
16.1.13	Enclosure Material	CRCA Sheet	
16.1.14	Enclosure degree of protection	IP 54	
16.1.15	Power Cable Termination	Suitable for 4CX50 Sq.mm Al	
16.1.16	Paint shade	RAL 7032 (Siemens Grey)	
16.1.17	Typical vertical section (Overall dimension (mm) and weight (Kg))	Required	
16.1.18	Incomer		
16.1.19	Outgoings		
16.1.20	Dimensions of the DCDB Panel	500(L)X500(D)X1800(H) mm3	
16.1.21	Weights of the DCDB Panel	(in kg.)	
16.1.22	Marking on the panel	As per the specification	
16.1.23	Cable Alley Width	230 mm	
16.1.24	Cable Gland	Compression Type	
16.1.25	Gasket Material	Neoprene	

DocUUID : f95933cb-c64c-4d46-b917-21c1b07d42ba

16.1.26	Ventilating louvers	Required	
16.1.27	Base Frame	100mm channel	
16.2	**MCB**		
16.2.1	Make	**Datar/Legrand/Hager/Schneider/ABB**	
16.2.2	Incomer	100A/50 A	
16.2.3	Emergency Lighting DB	32A/16 A	
16.2.4	Fire Alarm System	32A/16 A	
16.2.5	SCADA	32A/16 A	
16.2.6	CRP	32A/16 A	
16.2.7	11 kV Switchgear	32A/16 A	
16.2.8	Testing Purpose	32A/16 A	
16.2.9	NIFPS	32A/16 A	
16.2.10	Spare 1	100A/50 A	
16.2.11	Spare 2	32A/16 A	
16.3	**BUS AND BUS TAPS**		
16.3.1	Make		
16.3.2	Material	Tinned electrolytic copper or Aluminum	
16.3.3	Reference standard		
16.3.4	Continuous Current (at site condition, 50°C ambient) within cubicle		
16.3.5	Short Circuit withstand Current for 1 sec	15 KA	
16.3.6	Cross sectional Area		
16.3.7	DC resistance	ohm/m/ph	
16.3.8	Reactance	ohm/m/ph	

DocUUID : f95933cb-c64c-4d46-b917-21c1b07d42ba

16.3.9	Losses-middle phase	w/m/ph	
16.3.10	Minimum clearance of bus bar and joints	Required	
16.3.11	Phase to phase (mm)		
16.3.12	Phase to earth (mm)		
16.3.13	Bus bar insulation	i. Heat shrinkable sleeves rated for maximum operating voltage	
		ii. Cast resin shrouds for joint	
16.3.14	Bus joints	Silver	
16.3.15	Bus bar support insulator	Required	
16.3.16	Spacing (mm)		
16.3.17	Make		
16.3.18	Type		
16.3.19	Reference standard		
16.3.20	Voltage class (kV)		
16.3.21	Minimum creepage distance (mm)		
16.3.22	Cantilever strength (Kg/sq.cm.)		
16.4	**Wiring and Terminals**		
16.4.1	**Wiring**		
a	Grade and type	1100 V grade, PVC insulated, FRLS type stranded flexible copper wire.	
b	Ferruling	Each wire shall bear an identifying ferrule or tag at each end or connecting point.	
c	Spare	20% Spare Wiring	
16.4.2	**Terminals**		
a	Grade	1100 V grade, moulded piece terminals complete with insulated barriers, washers, nuts and lock nuts.	
b	Power Terminals type	Stud type, nut driver operated	
c	Control terminals type	Stud type, screw driver operated	
d	Spare terminals	20% spare	

DocUUID : f95933cb-c64c-4d46-b917-21c1b07d42ba

e	Accessibility	Placement of terminals shall enable proper cable termination. Terminals shall be readily accessible for inspection and maintenance.	
f	Marking	The terminals shall be serially numbered to facilitate installation and maintenance.	
16.5	**METERS, INDICATIONS, PUSH BUTTONS & HEATERS**		
16.5.1	Ammeter	DC Moving coil ammeter of size 96 sq.mm. with external shunt. Rating of Ammeter shall be 0-100A DC.	
a	Model No Ammeter		
b	Make of Ammeter		
16.5.2	Voltmeter	DC Moving coil voltmeter of size 96.sq.mm to read the DC Bus voltage. Rating of Voltmeter shall be 0-300VDC	
a	Model No Voltmeter		
b	Make of Voltmeter	Rishabh/Schneider/AE	
c	Type	Digital type	
16.5.3	Indicating lamps	Cluster LED type.	
a	Make of Indicating lamps	Vaishno/Binay/Teknic/Siemens/Mimic/C &S	
b	Incomer/ Outgoing On	Red	
c	Incomer/ Outgoing Off	Green	
d	Incomer/ Outgoing Trip	Amber	
e	Push buttons Make	L&T/Siemens/Vaishno/Schneider	
16.5.4	Heaters	Cubicle space heater having rating of 100W. Thermostat for space heater shall be provided with temperature range $0\text{-}90^0$	
16.5.5	CFL	Cubicle lamp shall be provided in DCDB having rating of 11 W.	
16.6	**NAME PLATES & MARKINGS**		

DocUUID : f95933cb-c64c-4d46-b917-21c1b07d42ba

a	Panel nameplate	Panel Serial No.-	
b		Customer Name - BSES Yamuna/Rajdhani Power Ltd	
c		PO No. & date -	
d		Type of Panel -	
e		Current rating -	
f		Guarantee period -	
16.6.1	Feeder nameplate	As per Spec	
a	Equipment nameplate	As per Spec	
b	Material	As per Spec	
c	Fixing	As per Spec	
d	Markings	As per Spec	
16.7	**FINISH**		
a	Primer	Two coats	
b	Paint	Two finishing coats of epoxy based paint of Shade RAL 7032 with glossy finish.	
c	Paint thickness	50 microns (minimum)	

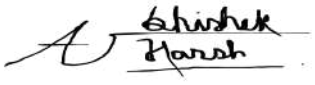
DocUUID : f95933cb-c64c-4d46-b917-21c1b07d42ba

Technical Specification

For

SMPS Based Battery Charger

Specification no – BSES-TS-73-SMPSBC-R0

Rev		0
Page		1 of 11
Date		05 May 2022
Prepared by	Abhishek Harsh	 3267d7c3-82b5-46cb-b5a6-867ee7820a34
Reviewed by	Srinivas Gopu	 5d325325e-ed3e-4f41-b1e7-b8a5e77d1519
Approved by	Gaurav Sharma	 23dc2de2-95de-4472-99a7-dea873f472b6

INDEX

DocUUID : af671952-6bf5-49da-8e80-1d8985636bb5

1 SCOPE OF SUPPLY

This specification covers the design, manufacturing, testing, supply, erection & commissioning of 20 VDC/ 50 VDC SMPS based 2X100% Float Cum Boost Charger at site for indoor installation with all necessary accessories associated with it.
Specification covers Type 1 and Type 2 Battery Charger. Type 1 Battery Charger is for Grid Substations while Type 2 Battery Charger is for BSES HT Customers.

.

2 CODES & STANDARDS

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

Indian Electricity Rules	
Indian electricity act	
CBIP manual	
IS 3895	Specification for rectifier equipment in general
IS 5921	Printed circuit boards
IS 6619	Safety code for semiconductor devices
IS 4540	Semiconductor rectifier assemblies and equipment
IS 694	PVC Insulated Cables for Working Voltage up to and including 1100V
IS 1248	Direct Acting Electrical indicating instruments
IS 2705	Current transformer
IS 3156	Voltage transformer
IS 3231	Electric relay for power system protection
IS 5578	Guide for making of insulated conductors
IS 8623	Low voltage switchgear and control gear assemblies
IS 13703	Low voltage fuses for voltages not exceeding 1000AC
IS 12063	Degree of enclosure protection
IS5	Color of mixed paints
IS 6297	Transformer & inductors for electronic equipment
IS 6553	Environment requirements for semiconductor device
IS 4007	Terminals for electronic equipment

3 SERVICE CONDITIONS

3.1	Max Ambient Temperature	50 deg C
3.2	Max Daily average ambient temp	40 deg C
3.3	Min Ambient Temp	0 deg C
3.4	Maximum Humidity	95%
3.5	Minimum Humidity	10%
3.6	Maximum annual rainfall	750 mm

DocUUID : af671952-6bf5-49da-8e80-1d8985636bb5

3.7	Average no of rainy days per annum	60
3.8	Rainy months	June to Oct
3.9	Altitude above MSL	300 M
3.10	Seismic Zone	IV

4 CHARGER DESIGN FEATURES

4.1	Type	SMPS Based
4.2	Rating	For Type-1 Battery Charger a. 70 A for 50 V b. 35 A for 220 V For Type-2 Battery Charger a. 35 A for 50 V b. 20 A for 220 V
4.3	Configuration	2X100% Float cum Boost Charger.
4.4	Incoming Supply	Provision of Two Incoming Supply with Auto Changeover Facility
4.5	Panel type	Metal enclosed frame construction
4.6	Overall Dimension	L - 1500 mm x D - 700 mm x H - 1900 mm
4.7	Cable Entry	Bottom
4.8	Location	Indoor, non air conditioned environment
4.9	Doors for front access	With anti theft hinge &handle
4.10	Cover for rear access	With Allen screw M6 size & handle
4.11	Construction	Sheet metal 2.0mm thick CRCA
4.12	Base frame	75mm ISMC
4.13	Lifting lugs	Four number
4.14	Gland plate	3mm metallic, un drilled & removable type
4.15	Enclosure protection	IP42 Minimum
4.16	Power terminal	Bus bar type, minimum 300mm above gland plate
4.17	Control terminal	Nylon66 with brass clamp
4.18	Bus bar	Tinned copper with insulation sleeve
4.19	Earth bus bar	Aluminum sized for rated fault duty for 1sec
4.20	Earth bus internal connection to all non current carrying metal parts	By copper flexible wire 2.5 sqmm
4.21	Earth bus external connection to owner earth	Al bus on both sides of panel with two holes for M10 bolt
4.22	Cooling	With Exhaust Fan
4.23	Panel heater	Thermostatically controlled through MCB
4.24	Panel internal wiring	Multi strand flexible color coded PVC insulated copper wire 1.5 sqmm 1100volt grade with 1.5 sqmm ferruling (other than circuit wiring related to PCB cards)
4.25	Isolation & protection device	Mounted at height minimum 1000mm from bottom
4.25.1	MCCB	For charger input, output & battery input

DocUUID : af671952-6bf5-49da-8e80-1d8985636bb5

4.25.2	Battery & test resistor load	Lockable change over switch with one position for charger, second for 'OFF' & third position for external test resistor.
4.26	Hardware (Nut, bolts & handle)	Stainless steel
4.27	Essential provision	Surge suppression, harmonic suppression, blocking diodes, filters for ripple control
4.28	Insulating shrouds	On all live parts, power semi conductors & electronic components
4.29	Ripple content in DC output	0.5 % maximum
4.30	DC output voltage regulation	Maximum ±1% of rating with AC input supply variation of ±10% from 415 volts, frequency variation of ±5% from 50 HZ and simultaneous load variation of 0-100%
4.31	Reverse polarity connection	Protected against reversed battery polarity
4.32	Charger efficiency	90% minimum at Rated Load
4.33	Noise output	65DB maximum
4.34	Charger selector switch	For auto/manual and float/boost selection, lockable type inside panel
4.35	Charging current settings	25% to 100% of rating
4.36	Charging current accuracy	2% of set current with input voltage variation of ±10% and frequency variation of ±5%
4.37	Auto and Manual DC output adjustment range for float & boost charge (voltage & current)	By potentiometers inside panel, range suitable for battery bank. Charger suitable for other type of batteries if offered, shall be subject to buyer's approval.
4.38	Louvers	With stainless steel wire mesh
4.39	Gasket	Neoprene rubber
4.40	Panel illumination lamp with door switch	MCB controlled, with 5/15amp switch socket
4.41	Panel door keys	4 no. per panel, identical key for all panels
4.42	PCBs for electronic circuitry	With protective layer finish at back
4.43	PCB soldering	Preferably by wave soldering process
4.44	PCB/ electronic card mounting	With press fit type locking arrangement
4.45	Semiconductor component mounting	Shall not be on bakelite sheet

5 METERING, ANNUNCIATION & INDICATION

5.1	Ammeter (96x96mm)	Digital type, for AC input, DC output & battery current. Auxiliary supply for meters should be 48V to 230V AC/DC (Universal type)
5.2	Voltmeter (96x96mm)	Digital type, with selector switch for AC input, DC output & battery voltage. Auxiliary supply for meters should be 48V to 230V AC/DC (Universal type)
5.3	LED indication on panel front	
5.3.1	Status	
5.3.1.1	Input AC supply available on	Red/yellow/blue color LED

DocUUID : af671952-6bf5-49da-8e80-1d8985636bb5

	R,Y & B phase	
5.3.1.2	Float cum Boost charger AC MCCB 'ON'	Red color LED for each charger module
5.3.1.3	Charger output DC 'ON'	Red color LED for each charger module
5.3.1.4	Outgoing DCDB feeder ON	Red color LED for each other
5.3.2	Fault	
5.3.2.1	DC earth fault	Amber color LED
5.3.2.2	Battery MCCB OFF	Amber color LED
5.3.2.3	Charger output DC under/ over voltage	Amber color LED
5.3.2.4	AC mains undervoltage	Amber color LED
5.4	Annunciation	Hooter with isolating switch for fault annunciation.
5.5	Potential free contacts for remote indication to be wired upto terminal block	a. AC under voltage b. AC over voltage c. CH-A AC MCCB trip/OFF d. CH-B AC MCCB trip/OFF e. CH-A Rect/Cond. fuse fail f. CH-B Rect/Cond. fuse fail g. CH-A DC MCCB trip/OFF h. CH-B DC MCCB trip/OFF i. Battery MCCB trip/OFF j. CH-A DC under voltage k. CH-B DC under voltage l. CH-A DC over voltage m. CH-B DC over voltage n. Battery DC under voltage o. Battery DC over voltage p. DC Bus over voltage q. DC Earth fault r. Battery Charger in boost mode
5.6	Microprocessor based monitoring unit cum controller	Charger should have a microprocessor based controller
5.6.1	Analog signals to be monitored by controller	a. AC Input Voltage and current b. DC output voltage and current for Charger -1 and Charger -2 c. Battery voltage and current
5.6.2	Alarms/Faults signals to be monitored by controller	a. AC under voltage b. AC over voltage c. CH-A AC MCCB trip/OFF d. CH-B AC MCCB trip/OFF e. CH-A Rect/Cond. fuse fail f. CH-B Rect/Cond. fuse fail g. CH-A DC MCCB trip/OFF h. CH-B DC MCCB trip/OFF i. Battery MCCB trip/OFF j. CH-A DC under voltage k. CH-B DC under voltage l. CH-A DC over voltage

DocUUID : af671952-6bf5-49da-8e80-1d8985636bb5

		m. CH-B DC over voltage n. Battery DC under voltage o. Battery DC over voltage p. DC Bus over voltage q. DC Earth fault r. Battery Charger in boost mode
5.6.3	SCADA Interfacing	Microprocessor controller should have RS485 port capable of transmitting all analog and alarm/fault signal to RTU on open MODBUS protocol. Any hardware/software required to achieve the said compatibility shall be in bidder's scope.
5.6.4	Display	Backlit display capable of displaying all the analog and fault/alarm signals mentioned above.

6 APPROVED MAKE OF COMPONENTS

6.1	Switch	Siemens / L&T (Salzer)
6.2	HRC Fuse Links	GE/ Siemens/ L&T
6.3	Diodes & SCR	Hirect/USHA/IOR
6.4	Meters	AE/Rishabh
6.5	AC Contractors &O/L Relay	L&T/Siemens/Telemechanique/GE/ABB
6.6	Terminals	Connectwell/Elmex/Wago/Phoenix
6.7	Push buttons / Actuator	L&T/Siemens/Vaishno
6.8	MCCB	L&T/Siemens/ ABB/GE
6.9	MCB	Datar/Legrand/Hager/Schneider
6.10	Indicating lamps LED type	Vaishno/Binay/Teknic/Siemens/Mimic

7 MIMIC DIAGRAM, LABEL & FINISH

7.1	Mimic diagram	To be provided
7.2	Name plate on panel front	
7.2.1	Material	Anodized aluminum 16SWG
7.2.2	Background	SATIN SILVER
7.2.3	Letter, diagram & boder	Black
7.2.4	Process	Etching
7.2.5	Name plate details	a. Manufacturer name b. Month & year of manufacture c. Equipment type d. Input & Output rating e. Owner name & order number f. Guarantee period g. Weight of panel h. Degree of protection i. Sr. No.
7.3	Labels for meters, indication & all cards / sub assemblies in panel	Anodized aluminum with white character on black background
7.4	Danger plate on front & rear	Anodized aluminum with white letters on red

DocUUID : af671952-6bf5-49da-8e80-1d8985636bb5

	side	background
7.5	Painting surface preparation	Shot blasting or chemical 7 tank process
7.6	Painting external finish	Powder coated polyester base grade A, shade –RAL 7032, uniform
7.7	Painting internal finish	Powder coated polyester base grade A, shade – white, uniform thickness 50 micron minimum
7.8	Labels for all components in panel	Anodized aluminum with white character on black background, fixed by rivets only
7.9	SLD	SLD of charges shall be provided at backside of the main door of Charger on Aluminium plate

8 QUALITY ASSURANCE, INSPECTION & TESTING

8.1	Vendor quality plan	To be submitted for purchaser approval
8.2	Inspection points	To be mutually identified & agreed in quality plan
8.3	Type test	Equipment should be of type tested quality only, type test certificate to be submitted along with offer. If the manufacturer's lab is accredited by govt. / authorized body then it shall be acceptable for type testing.
8.4	Routine test	As per relevant Indian standard
8.5	Acceptance test	To be performed in presence of Owner at manufacturer works a. Physical inspection & BOM, wiring check b. Insulation resistance test c. HV test for one minute d. Voltage regulation test e. Heat run test for 12 hours f. Measurement of efficiency, power factor & ripple content

9 DEVIATIONS

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

10 GTP

Vendor must submit clause wise compliance against specification at the time of drawing approval clearly highlighting the deviations from specification against each clause.

11 DRAWING AND DATA SUBMISSION MATRIX

DocUUID : af671952-6bf5-49da-8e80-1d8985636bb5

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
11.1	Contact Person Name, Email ID and Mobile Number	Required	Required		
11.2	Deviation Sheet (as per “Deviations” Clause)	Required			
11.3	GTP		Required		
11.4	Relevant Type Test as per IS/IEC/UL	Required	Required		
11.5	Manufacturer's quality assurance plan and certification for quality standards		Required		
11.6	Sizing Calculation of Associated Equipment		Required		
11.7	Recommended Spares for five years of operation)		Required		
11.8	**Battery Charger Drawing**				
11.8.1	General Arrangement	Required	Required		
11.8.2	Sectional Layout		Required		
11.8.3	Cabinet Layout		Required		
11.8.4	SLD	Required	Required		
11.8.5	Schematic Circuit diagram and Scheme of Each type of Panel		Required		
11.8.6	Communication Architecture		Required		
11.8.7	QAP		Required		
11.8.8	BOQ		Required		
11.8.9	Plan		Required		
11.8.10	Foundation Diagram		Required		
11.8.11	Make of all Component as per specification		Required		
11.8.12	Drawing of Substation Room		Required		
11.9	Installation, erection and commissioning manual		Required		
11.10	Inspection Reports			Required	
11.11	As manufacturing Drawings			Required	

DocUUID : af671952-6bf5-49da-8e80-1d8985636bb5

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
11.12	Operation and Maintenance Manual			Required	
11.13	Trouble shooting manual			Required	
11.14	As built Drawings				Required

12 PACKING

12.1	Packing Protection	Against corrosion, dampness, heavy rains, breakage and vibration. During transportation/ transit and storage, module may be subjected to outdoor conditions. Hence, packing of each panel shall be weatherproof.
12.2	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection & identification Label
12.3	Packing Identification Label to be provided on each packing case with the following details	
12.3.1	Individual serial number	
12.3.2	Purchaser's name	
12.3.3	PO number (along with SAP item code, if any) & date	
12.3.4	Equipment Tag no. (if any)	
12.3.5	Destination	
12.3.6	Project Details	
12.3.7	Manufacturer / Supplier's name	
12.3.8	Address of Manufacturer / Supplier / it's agent	
12.3.9	Description and Quantity	
12.3.10	Country of origin	
12.3.11	Month & year of Manufacturing	
12.3.12	Case measurements	
12.3.13	Gross and net weights in kilograms	
12.3.14	All necessary slinging and stacking instructions	
12.4	Packing Protection	Against corrosion, dampness, heavy rains, breakage and vibration. During transportation/ transit and storage, module may be subjected to outdoor conditions. Hence, packing of each panel shall be weatherproof.
12.5	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection & identification Label
12.6	Packing Identification Label to be provided on each packing case with the following details	
12.6.1	Individual serial number	
12.6.2	Purchaser's name	
12.6.3	PO number (along with SAP item code, if any) & date	

12.6.4	Equipment Tag no. (if any)
12.6.5	Destination
12.6.6	Project Details
12.6.7	Manufacturer / Supplier's name
12.6.8	Address of Manufacturer / Supplier / it's agent
12.6.9	Description and Quantity
12.6.10	Country of origin
12.6.11	Month & year of Manufacturing
12.6.12	Case measurements
12.6.13	Gross and net weights in kilograms
12.6.14	All necessary slinging and stacking instructions

13 SHIPPING

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

14 HANDLING AND STORAGE

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

DocUUID : af671952-6bf5-49da-8e80-1d8985636bb5

Technical Specification

Of

50 V and 220 V Lithium Ion Battery Bank

Specification no – BSES-TS-72-LIBB-R0

Rev:		0
Pages:		1 of 14
Date:		06 May 2022
Prepared by	Abhishek Harsh	3267d7c3-82b5-46cb-b5a6-867ee7820a34
Reviewed by	Srinivas Gopu	5d32525e-ed3a-4f41-b1c7-b8a5e77d1519
Approved by	Gaurav Sharma	23dc2de2-95de-4472-99a7-dea873f472b6

TABLE OF CONTENT

1 SCOPE

This specification covers the design, manufacture, testing, supply, erection & commissioning of 50 V & 220 V Li Ion Battery Bank.

Specification covers Type 1 and Type 2 Li Ion Battery Bank. Type 1 Battery Bank is for Grid Substations while Type 2 Battery Bank is for BSES HT Customers.

2 CODES & STANDARDS

Material, equipment and methods used in the manufacturing of Li Ion battery shall confirm to the latest edition of following standard

S. No	Standard Name / No	Standard's Description
2.1	Indian Electricity Act	Latest Edition
2.2	CBIP manual	Latest Edition
2.3	IEC 62281,62619, 61000-4-2	Safety of primary and secondary lithium cells and batteries, Safety requirements for secondary lithium cells and batteries, for use in industrial applications, Electrostatic Discharge Immunity Test
2.4	IEC 62133, IEC 62620:2014,	Battery Safety
2.5	IEC 61960	Performance tests, Designations, markings, dimensions, and other requirements
2.6	IEC 61959	Tests and requirements for verifying the mechanical behavior.
2.7	IS 5	Paint and Enamels
2.8	IS 13703	LV Fuses
2.9	IS 5578	Guide for marking insulated conductors
2.10	IS 694	Polyvinyl Chloride Insulated Unsheathed And Sheathed Cables/Cords With Rigid And Flexible Conductor For Rated Voltages Up To And Including 450/750 V
2.11	IS 1248	Direct Acting Indicating Analogue Electrical Measuring Instruments and their Accessories
2.12	IEEE	Relevant Standard
2.13	UL 1642	Individual cell compliance
2.14	UL 1973	Battery module complies, test methods and requirements to ensure safety during transport other than for recycling or disposal
2.15	UL 2054	Household and commercial Batteries

DocUUID : 80b262c0-4bf3-4141-9342-27e739c3a690

3 SERVICE CONDITIONS

3.1	Max Ambient Temperature	50 deg C
3.2	Max Daily average ambient temp	40 deg C
3.3	Min Ambient Temp	0 deg C
3.4	Maximum Humidity	95%
3.5	Minimum Humidity	10%
3.6	Maximum annual rainfall	750 mm
3.7	Average no of rainy days per annum	60
3.8	Rainy months	June to Oct
3.9	Altitude above MSL	300 M
3.10	Seismic Zone	IV

4 DC DISTRIBUTION SYSTEM DATA

4.1	DC Supply	2 wire, with positive & negative polarity
4.2	Earth reference	Unearthed system
4.3	Voltage	50 VDC/ 220 VDC
4.4	Application	Standby DC back up for switchgear control supply & SCADA RTU

5 GENERAL FEATURES

5.1	Number of Modules	6 (Maximum)
5.2	Connection of Modules	Parallel
5.3	DC battery bank Ah rating	For Type-1 Li Ion Battery Bank a. 600 Ah for 50 V b. 300 Ah for 220 V For Type-2 Li Ion Battery Bank a. 200 Ah for 50 V b. 100 Ah for 220 V
5.4	Voltage Output	50 V / 220 V
5.5	Battery Efficiency	>90%
5.6	Gas Evolution from Battery	None
5.7	DC load curve	With High discharge characteristics.
5.8	Location of Module	Indoor
5.9	Ingress Protection	IP 4X
5.10	Installation	On cabinet, painted with anti-corrosive paint.

DocUUID : 80b262c0-4bf3-4141-9342-27e739c3a690

5.11	Battery type	Li Ion Battery
5.12	Cell Chemistry	Different chemistry with material Manganese /Cobalt/iron/titanium etc subject to fulfillment of required parameters as mentioned in this specification.
5.13	Battery lifting/withdrawing arrangement	Suitable arrangement on Module
5.14	Battery Module marking	PO Number and Date, Customer Name- BSES Yamuna/Rajdhani Power Limited, Manufacturer name, month & year of manufacturer, Warranty Period, Nominal voltage, rated Ah capacity & cell number , Customer Care Number
5.15	Terminal polarity marking	Positive& negative marked on Module
5.16	Battery cell shorting metal links	Nickel plated copper with protective insulating sleeve
5.17	Insulating shrouds	For all battery terminals & shorting links
5.18	Insulating pads for battery rack	At the bottom of rack supports, made from high impact material
5.19	Battery suitable for Ripple content	5% minimum in DC charger output

6 BATTERY MANAGEMENT SYSTEM

Module must comprise BMS (Battery Management System) which monitors battery internal vital parameters, measures and displays various alarms/warnings; establish a communication link with the external system i.e. Charger, SCADA.

6.1	Arrangement	a. Battery shall comprise of two strings of equal rating. b. In Type-1 Battery Bank, for 220 VDC, two strings of 150 Ah capacity shall be provided c. In Type-1 Battery Bank, for 50 VDC, two strings of 300 Ah capacity shall be provided d. In Type-2 Battery Bank, for 220 VDC, two strings of 50 Ah capacity shall be provided e. In Type-2 Battery Bank, for 50 VDC, two strings of 100 Ah capacity shall be provided f. Each battery string should have its own dedicated BMS. g. Refer Annexure –A for architecture
6.2	Display	BMS shall have a display showing all measured parameters.
6.3	Communication	
6.3.1	Protocol For SCADA Interface	Modbus
6.3.2	Port	RS-485

DocUUID : 80b262c0-4bf3-4141-9342-27e739c3a690

6.3.3	Key Battery Parameters to be Integrated With SCADA	As per Annexure-A
6.3.4	Status LED	Dual color type
6.3.5	SOC LED	Dual color type
6.3.6	In-built data logging	Upto 6 months
6.3.7	Protection feedback to SCADA	From S.No 7.4.7 to 7.4.13
6.4	Safety Feature	
6.4.1	Module reverse polarity protection	
6.4.2	Internal fuse	
6.4.3	Controllable internal fuse	
6.4.4	Protective terminal covering to avoid unintentional contact	
6.4.5	Secondary level hardware protection for overvoltage	
6.4.6	Heat propagation resistant cell holding structure	
6.4.7	Overvoltage protection	
6.4.8	Under voltage protection	
6.4.9	Over charging current protection	
6.4.10	Over discharge current protection	
6.4.11	Over temperature during discharge protection	
6.4.12	Over temp during charge protection	
6.4.13	Over internal FET temp protection	
6.5	Arrangement for Bypassing the BMS	

7 CABINET

7.1	Panel Type	a. Separate compartment shall be provided for both battery strings b. Simplex panel with Dimension 0.6x0.6x1.4 m^3
7.2	Pocket	Pocket for Drawing is required
7.3	Display	a. Local LED Display on Cabinet shall be provided having key battery Parameters. b. Battery key parameters shall be as per Annexure-A
7.4	Ingress Protection	IP4Xin accordance with IS 13947
7.5	Cooling	Natural
7.6	Enclosure material	Pre-galvanized, cold-rolled sheet steel of thickness not less than 2.0 mm. Stiffeners shall be provided wherever necessary.
7.7	Doors	Double leaf doors shall be provided at the rear. Doors shall have handles with built-in locking facility
7.8	Gland Plate	At least two separate gland plates of removable type with gasket shall be provided for each panel. They shall be of sheet steel of thickness not less than 3.0 mm.

DocUUID : 80b262c0-4bf3-4141-9342-27e739c3a690

7.9	Gaskets	All doors, removable covers and panels shall be Gasketed all around with neoprene gaskets
7.10	Foundation	The panels shall be fixed on the embedded foundation channels with intervening layers anti vibration strips made of shock absorbing materials
7.11	Base Frame	Base frames shall be supplied along with panels.
7.12	Earthing	50x6 sqmm GI Earth bus shall run through the cabinet and same shall be extended to outside of the panel from both sides for earthing purpose.
7.13	Pocket	Pocket shall be Provided for drawing placement purpose

8 NAMEPLATES AND MARKING

8.1	Panel nameplate	a. BSES Logo b. Property of BSES c. Name of manufacturer d. Name of customer e. Battery Rating f. PO no. & Date g. Serial Number h. Month & year of manufacturing i. Guarantee period j. Manufacturer Call center no. & email id k. Weight of Panel
8.2	Name Plate Material	Anodized Aluminum 16SWG
8.3	Background	Satin Silver
8.4	Letter, Diagram & Border	Black
8.5	Process	Etching
8.6	Equipment ID Marking	Shall be given at the time of drawing approval. Following will be the features: a. Equipment ID shall be painted on any appropriate face of the equipment at a clearly readable height from the base level of the equipment.

DocUUID : 80b262c0-4bf3-4141-9342-27e739c3a690

		b. Font: 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.

9 EQUIPMENT LIST

9.1	Battery Cabinet
9.2	Battery Module
9.3	Communication cable
9.4	DC power cable
9.5	Cable terminal block/bus-bar
9.6	Earth cable
9.7	Tools and Accessories for Maintenance
9.8	Mandatory and Recommended Spares if Any

10 INSPECTION & TESTING

10.1	Type test	Equipment shall be type tested from CPRI/ERDA accreted lab as per IEC/IS/UL standard.
10.2	Routine test	As per relevant standard
10.3	Acceptance test	To be performed in presence of Owner at manufacturer works shall be as per approved QAP
10.4	Heating Compliance	JIS C8712
10.5	ROHS Compliance	Required

11 GTP

Vendor must submit clause wise compliance in Excel sheet against specification at the time of drawing approval clearly highlighting the deviations from specification against each clause.

12 DEVIATIONS

Deviation from this specification shall be provided in excel sheet with the tender by reference to the specification clause/ GTP/ Drawing and description of alternative offer. In

DocUUID : 80b262c0-4bf3-4141-9342-27e739c3a690

absence of such a statement, it shall be assumed by the buyer that the seller complies fully with this specification.

13 DRAWING AND DATA SUBMISSION MATRIX

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

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
13.1	Contact Person Name, Email ID and Mobile Number	Required	Required		
13.2	Deviation Sheet(as per “Deviations” Clause)	Required			
13.3	GTP		Required		
13.4	Relevant Type Test as per IS/IEC/UL	Required	Required		
13.5	Manufacturer's quality assurance plan and certification for quality standards		Required		
13.6	Sizing Calculation of Associated Equipment		Required		
13.7	Recommended Sparesfor five years of operation)		Required		
13.8	**Li Ion drawing**				
13.8.1	General Arrangement	Required	Required		
13.8.2	Sectional Layout		Required		
13.8.3	Cabinet Layout		Required		
13.8.4	Battery Layout		Required		
13.8.5	SLD	Required	Required		
13.8.6	Schematic Circuit diagram and Scheme of Each type of Panel		Required		
13.8.7	Communication Architecture		Required		

DocUUID : 80b262c0-4bf3-4141-9342-27e739c3a690

13.8.8	QAP		Required		
13.8.9	BOQ		Required		
13.8.10	Plan		Required		
13.8.11	Foundation Diagram		Required		
13.8.12	Make of all Component as per specification		Required		
13.8.13	Drawing of Substation Room		Required		
13.9	Installation, erection and commissioning manual		Required		
13.10	Inspection Reports			Required	
13.11	As manufacturing Drawings			Required	
13.12	Operation and Maintenance Manual			Required	
13.13	Trouble shooting manual			Required	
13.14	As built Drawings				Required

14 PACKING

14.1	Packing Protection	Against corrosion, dampness, heavy rains, breakage and vibration. During transportation/ transit and storage, module may be subjected to outdoor conditions. Hence, packing of each panel shall be weatherproof.
14.2	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection & identification Label
14.3	Packing Identification Label to be provided on each packing case with the following details	
14.3.1	Individual serial number	
14.3.2	Purchaser's name	
14.3.3	PO number (along with SAP item code, if any) & date	
14.3.4	Equipment Tag no. (if any)	
14.3.5	Destination	

DocUUID : 80b262c0-4bf3-4141-9342-27e739c3a690

14.3.6	Project Details
14.3.7	Manufacturer / Supplier's name
14.3.8	Address of Manufacturer / Supplier / it's agent
14.3.9	Description and Quantity
14.3.10	Country of origin
14.3.11	Month & year of Manufacturing
14.3.12	Case measurements
14.3.13	Gross and net weights in kilograms
14.3.14	All necessary slinging and stacking instructions

15 SHIPPING

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

DocUUID : 80b262c0-4bf3-4141-9342-27e739c3a690

16 HANDLING AND STORAGE

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

17 QUALITY AND ASSURANCE

17.1	Vendor quality plan	To be submitted for purchaser approval
17.2	Inspection points	To be mutually identified & agreed in quality plan

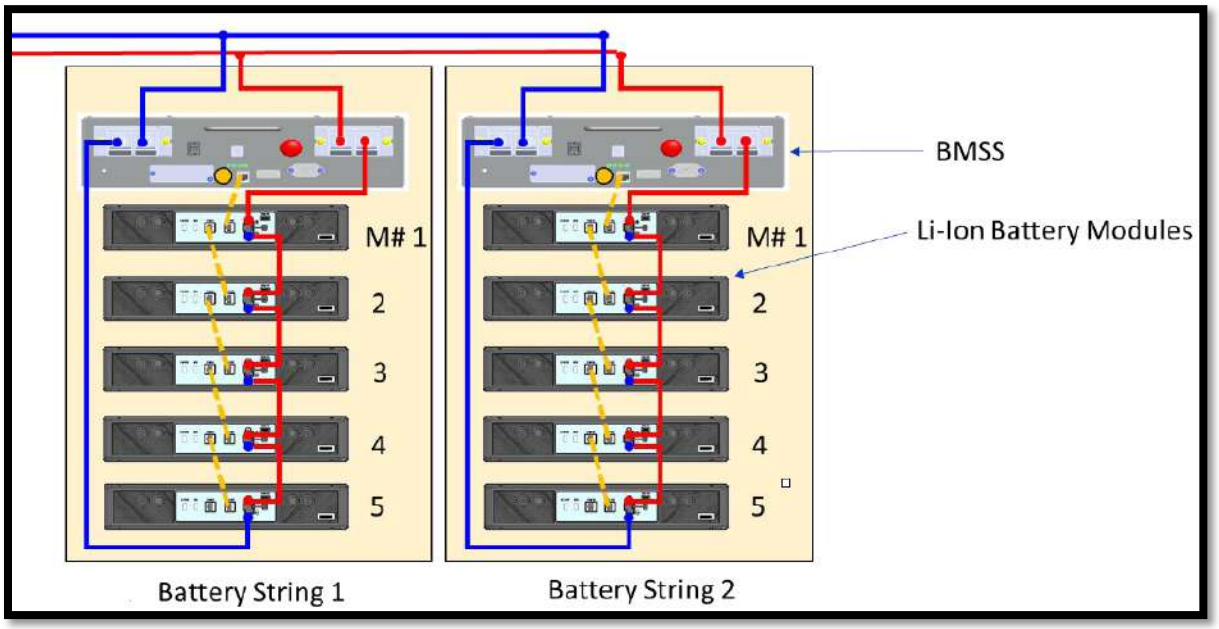
18 ANNEXURE A- BATTERY KEY PARAMETERS

S.NO.	Description	BSES Requirement		Data to be filled by Manufacturer	
		50V	220V	50V	220V
18.1	Battery (as per scope of supply) – Yes / No	Yes	Yes		
18.2	Battery type	Li-Ion	Li-ion		
18.3	Type/Model No.				
18.4	Cell Chemistry				
18.5	Battery nominal voltage with variation upto ±5%				
18.6	Total battery bank CC-CV charging required in volts				
18.7	Nominal Voltage of each Cell				
18.8	No of cells in each module				
18.9	No. of modules				
18.10	Input charge voltage				
18.11	Charge current				
18.12	Discharge current				
18.13	Battery DOD	80% (minimum)	80% (minimum)		
18.14	Life cycle with 80% DOD	3000 (minimum)	3000 (minimum)		
18.15	Battery efficiency (watt hour round trip)	>92%	>92%		
18.16	Service life	10 Years	10 Years		

DocUUID : 80b262c0-4bf3-4141-9342-27e739c3a690

18.17	Self-discharge rate per month	3% @ 25°C	3% @ 25°C		
18.18	Cut off voltage	45V	210V		
18.19	Submitted of deviation sheet for each specification clause no - Yes / No	Furnish each deviation if yes	Furnish each deviation if yes		
18.20	Battery rating offered in AH	600 AH/200 AH	300 AH/100 AH		
18.21	Rating at temperature 45 deg C	600 AH/200 AH	300 AH/100 AH		
18.22	Battery bank dimensions in mm (length x depth x height)	As required	As required		
18.23	Battery Module weight in kg	As required	As required		
18.24	Heat generated by battery at rated full load (in Kw)	Less than 0.025kW/module	Less than 0.025kW/module		
18.25	Manufacturer of Li-Ion Battery Cells and Modules	Yes	Yes		
18.26	Manufacturer of Battery management system (BMS)	Yes	Yes		
18.27	Availability of Service team in India	Yes	Yes		
18.28	Built In Battery Management System	Yes	Yes		

19 ANNEXURE B-BATTERY ARRANGEMENT



Battery System

TECHNICAL SPECIFICATION

FOR

EARTHING PRACTICE IN GRID SUBSTATION

PREPARED BY	REVIEWED BY	APPROVED BY	REV	0
A.H	G.S	A.A	DATE 18/10/2017	

INDEX TABLE

TECHNICAL SPECIFICATION FOR EARTHING PRACTICE IN GRID SUBSTATION

1. SCOPE

This specification covers the guidelines of earthing at 66/11, 33/11, 66/33/11 kV Grid substation and the technical requirements of material required for earthing.

2. STANDARDS & CODES

2.1.	CEA guidelines	Technical standards for construction of electrical plants and electrical lines
2.2.		IE Rules of 1956
2.3.	IEEE Std 80	IEEE guide for safety in AC substation grounding
2.4.	CBIP :2006 – publication no. 229	Manual on substation layout
2.5.	IS 3043: 1987	Code of practice for earthing
2.6.	IS 2629 (1985)	Recommended practice for hot dip galvanizing of Iron & Steel
2.7.	IS 2633 (1986)	Method for testing uniformity of coating on zinc coated article
2.8.	IS 5358 (1969)	Specification for hot dip galvanized coating on fasteners
2.9.	IS 4759 (1996)	Specification of Hot dip zinc coatings on structural steel and other allied products
2.10.	IS 1239 (2004)	Steel tubes, tubular and other wrought steel fittings- specification
2.11.	IEC 62561-2	Requirements for conductors and earth electrodes
2.12.	IEC 62561-7	Requirements for earthing enhancing compounds
2.13.	UL 467	Standard for safety - Grounding and bonding equipment
2.14.		Handbook on Electrical Earthing (Ministry of Railways)

3. REQUIREMENT OF EARTHING

3.1.	Primary guidelines	Following are primary guidelines for a good earthing system in a Grid substation: a. The impedance to ground should be as low as possible. In general it should not exceed **0.5 ohm**. b. The step and touch potentials shall be within safe limits. c. The contractor shall do the calculation for number of earthing rods being used in a substation for achieving the desired earth resistance.
3.2.	Earthing lead size	a. The actual size of earthing lead will depend on the maximum fault current which the earthing lead will be required to carry safely. b. Please refer **Annexure A1** for HT fault level.
3.3.	Earthing type	a. Rod earthing shall be provided for the Grid substation. b. The size of the rod depends upon the current to be carried and the type of the soil. Soil resistivity testing will be carried out by vendor. c. The Earth Electrode should be embedded vertically. Wherever hard rock is encountered, the rod can be inclined at an angle of about 30deg to the horizontal as per clause 9.2.2 of IS 3043. d. The vertically driven rods shall be interconnected with each other using horizontal grid conductors.
3.4.	Earth Pit	a. As per clause 20.5.2 of IS 3043, the minimum distance between the vertical earth electrodes shall not be less than the length of rod. b. Minimum of 1m distance of earth pit from electrical equipment and structures shall be maintained. c. The earth pits shall be backfilled with earth enhancing material as per Drawing . d. Treated Earth pits shall be used where earth resistance value is getting over the prescribed value in specification i.e. 0.5 ohms.
3.5.	Horizontal Conductor	a. The entire earth rod driven in ground vertically shall be interconnected with earth grid conductors horizontally under the ground. b. The Horizontal conductors shall be laid 600 mm below FGL. c. Minimum earth coverage of 300 mm shall be provided between the Horizontal conductor and the bottom of trench/foundation/underground pipe at the crossing. d. Horizontal conductors around a building /switchyard fence shall be buried outside the boundary at a minimum distance of 2000 mm. e. Risers shall be provided 300mm above the ground level for equipment earthing. Two number earth pits shall be provided with riser for connection of transformer neutral. f. All the joints between rods flats shall be **exothermic** type for creating better electrical contact between two. Welding between rods to flat, flat to flat should be arc welding type. g. Wherever bolted connection is done, it shall be done through two bolts at each joint to ensure tightness and avoid loosening with passage of time.
3.6.	Equipment earthing	a. GI strips shall be used for the equipment earthing. b. Two separate and distinct earth connections shall be provided for earthing of electrical frameworks.

		c. The connection of GI strip with riser of earth mat shall be electric arc welding arrangement; connection of equipment with earthing end shall be double bolted arrangement. d. The transformer neutral shall be earthed with two independent grounding conductors connected to two separate earth pits. e. Fence within the earth grid shall be bonded to the plant earth system at regular interval not exceeding 10 meters. Fence gate shall be separately earthed with flexible connection to permit movement. f. Bolted connection shall be made only for earthing of equipment/devices and for some removable structures. The contact surfaces shall be thoroughly cleaned before connection to ensure good electrical contact. g. Cable armor shall be earthed at both ends for multi core cables. For single core cables, the earthing shall be at switchgear end only. h. Metallic stairs and hand rails shall be earthed as for columns. Additionally a 25x6 GI flat shall run the entire length of the stairs. The GI flat shall be welded to the stairs and hand rails at intervals of 1500 mm. i. The main earth conductor shall be securely fixed to the columns /walls/trays by welding /clamping at the intervals not exceeding 1500 mm. The earth conductors shall be interconnected between them and to the main earth grid through risers.

4. SPECIFICATION OF EARTHING MATERIALS

4.1.	GI earthing strip	a. Fully galvanized iron strips shall be used conforming to IS 2629. b. The zinc deposition shall not be less than 610gm/sqm of the galvanized surface area of the MS Earthing strips. c. The zinc coating used for the galvanization shall be of 9.99 % purity grade as per IS 209. d. All the galvanized material shall be checked for uniformity and weight as per IS. e. The standard length of galvanized iron earthing strip shall be minimum 7Mtrs.
4.2.	Vertical and Horizontal Earth Electrode	a. Copper clad steel rod driven in the earth vertically shall be a high tensile-low carbon steel rod of adequate diameter(as per the clause 6.0 of the specs) and 3 m length complying UL467, IEC62561-2 and IS 3043, molecularly bonded by 99.99% pure high conductivity copper on the outer surface with copper coating thickness 254 microns or more with sufficient amount of earth enhancement compound as per IEC 62561-7. b. Copper bonding must be UL/CPRI/ERDA certified. c. Rod shall be tested and certified from CPRI/ERDA for a short circuit current withstanding of desired value. d. There shall be following marking on the rod-Dimension Detail, product model no, Reference number of certification. e. It shall have high corrosion resistance and shall eliminate electrolytic action. f. The rod shall have thread profile at both the ends to ensure no copper is removed from the steel.

4.3.	Earth enhancing compound	a. It shall be as per IEC 62561-7. b. It shall be chemically inert to subsoil. c. It shall not pollute the environment. The RoHS certificate shall be provided from any NABL accredited lab for not having any toxic chemical in earth enhance material. d. It shall provide a stable environment in terms of physical and chemical properties and exhibit low resistivity. e. The earthing enhancing compound shall not be corrosive to the earth electrodes being used. f. It shall be maintenance free. g. The earth enhancement material shall be supplied in sealed, moisture proof bags. These bags shall be marked with manufacturer's name or trade name, quantity, batch no. & date of manufacturer, resistivity, Buyer's name, PO no. & date. h. As per IEEE 80-2013 clause 14.5 d, grounding material shall be tested and certified for resistivity less than 0.12 Ω-m.

5. SIZES OF THE EARTHING MATERIALS FOR EQUIPMENT EARTHING

S.No.	Title	Material	Sizes of the earthing	Type	UOM	No of Lead
	Main Earthing Grid					
5.1	Vertical Rods	Cu Bonded Rods	25	Rod	mm (dia)	
5.2	Above Ground risers	GI	50x10	Flat	sqmm	2
5.3	Horizontal Rods	Cu Bonded Rods	25	Rod	mm (dia)	
5.4	Treated Earth Pit	Cu Bonded Rods	25	Rod	mm (dia)	
	Power Transformers					
5.5	Frame	GI	75X10	Flat	sqmm	2
5.6	Marshalling Box	GI	50X6	Flat	sqmm	2
5.7	Radiator	GI	50X6	Flat	sqmm	2
5.8	Neutral	GI	65x10	Flat	sqmm	2
5.9	Fan	GI		As per sizes mentioned for fans		
	11 KV System					
5.10	11 KV Swithcgear	GI	50X6	Flat	sqmm	2

5.11	11 KV Bus Duct	GI	50X6	Flat	sqmm	2
5.12	11 KV Cable Box	GI	50X6	Flat	sqmm	2
	415 V System					
5.13	ACDB	GI	50X6	Flat	sqmm	2
5.14	Station Trafo Frame	GI	50X6	Flat	sqmm	2
	DC System					
5.15	Battery Charger	GI	50X6	Flat	sqmm	2
5.16	DCDB	GI	50X6	Flat	sqmm	2
	Other Electrical Items					
5.17	Three phase receptacles, welding outlet	GI	25x3	Flat	sqmm	1
5.18	C&R Panel	GI	50X6	Flat	sqmm	2
5.19	Push Button	GI	8	Wire	swg	1
5.20	Cable Trays(one run along the tray section)	GI	50X6	Flat	sqmm	1
	Other Non Electrical Items					
5.21	Railway Tracks	GI	25x6	Flat	sqmm	At suitable Points
5.22	Metallic noncurrent carrying structures like stair case	GI	25x6	Flat	sqmm	1
5.23	Columns, Structures	GI	50X6	Flat	sqmm	2
5.24	Steel pipe racks	GI	25x6	Flat	sqmm	1
5.25	Fence/Gate	GI	50X6	Flat	sqmm	At suitable Points(2 min)
5.26	Hand Rail	GI	8	Wire	swg	1

6. TESTING AND INSPECTION

6.1.	Earthing materials	a. The purchaser reserves the right to inspect the material at the time of tests. All tests shall be performed in the presence of BYPL representative. The bidder shall give intimation in advance to witness the test. b. Acceptance test for GI earthing strips – Tests for Visual examination, dimensional verification and galvanization shall be witnessed at the time of inspection. c. Acceptance test of Earth enhancement compound – Tests for leaching, sulphur determination, corrosion and resistivity shall be done as per IEC 62561-7 d. Type test reports of the earthing materials from CPRI/ERDA/Equivalent lab shall be submitted. The bidder shall submit UL-467/CPRI/ERDA test reports for copper clad steel rod.
6.2.	Measurement of Earth resistance	a. After the completion of work ground resistance of each installation shall be measured by BYPL/Contractor. b. The measurement of resistance shall be witnessed and signed by representative of BYPL as well as the contractor. The test certificates shall be generated for each installation clearly indicating the details of the transformer, name of the substation, location, district, serial no. of testing equipment and name of testing engineer. c. The desire ground resistance shall be measured after interconnection of earth pits is completed. The value of earth resistance shall not be more than **0.5 ohm**. d. In case where this value exceeds 0.5 ohms, the earthing design shall be redesigned. The pit location, earth electrode, soil treatment, earth conductor, GI strip used shall be checked whether properly used at site. If not, these shall be changed as per the redesigned plan.

7. DEVIATIONS

7.1.	Deviation	Deviations from this Specification shall be stated in writing with the tender by reference to the Specification clause/GTP/Drawing and a description of the alternative offer. In absence of such a statement, it will be assumed that the bidder complies fully with this specification. No deviation will be acceptable post order.

8. DOCUMENTS SUBMISSION

The bidder has to submit the following documents along with bid:-

8.1.	Complete earthing calculation
8.2.	Complete product catalogue, Manual and calibration certificate of the equipment
8.3.	Type test reports
8.4.	Deviation Sheet (if any)

9. GUARANTEED TECHNICAL PARTICULARS

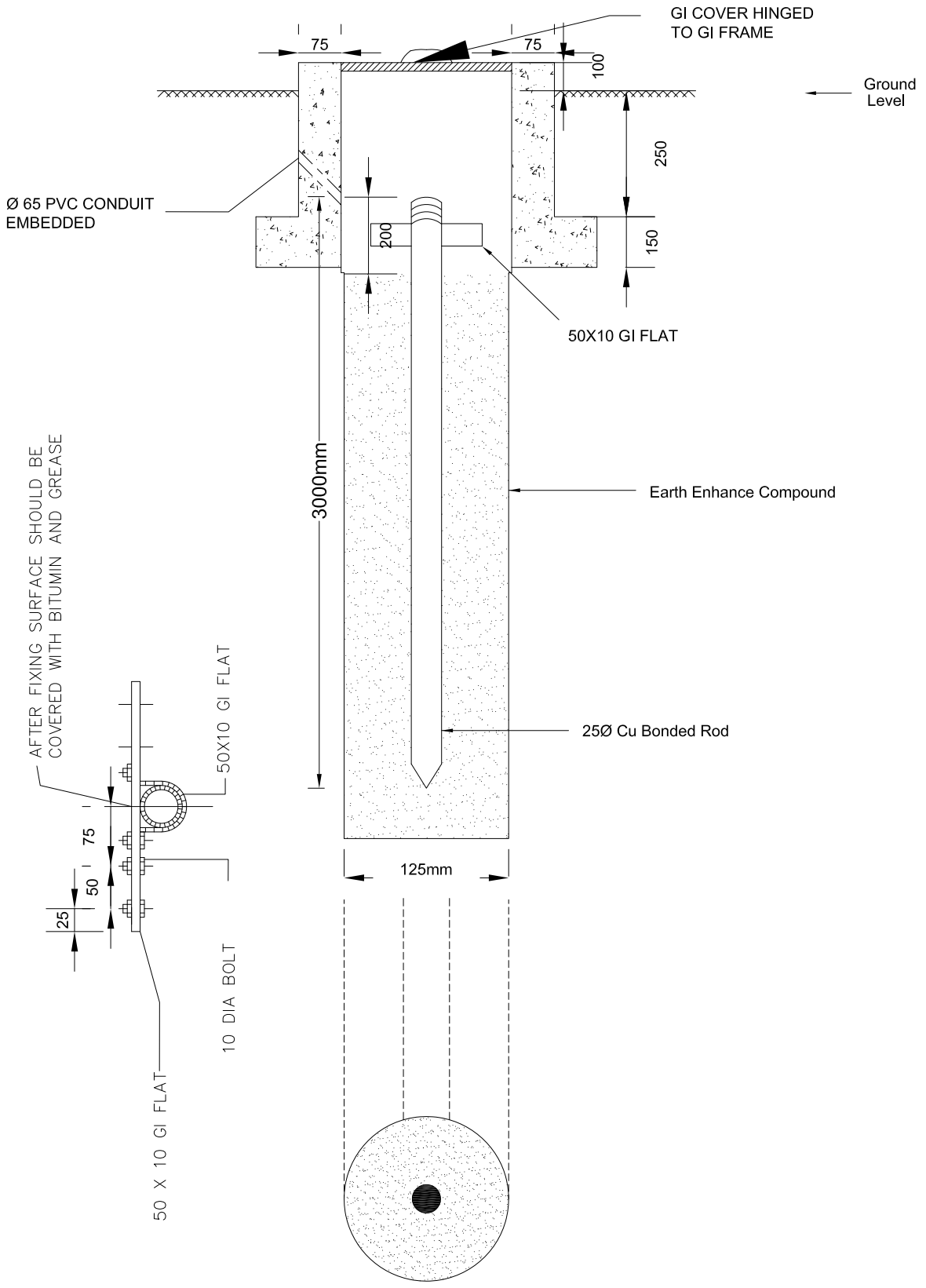
S. No	Parameter	BYPL Requirement	Vendor Data
9.1	Rod to rod welding	Exothermic	
9.2	Zinc deposition of GI earthing Strip	610gm/sqm	
9.3	Length of GI Strip	7m (Minimum)	
9.4	Diameter of Cu clad Rod	25 mm	
9.5	UL/CPRI/ERDA Certification of Cu Bonding	Test certificate to be provided	
9.6	Cu bonding	250 Micron	
9.7	Length of Copper bonded rod	3 m	
9.8	Purity of Copper	99.99%	
9.9	Short circuit withstand test of Rod	31.5kA	
9.10	Marking on the rod-Dimension Detail, product model no, Reference number of certification	Sample Required	
9.11	ROHS Certificate from NABL accredited lab for not having toxic chemical in earth enhance material	Test certificate to be provided	
9.12	Resistivity of earth enhancing material	0.12 ohm-m(Max)	

9.13	Exothermic welding material	IEEE 837 Complied	
9.14	Make of Steel	SAIL/ESSAR/TATA	

ANNEXURE A1 : REFERENCE FAULT LEVEL

Voltage Level(kV)	Design Fault Level
66/11	31.5 KA
33/11	25 KA

ANNEXURE A2: REFERENCE DRAWINGS



DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

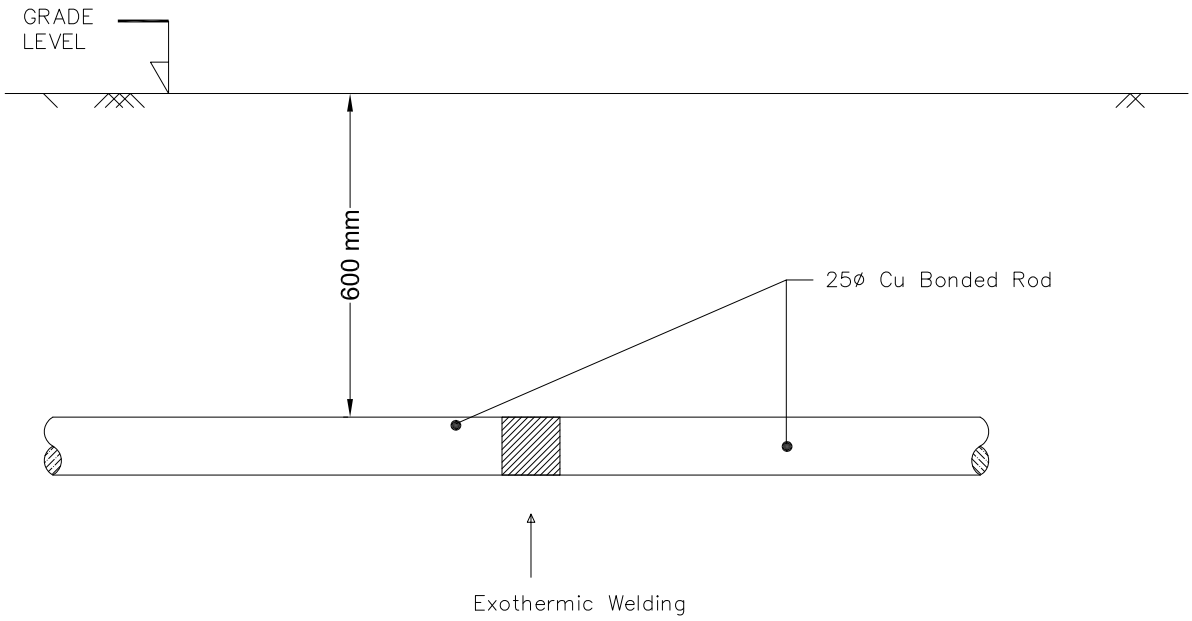
TITLE:–

EARTH ELECTRODE

BSES Yamuna Power Limited

FILE NAME: REL–COENG–NEE–E21–P–00085 DATE:–08.09.10

A4 [210x297]



DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

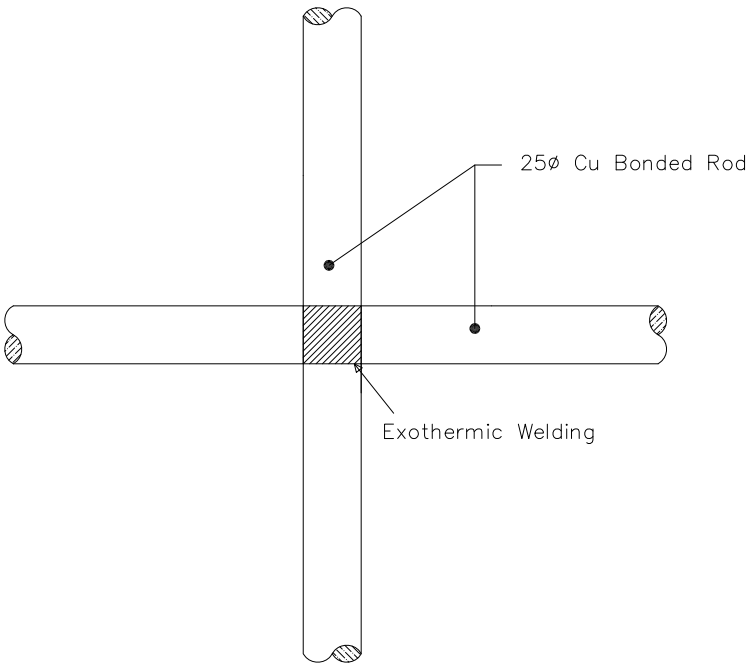
TITLE:–

LAP JOINT BETWEEN RODS

BSES Yamuna Power Limited

FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

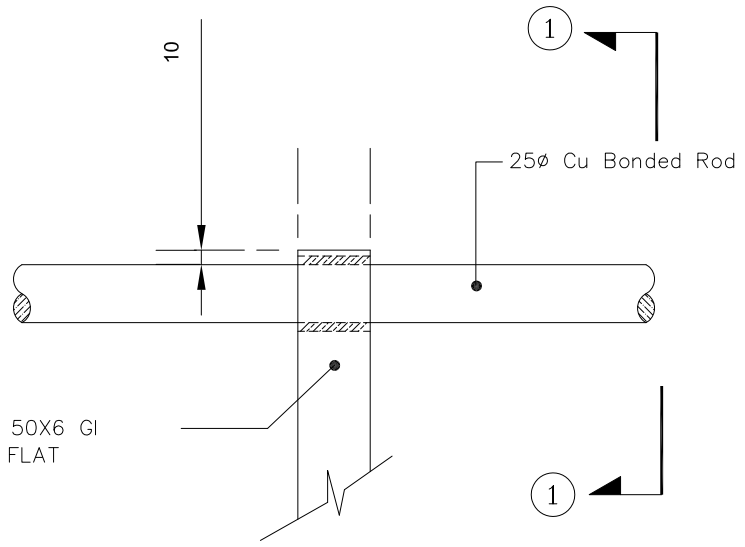
A4 [210x297]

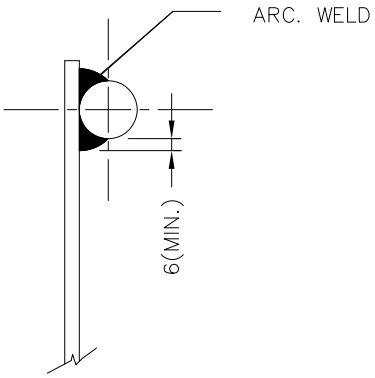


DRAWN	A.H	TITLE:–	BSES Yamuna Power Limited
CHECKED	G.S		
APPD.	A.A	CROSS JOINT BETWEEN RODS	
DATE	17.10.17		
SCALE	NTS		

FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

A4 [210x297]





SECTION – (1)

DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

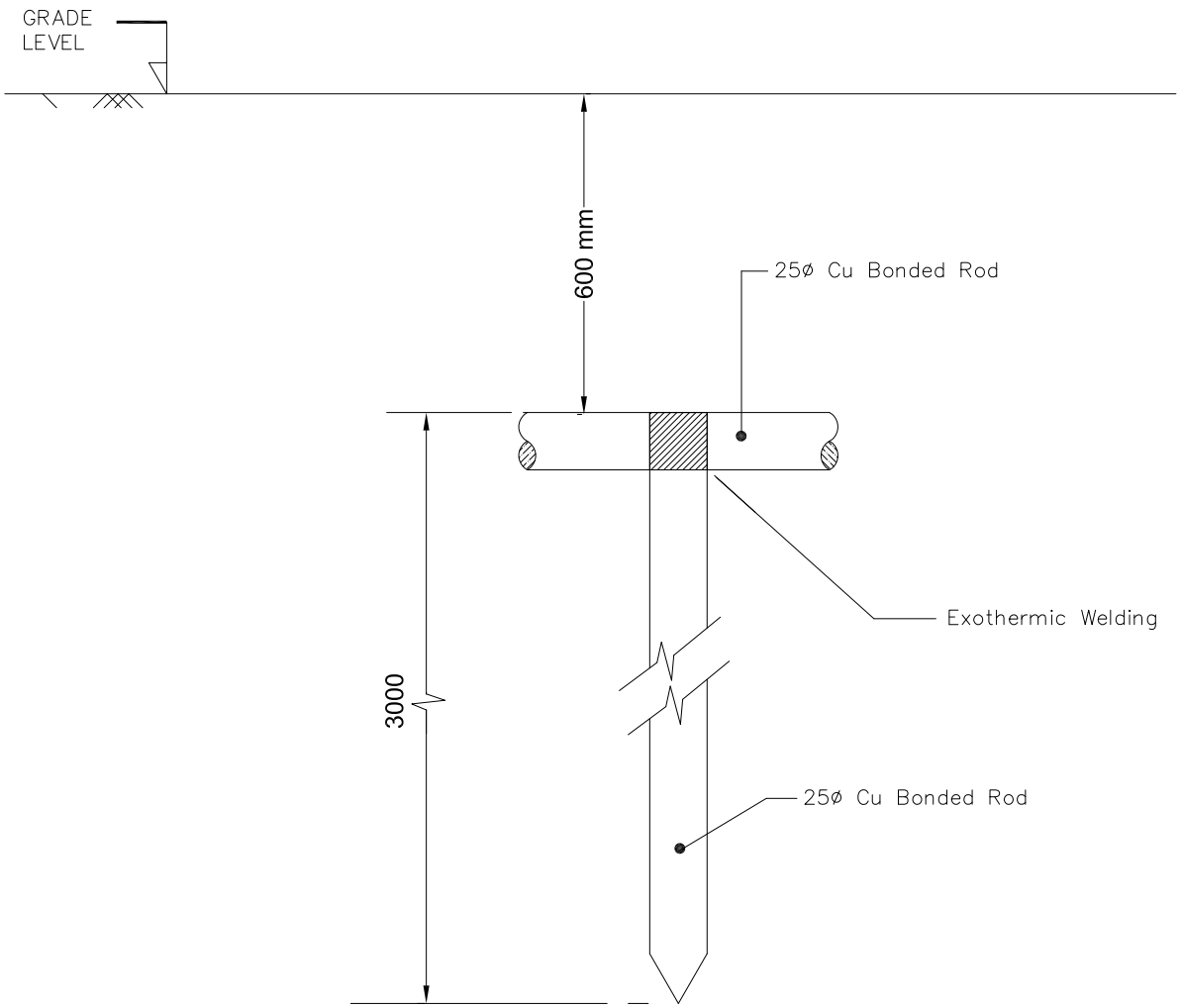
TITLE:–

CROSS JOINT BETWEEN ROD AND GI FLATS

BSES Yamuna Power Limited

FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

A4 [210x297]



DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

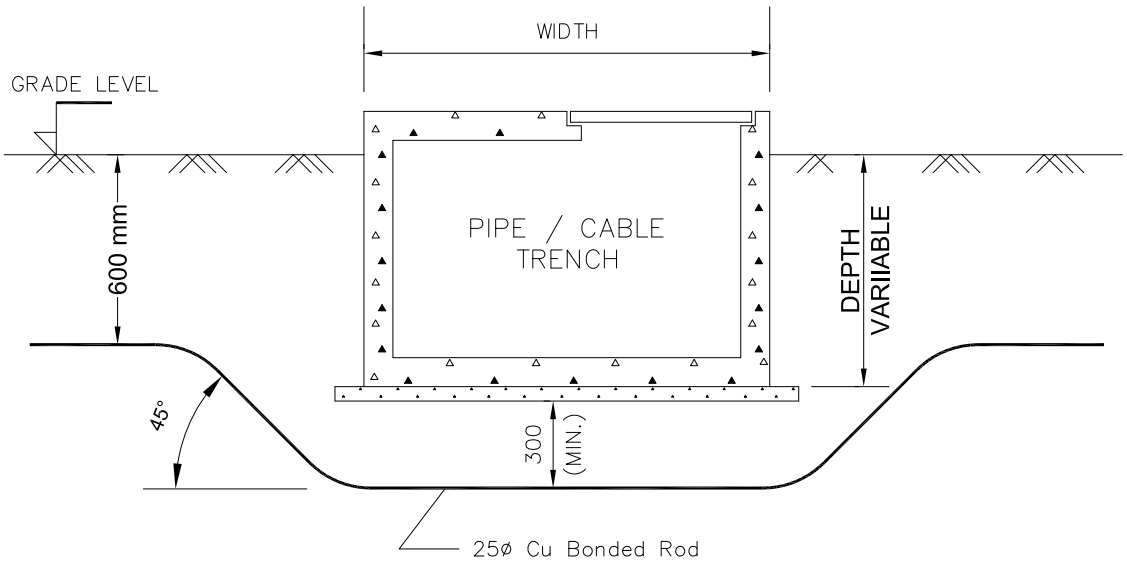
TITLE:-

EARTH ELECTRODE

BSES Yamuna Power Limited

FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

A4 [210x297]



DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

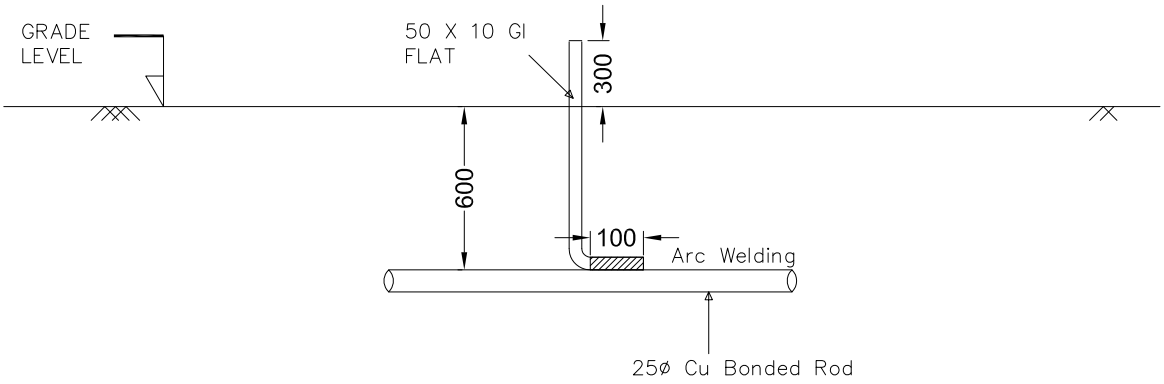
TITLE:–

TRENCH CROSSING OF EARTHING CONDUCTOR

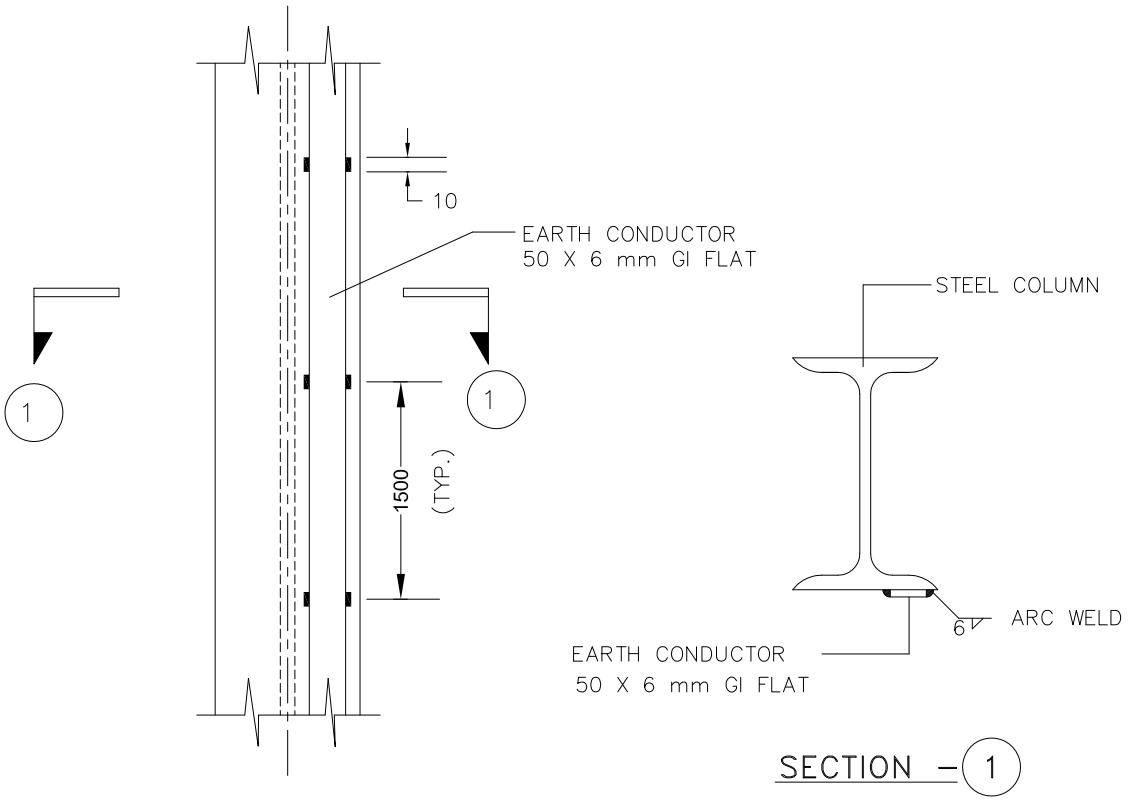
BSES Yamuna Power Limited

FILE NAME: REL–COENG–NEE–E21–P–00085 DATE:–08.09.10

A4 [210x297]



DRAWN	A.H	TITLE:–	BSES Yamuna Power Limited
CHECKED	G.S	EARTH RISER DRAWING	
APPD.	A.A		
DATE	17.10.17		
SCALE	NTS		



DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

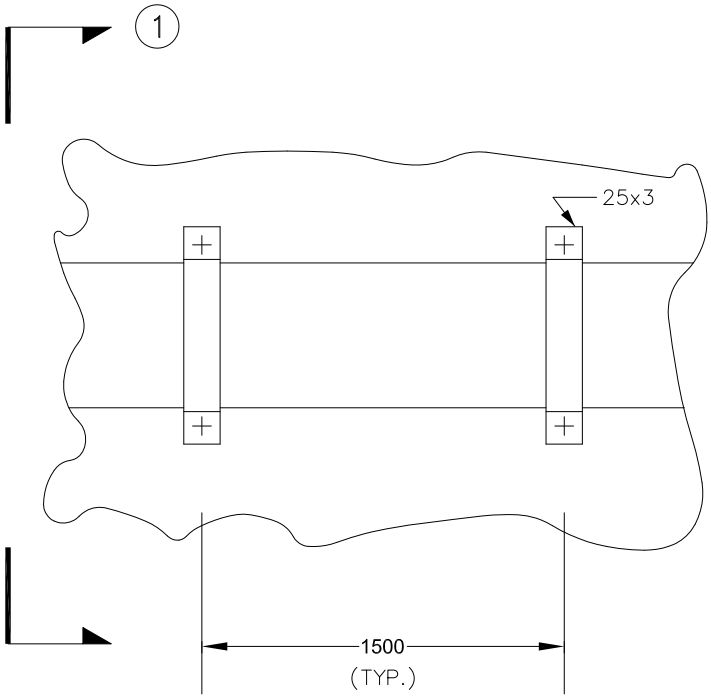
TITLE:–

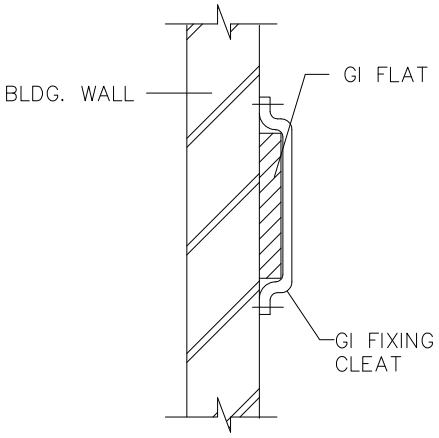
EARTHING CONDUCTOR ALONG STEEL COLUMN

BSES Yamuna Power Limited

FILE NAME: REL–COENG–NEE–E21–P–00085 DATE:–08.09.10

A4 [210x297]





SECTION – (1)

DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

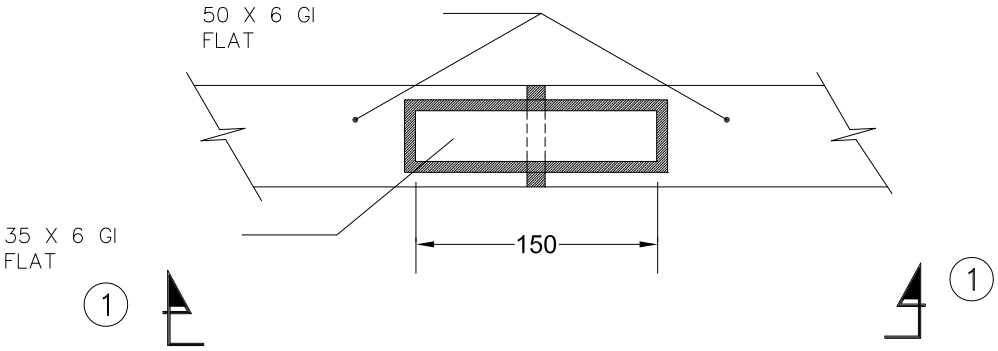
TITLE:–

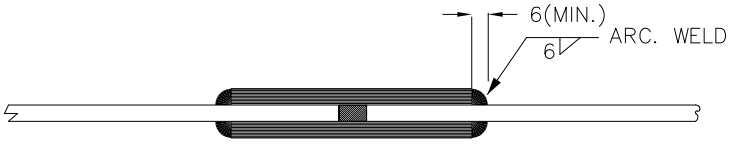
EARTHING CONDUCTOR ALONG BUILDING WALL

BSES Yamuna Power Limited

FILE NAME: REL–COENG–NEE–E21–P–00085 DATE:–08.09.10

A4 [210x297]





SECTION – (1)

DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

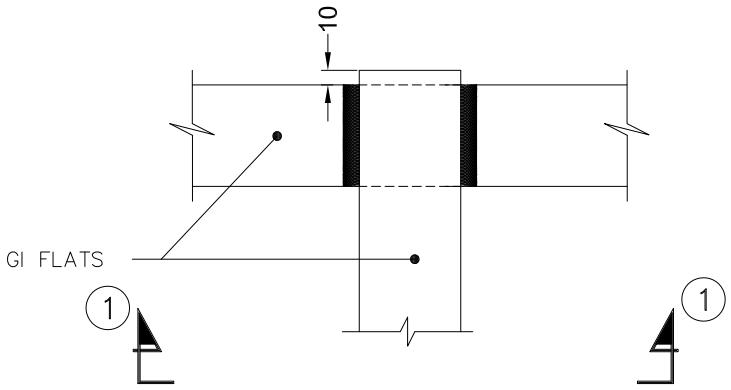
TITLE:–

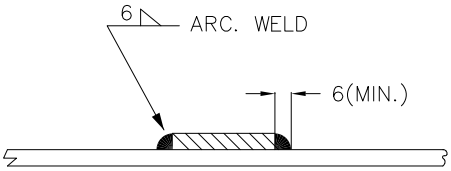
BUTT JOINT BETWEEN GI FLATS

BSES Yamuna Power Limited

FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

A4 [210x297]





SECTION – (1)

DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

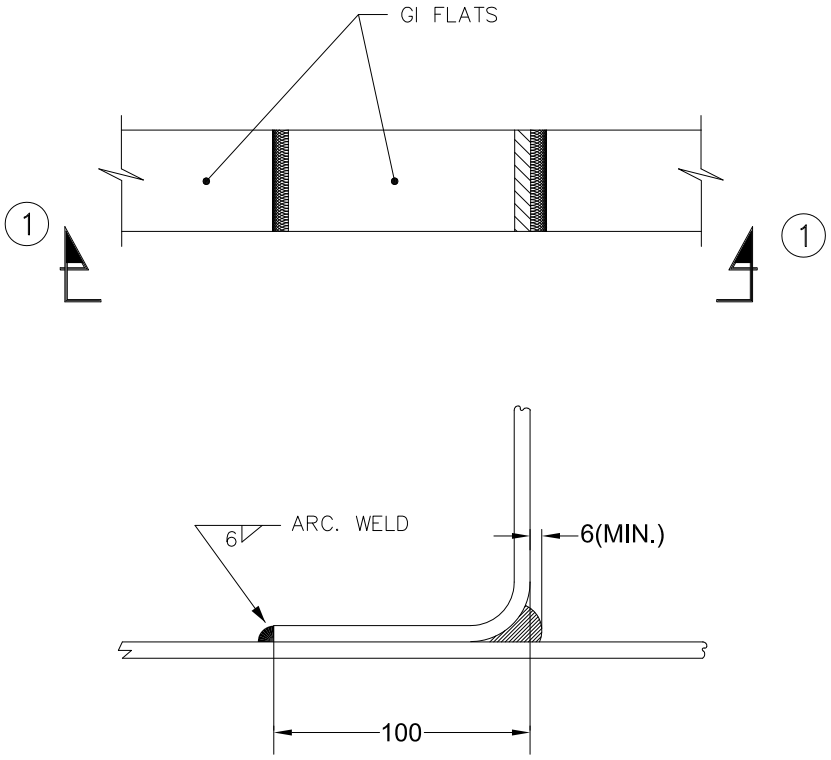
TITLE:–

CROSS JOINT BETWEEN GI FLATS

BSES Yamuna Power Limited

FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

A4 [210x297]



SECTION – (1)

DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

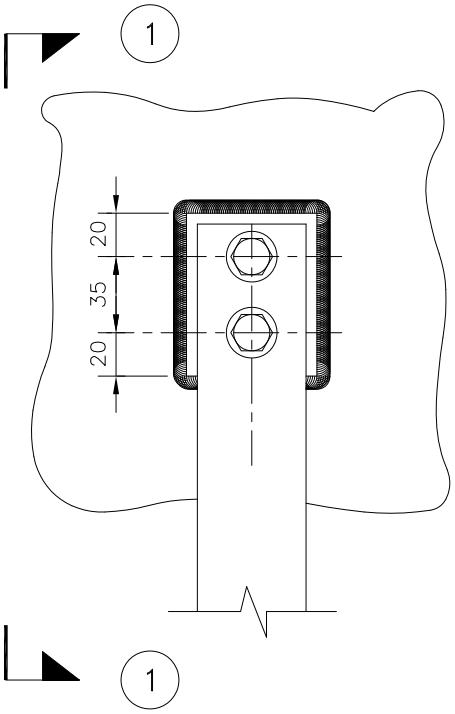
TITLE:–

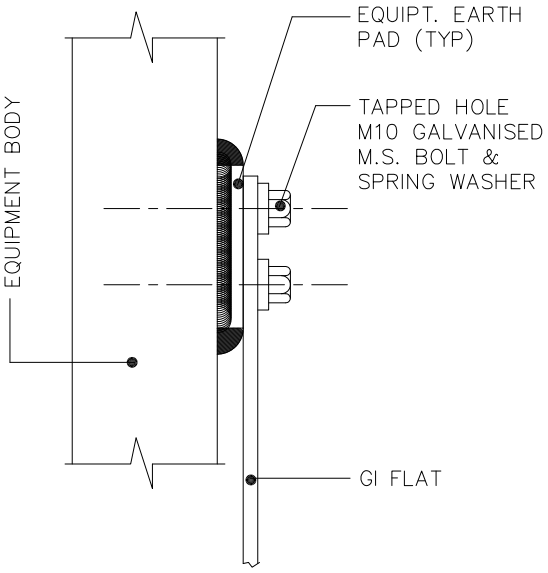
ANGULAR JOINT BETWEEN GI FLATS

BSES Yamuna Power Limited

FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

A4 [210x297]





SECTION – (1) – (1)

DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

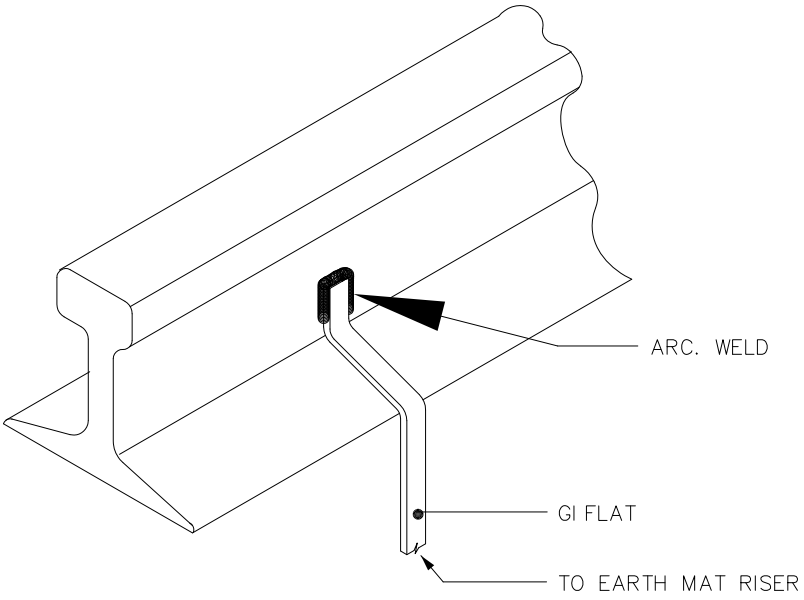
TITLE:–

EQUIPMENT EARTHING

BSES Yamuna Power Limited

FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

A4 [210x297]



DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

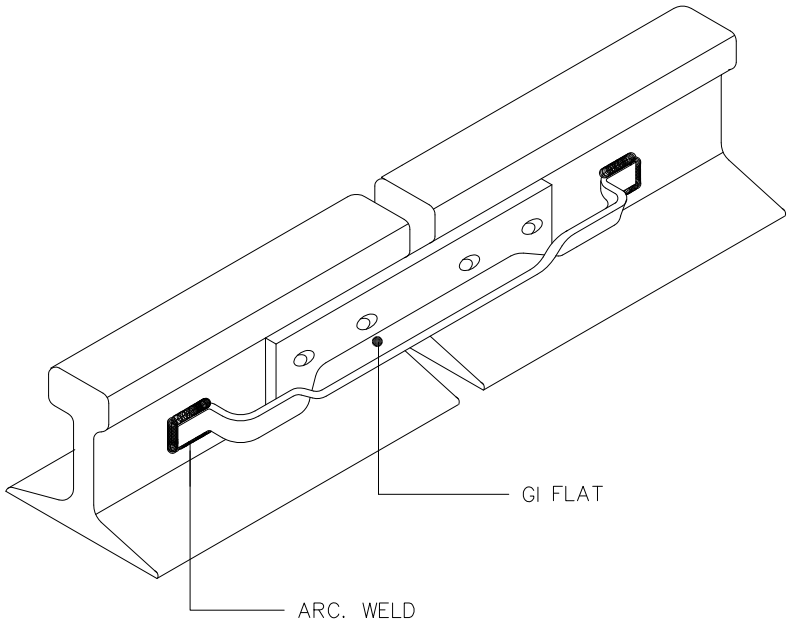
TITLE:-

RAIL EARTHING

BSES Yamuna Power Limited

FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

A4 [210x297]



DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

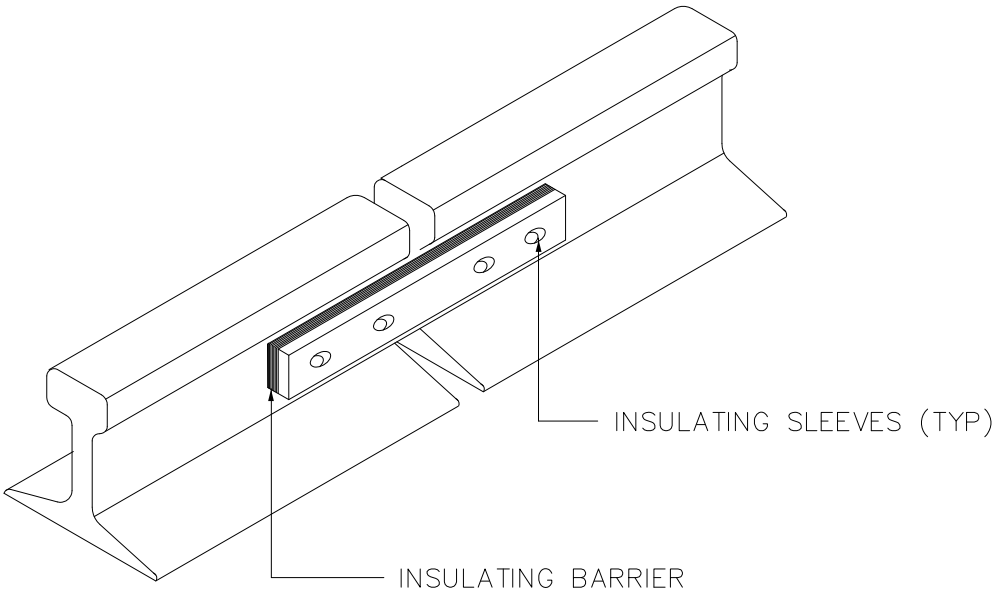
TITLE:–

RAIL BONDING

BSES Yamuna Power Limited

FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

A4 [210x297]



Note: Such installation shall be provided at points where the rail track leaves the earth grid(typically at the plant boundary)

DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

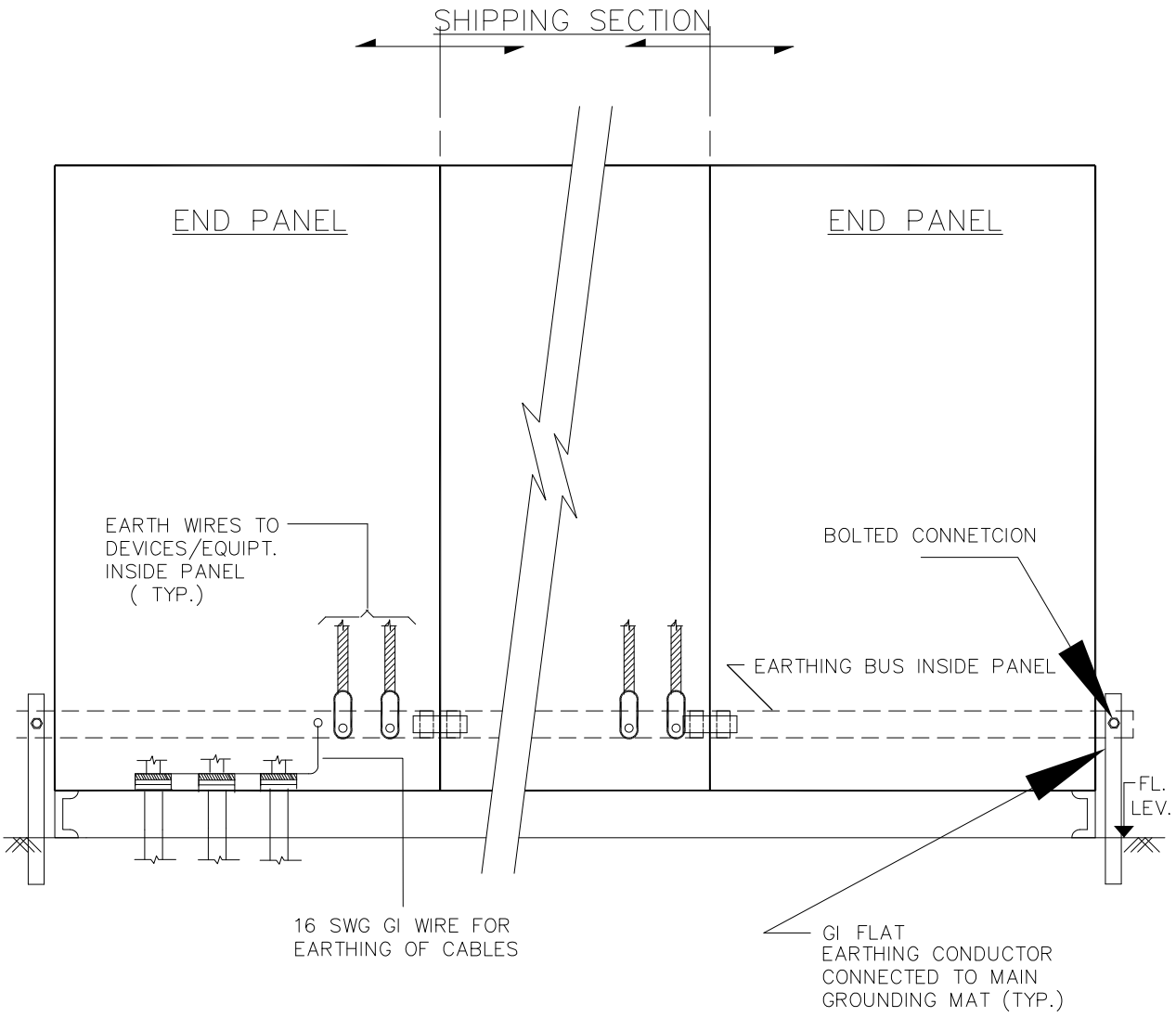
TITLE:–

RAIL SECTIONS LEAVING THE EARTH MAT

BSES Yamuna Power Limited

FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

A4 [210x297]



DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

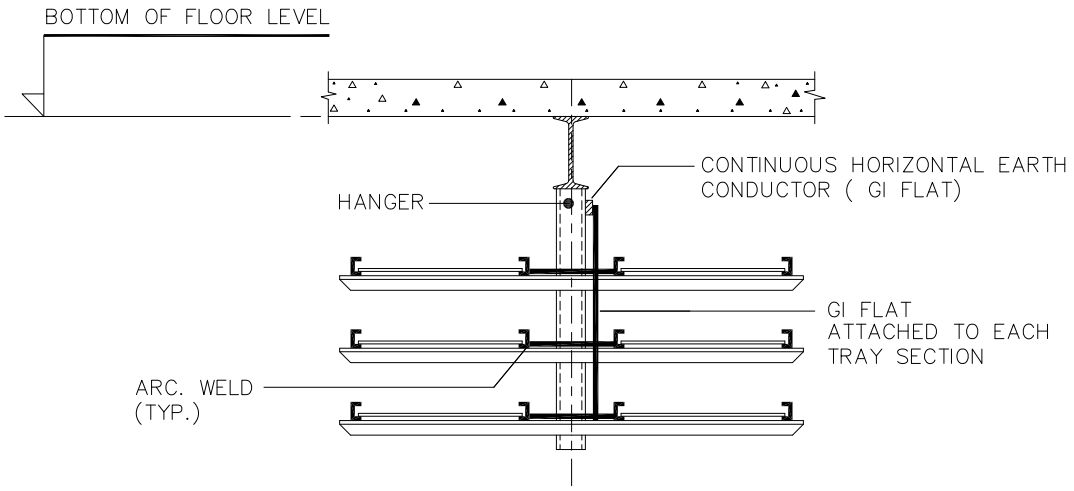
TITLE:-

EARTHING OF MCC, SWITCHGEAR

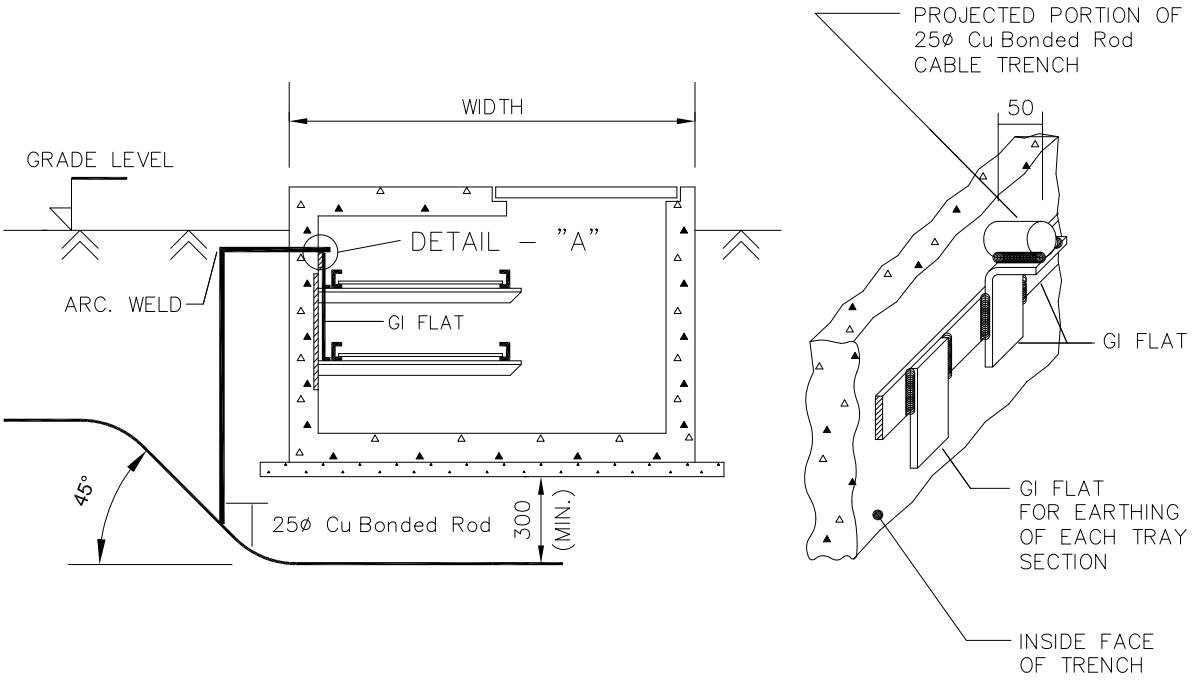
BSES Yamuna Power Limited

FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

A4 [210x297]



OVERHEAD CABLE TRAY EARTHING



DETAIL – A

DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

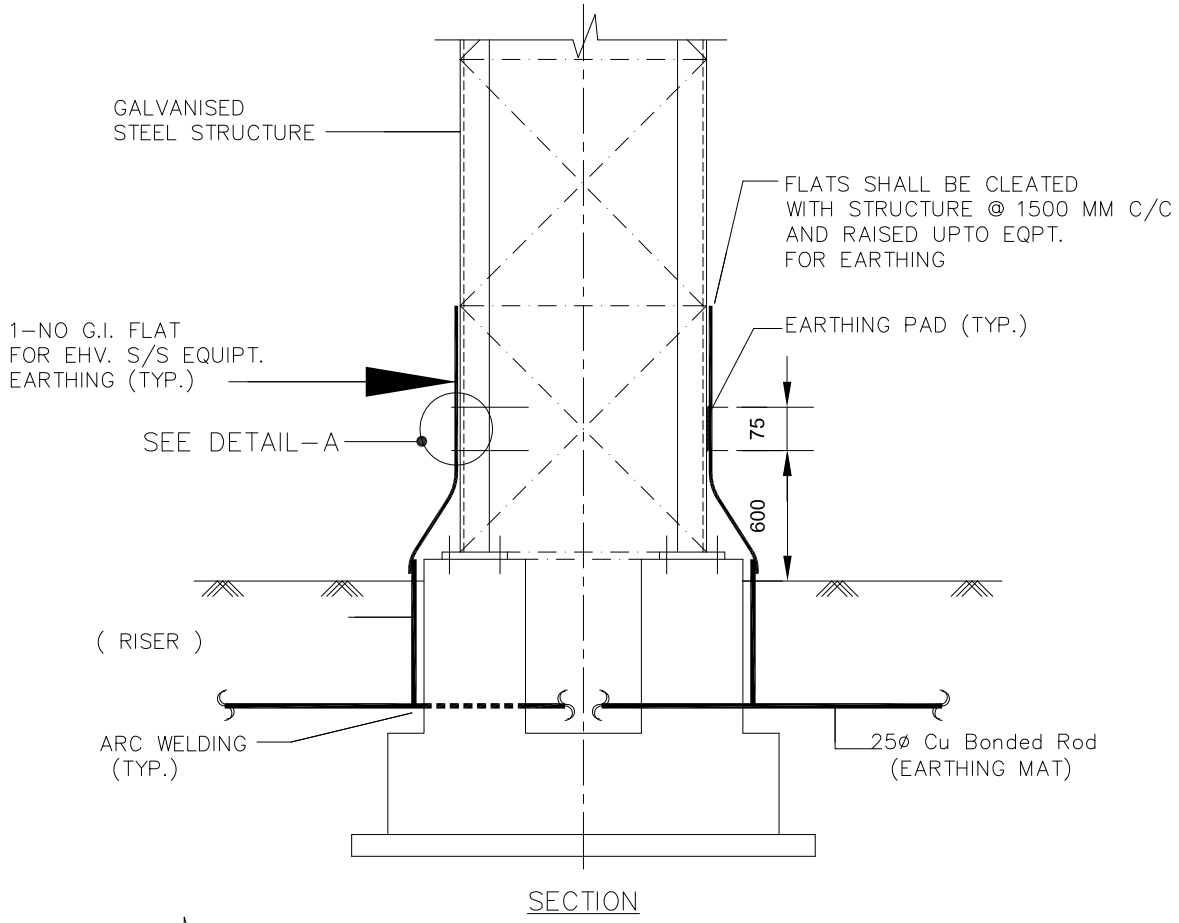
TITLE:–

CABLE TRANCH/TRAY EARTHING

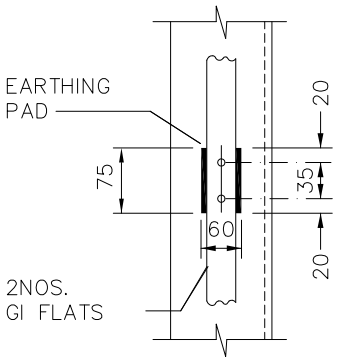
BSES Yamuna Power Limited

FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

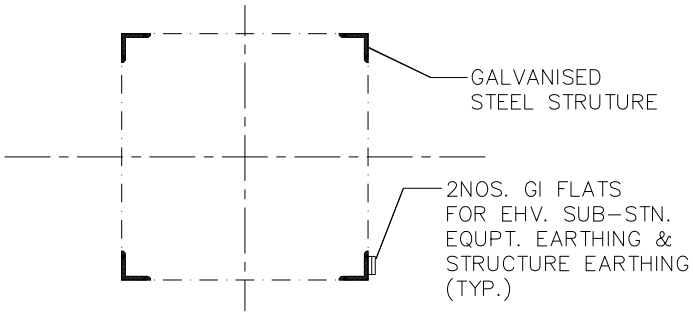
A4 [210x297]



SECTION



DETAIL – 'A'



PLAN

DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

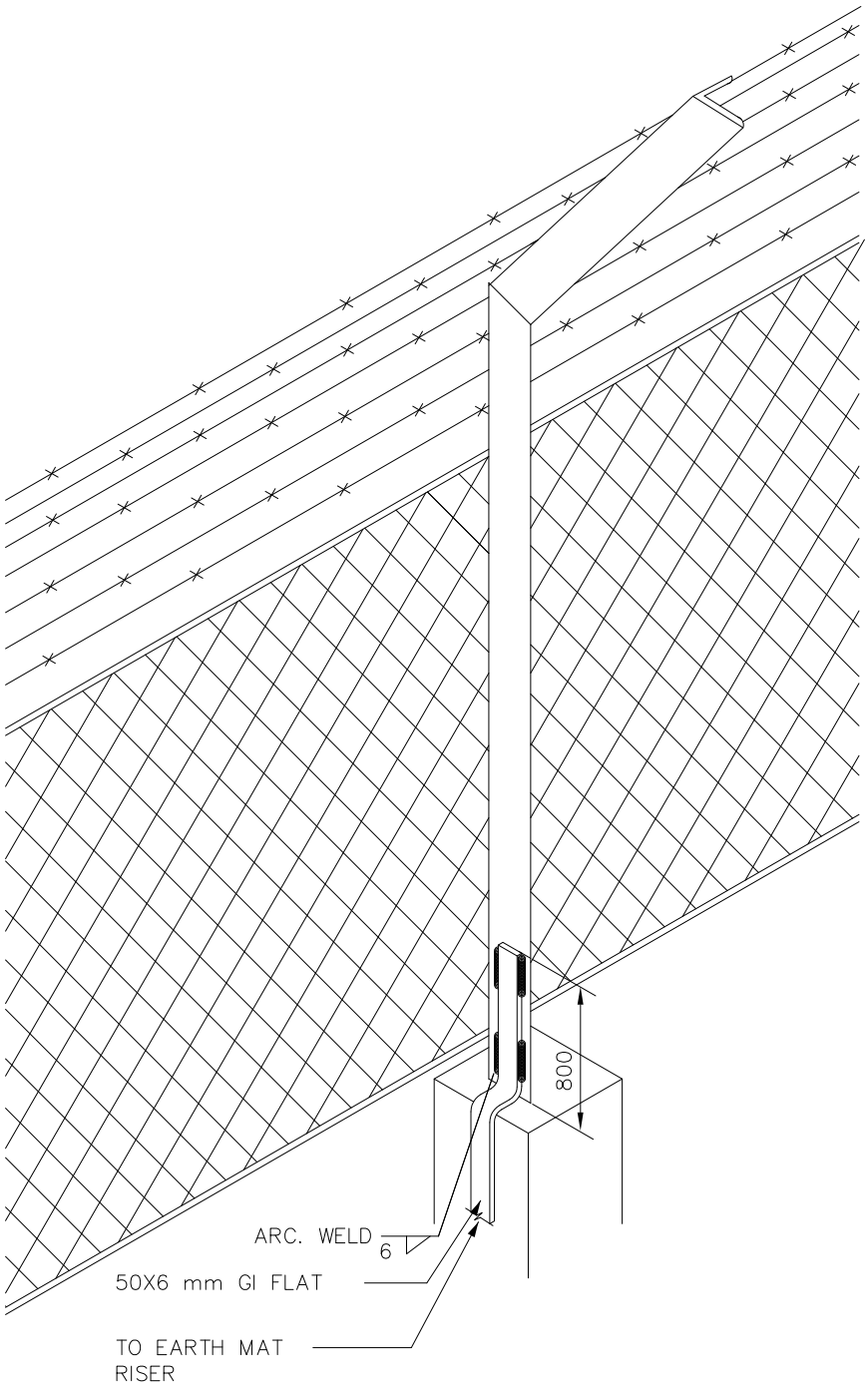
TITLE:–

EARTHING OF STRUCTURE MOUNTED ELECTRICAL EQUIPMENT

BSES Yamuna Power Limited

FILE NAME: REL–COENG–NEE–E21–P–00085 DATE:–08.09.10

A4 [210x297]



DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

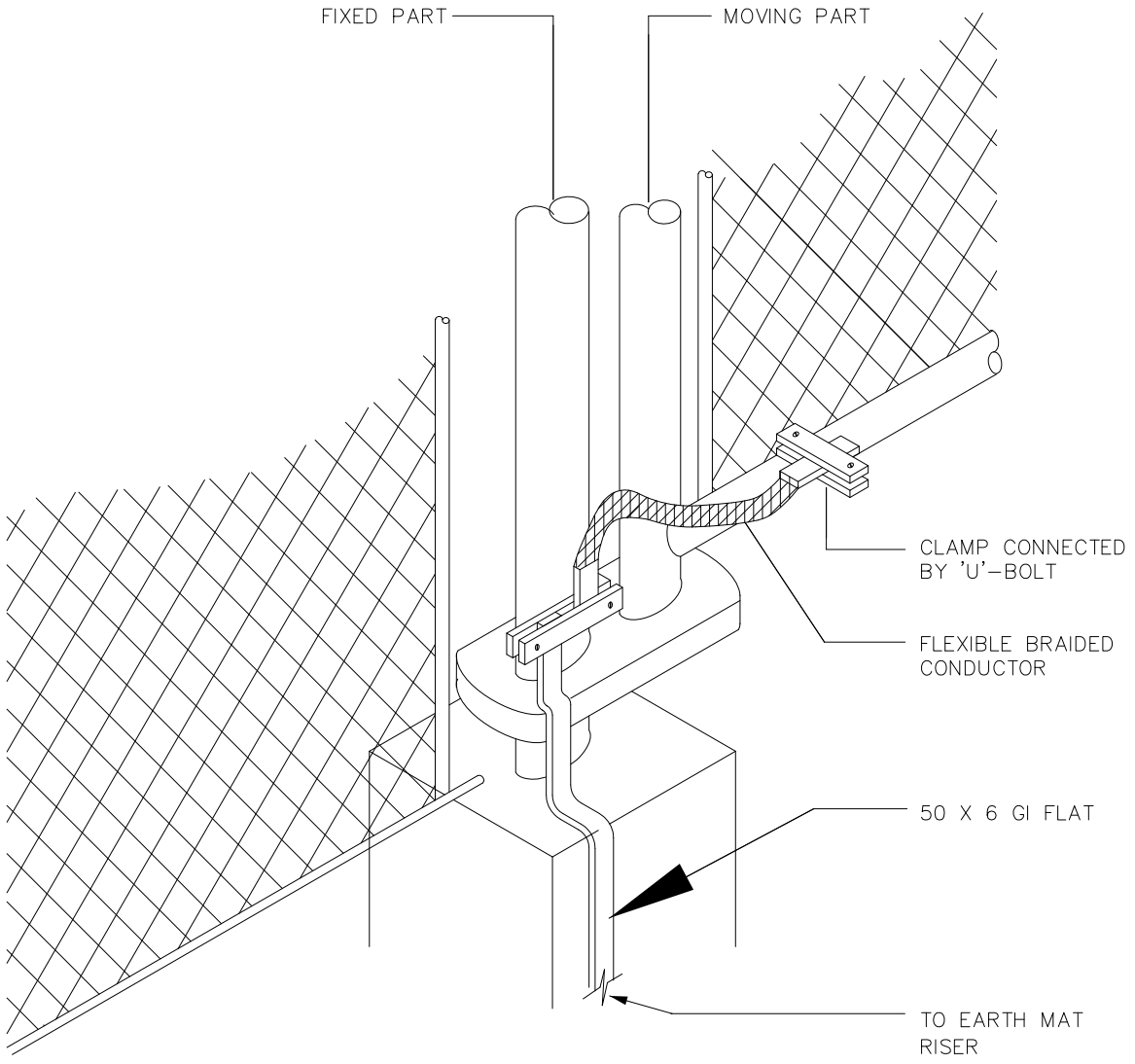
TITLE:–

FENCE EARTHING

BSES Yamuna Power Limited

FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

A4 [210x297]



DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

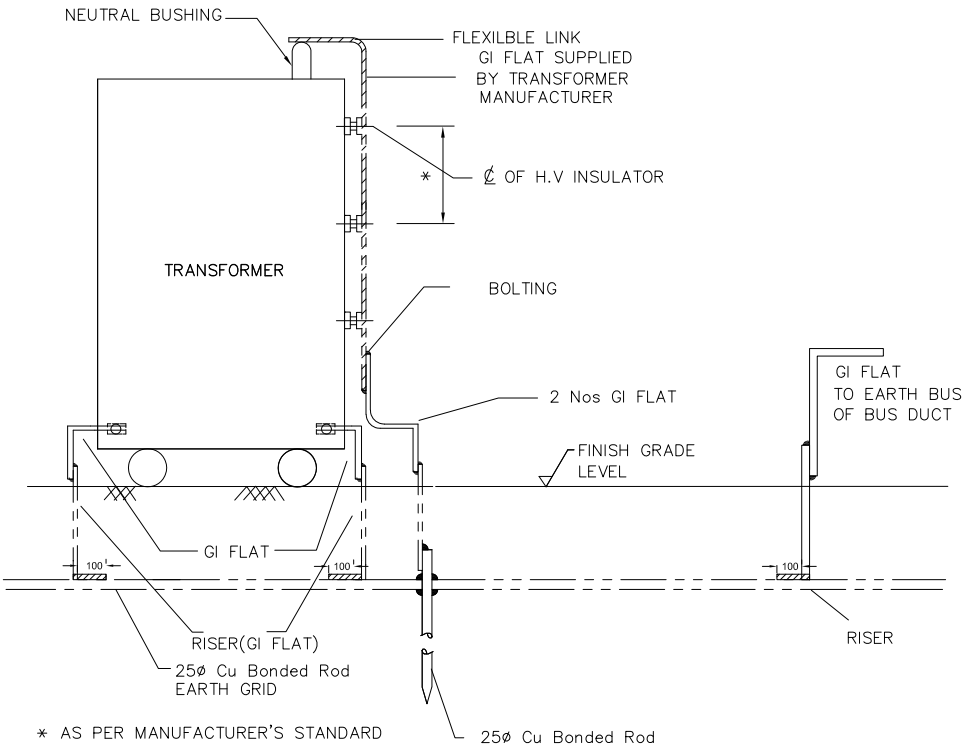
TITLE:-

FENCE GATE EARTHING

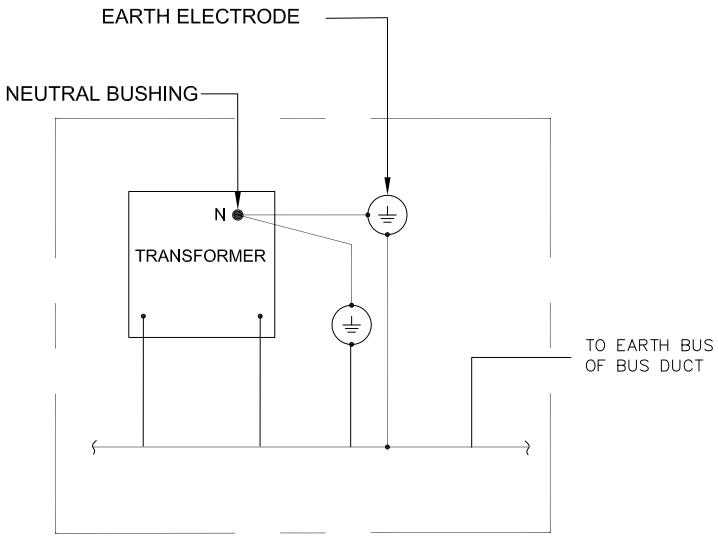
BSES Yamuna Power Limited

FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

A4 [210x297]



NOTE: APPLICABLE TO EHV WINDINGS AND LV (415V) WINDINGS OF TRANSFORMERS REQUIRING DIRECT EARTHING OF NEUTRALS.



LINE DIAGRAM

SOLID NEUTRAL EARTHING

DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

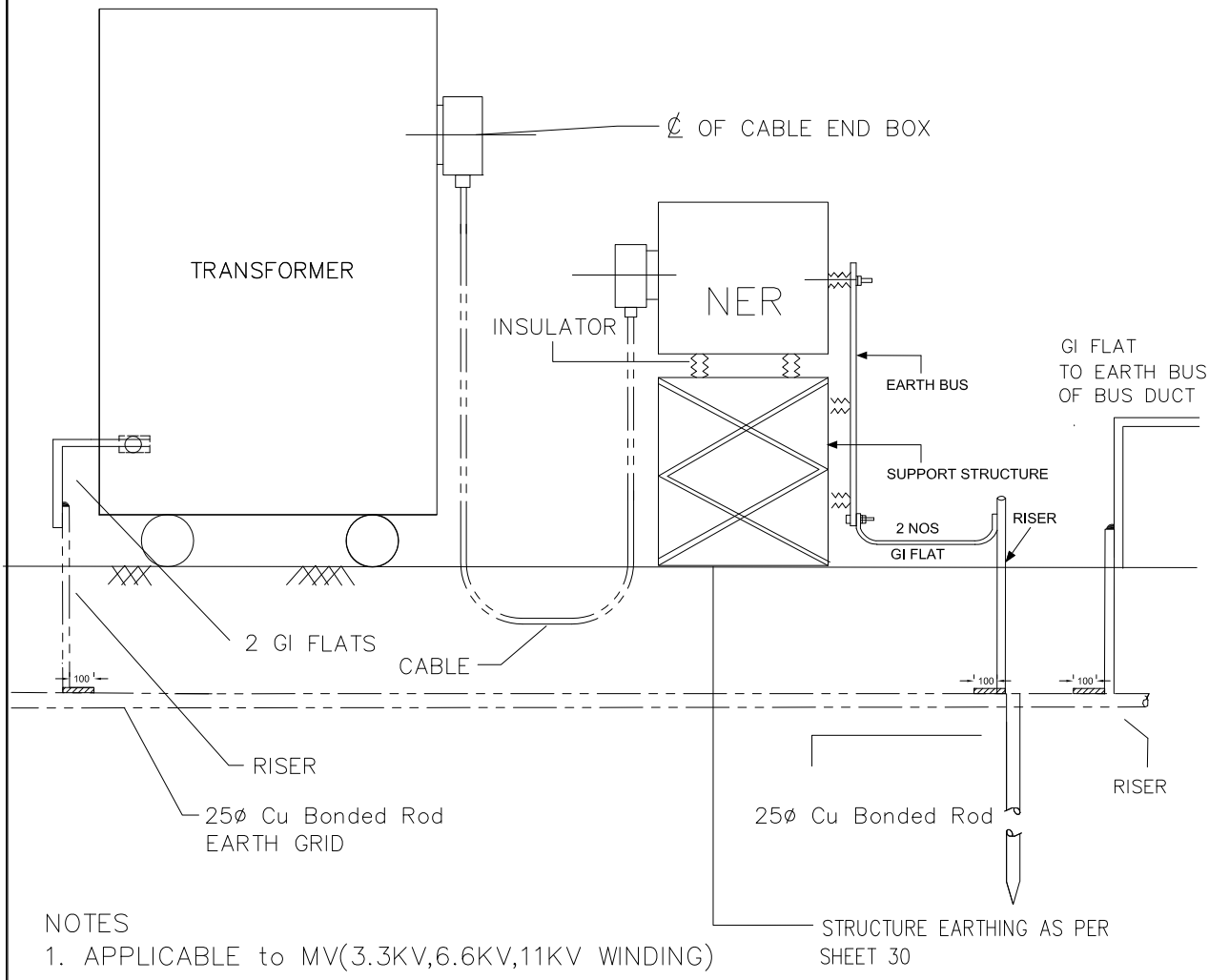
TITLE:-

TRANSFORMER NEUTRAL EARTHING (DIRECT)

BSES Yamuna Power Limited

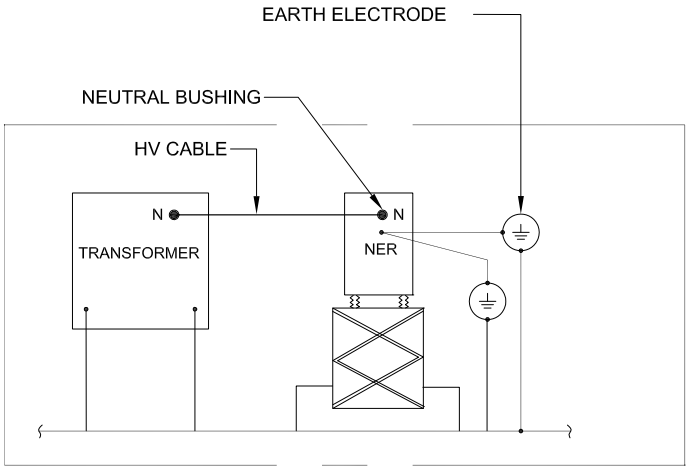
FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

A4 [210x297]



NOTES

1. APPLICABLE to MV(3.3KV,6.6KV,11KV WINDING)



LINE DIAGRAM

NEUTRAL EARTHING THROUGH NER

DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

TITLE:–

TRANSFORMER NEUTRAL EARTHING (THROUGH NGR)

BSES Yamuna Power Limited

FILE NAME: REL–COENG–NEE–E21–P–00085 DATE:–08.09.10

A4 [210x297]

Technical Specification

Of

Insulated Floor Coating

Specification no – BSES-TS-75-INFC-R0

Rev:		0
Pages:		1 of 7
Date:		06 May 2022
Prepared by	Abhishek Harsh	3267d7c3-82b5-46cb-b5a6-867ee7820a34
Reviewed by	Srinivas Gopu	5d32525e-ed3a-4f41-b1c7-b8a5e77d1519
Approved by	Gaurav Sharma	23dc2de2-95de-4472-99a7-dea873f472b6

INDEX

DocUUID : 0741b82a-0e63-45fd-a24f-3f04776609e6

1 SCOPE

This specification covers the basic requirement, the testing and inspection, supply and installation/fixing of insulating paints on floors in front of the switchgear panels at BYPL/BRPL grid locations.

2 STANDARDS AND CODES

2.1.	IS 15652:2006	Specification of Insulating mats for electrical purposes
2.2.	CEA guidelines, 2010	Measures relating to safety and Electric supply

3 SERVICE CONDITION

3.1	Location	Indoor
3.2	Average grade atmosphere	Heavily polluted, Dry
3.3	Maximum altitude above sea level	1000M
3.4	Ambient air temperature	Highest 50Deg C Average 40Deg C
3.5	Minimum ambient air temperature	0 Deg C
3.6	Relative Humidity	100%
3.7	Rainfall	750mm concentrated in four months
3.8	Seismic Zone	IV

4 GENERAL REQUIREMENTS OF INSULATING PAINTS ON FLOORS

4.1	General Properties	a. The Insulating coating shall be self-levelling, solvent free, and have high breakdown voltage, loaded with special insulating additives. b. The material of the insulating floor shall be epoxy resin. c. It shall be resistant to chemicals and oils. d. It shall be tough, wear & weather resistant. e. It shall exhibit high build, high adhesion with smooth and glossy finish and slip resistant. f. It shall be easy to apply/install, clean and repair on floors.
4.2	Colour of the finished item	The insulating floors shall be light Grey in colour

DocUUID : 0741b82a-0e63-45fd-a24f-3f04776609e6

4.3	Class of the insulating floor to be used	For 11kV voltage : Class B For 33kV voltage : Class C
4.4	Thickness of the paint on floor	For 33kV voltage : 3 mm +/- 10% For 11kV : 2.5 mm +/- 10%
4.5	AC proof voltage	For 33kV : 36kV minimum For 11kV: 22 kV minimum
4.6	Dielectric strength	For 33kV: 65kV rms For 11kV: 45kV rms

5 TESTING AND INSPECTION

5.1	Routine and Acceptance tests in the factory	All the routine and acceptance tests shall be performed as per IS 15652. The purchaser reserves the right to witness the tests at the time of inspection.
5.2	Inspection at site	The purchaser reserves the right to verify the material at the time of applying the insulating floors at site. Following tests shall also be verified at site: 1. Dielectric strength 2. Ac proof voltage 3. Thickness
5.3	Type Test Reports	All the Type test reports of the material to be used as the insulating floors as per IS 15652 from CPRI/ERDA shall be submitted.

6 INSTALLATION

DocUUID : 0741b82a-0e63-45fd-a24f-3f04776609e6

6.1	Application of insulating paints	a. The insulating paint shall be applied in accordance with manufacturer's installation procedure. b. The purchaser may witness the painting process.

7 INSPECTION AND TESTING

7.1	Type test	Equipment should be of type tested quality only, type test certificate to be submitted along with offer. If the manufacturer's lab is accredited by govt. / authorized body then it shall be acceptable for type testing.
7.2	Acceptance & Routine tests	As per relevant Indian standard

8 PACKING, SHIPPING, HANDLING AND SITE SUPPORT

8.1	Packing Protection	The packing shall be fit to withstand rough handling during transit and storage at destination. The test set should be properly protected against corrosion, dampness & damage.
8.2	Packing for accessories and spares	Robust non-returnable packing case with all the above protection & identification Label. The bidder should get the packing list approved before dispatching the material.
8.3	Packing Identification Label	On each packing case, following details are required:
8.3.1	Individual serial number	
8.3.2	Purchaser's name	
8.3.3	PO number (along with SAP item code, if any) & date	
8.3.4	Equipment Tag no. (if any)	
8.3.5	Destination	
8.3.6	Manufacturer / Supplier's name	
8.3.7	Address of Manufacturer / Supplier / it's agent	
8.3.8	Description	
8.3.9	Country of origin	

DocUUID : 0741b82a-0e63-45fd-a24f-3f04776609e6

8.3.10	Month & year of Manufacturing	
8.3.11	Case measurements	
8.3.12	Gross and net weight	
8.3.13	All necessary slinging and stacking instructions	
8.4	Shipping	The seller shall be responsible for all transit damage due to improper packing.
8.5	Handling and Storage	Manufacturer instruction shall be followed.
8.6	Detail handling & storage instruction sheet / manual to be furnished before commencement of supply.	

9 DEVIATIONS

9.1	Deviation	Deviations from this Specification shall be stated in writing with the tender by reference to the Specification clause/GTP/Drawing and a description of the alternative offer. In absence of such a statement, it will be assumed that the bidder complies fully with this specification. No deviation will be acceptable post order.

10 DOCUMENT SUBMISSION

Drawing submission shall be as per the matrix given below. All documents/ drawing shall be provided on A3/A4 sheet in box file with separators for each section. Also provide USB containing pdf with bid for soft copy. Language of the documents shall be English only. Deficient/ improper document/ drawing submission may liable for rejection

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
15.1	Contact Person Name, Email ID and Mobile Number	Required			
15.2	Deviation Sheet	Required	Required		
15.3	Type Test	Required			
15.5	Manufacturer's quality assurance plan and certification for quality standards		Required		
15.6	Datasheet		Required		

DocUUID : 0741b82a-0e63-45fd-a24f-3f04776609e6

15.7	Floor Layout		Required		
15.13	GTP	Required	Required		
15.14	QAP		Required		
15.15	BOQ		Required		
15.19	Make of all Component as per specification		Required		
15.20	Inspection Report			Required	
15.21	As manufacturing Drawings			Required	
15.22	Operation and Maintenance Manual			Required	Required
15.24	As built Drawings				Required
15.25	Test Report				Required

11 GUARANTEED TECHNICAL PARTICULARS

Vendor must submit clause wise compliance in Excel sheet against specification at the time of drawing approval clearly highlighting the deviations from specification against each clause.

DocUUID : 0741b82a-0e63-45fd-a24f-3f04776609e6

TECHNICAL SPECIFICATION

SCADA RTU/ DCU & NETWORK AUTOMATION SYSTEM FOR 66/33/11kV NEW GRID STATION (IEC 61850 PROTOCOL)

INDEX

PREPARED BY	REVIEWED BY	APPROVED BY	REV	1
			DATE	06th May 2022
AISHWARYA V	RAJEEV V	ANIL V	PAGE	1 of 50

INDEX

Sr. No.	Topic	Description
1	**Scope of the Document**	BYPL already has SCADA Control Centre implementation consisting of MCC (Master Control Centre) and (BCC) Business Continuity Centre (commissioned by M/s ABB Ltd. with Network Manager Ver 5.5) through which currently 55 grid stations and approx 400 DMS stations are being controlled and monitored. The present SCADA RTU/ DCU & Network system enable remote monitoring and controlling of all equipment's of the unmanned grid stations. This document states that the new RTU/ DCU & Network automation system supplied will integrate with the existing SCADA infrastructure enabling remote monitoring and controlling of grid equipment's, facilitating unmanned station provision. The scope of this specification covers all the Technical requirements of the RTU/ DCU & Network Automation system including System Architecture design, Manufacturing, Quality, Testing facility at manufacturer's works, packing, forwarding with loading/ unloading at site/ stores. It also states the installation, commissioning and testing of all the equipment's supplied or required for efficient and trouble free SCADA RTU/ DCU & Network Automation system. The scope also covers supply of spares, trainings, configuration tools and documents. This document describes the automation requirement for C&R/ switchgear panels, IEDs, and all other items required for SCADA controlled 66/33/11 kV power system supplied in grid. The specific requirements are covered under technical requirements (Ref. 3)
2.	**Climate conditions for system**	The atmosphere of Delhi/National Capital Region (NCR) is generally laden with mild acid and dust suspended during dry months and subjected to fog in cold months. The design of the equipment's and accessories shall be suitable to withstand seismic forces corresponding to an acceleration of 0.1g • Max. Ambient Temperature (Working): 50°C • Min. Ambient Temperature: 0°C • Max. Humidity: 95% non-condensing • Min. Humidity: 10% • Avg. no. of Thunderstorm days per annum: 50 • Avg. Annual Rainfall: 750mm

		The supplier/ BA is required to submit climate compliance test certificate for supplied SCADA RTU/ DCU & network Automation system.
3	**Technical Requirements**	
3.a	General requirements for Supplier/ Business Associates (BA)	The supplier/ BA should have at least 10 years of experience in design, manufacturing and supply of SCADA RTU/ DCU & Network Automation system integrated with the protection system for controlling and monitoring of the electricity transmission and distribution network. The supplier/ BA needs to submit the proof of completing minimum 5 such projects with other Indian utilities/ concerns as its experience certificate. The supplier/BA should have direct business office at Delhi/NCR. In case of support through business partners details of customers supported by the service partners to be submitted to BYPL. The supplier/ BA should have experience of SCADA RTU/ DCU and Network system integration with numerical relays/ IEDs on standard international protocols (Ref 3.d). The supplier/ BA shall produce a well- structured project plan constituting of timelines for installation, commissioning and testing of the SCADA RTU/ DCU and Network Automation system to which he will have strictly abide. The supplier/ BA can offer an innovative and advanced system and the ways and cost to integrate the same in the existing infrastructure. The offer is subjected to an approval from BYPL after a thorough discussion between the supplier/BA and BYPL. In case, an approval is not awarded to the supplier/BA's offered innovative system, BYPLs existing/ desired infrastructure prevails and the supplier/BA shall provide the system accordingly. The supplier/ BA should optimize on the cost of software products offered to BYPL considering already available licenses with BYPL. The supplier/BA should clearly indicate licensing policy for the software tools offered. The supplier/ BA should be technically capable to provide necessary training to the personnel recommended by BYPL to maintain the system and troubleshooting reports (Ref. 10)
3.b	General System	The SCADA RTU/ DCU & Network Automation system shall be modular

	Design	and suitable for remote operation and monitoring of the complete substation including future expansions. The systems shall be state of the art, suitable for operation under electrical environment present in high voltage substations (66/33/11kV), follow the latest engineering practice, and ensure long-term compatibility requirements and continuity of equipment supply and the safety of the operating staff. The housing of the SCADA RTU/ DCU & Network Automation system hardware should be IP class protected suitable for both indoor and outdoor installations. The offered SCADA RTU/ DCU & Network Automation system shall support remote control and monitoring from existing remote SCADA control centers (MCC/ BCC) via gateways. The system shall be designed such that personnel without any background knowledge in Microprocessor-based technology are able to operate the system. The operator Interface shall be intuitive such that operating personnel shall be able to operate the system easily after having received some basic training. The system shall incorporate the control, monitoring and protection functions specified, self-monitoring, signaling and testing facilities, measuring as well as memory functions, event recording and evaluation of disturbance records. Maintenance, modification, diagnosis or extension of components shall not cause a shutdown of the whole SCADA RTU/ DCU & Network Automation system. Self-monitoring of components, modules and communication shall be incorporated to increase the availability and the reliability of the equipment and minimize maintenance. The SCADA RTU/ DCU and Network Automation system should be processor, co-processor, power supply, rack and media redundant. The SCADA RTU/ DCU & Network Automation system should be web accessible with facility to upload/ download the system configuration files and controlling & monitoring of equipment's. The SCADA RTU/ DCU & Network Automation system should be cyber secured with user based configured password protection.

3.c	System Architecture	The SCADA RTU/ DCU & Network Automation system shall be based on decentralized architecture and on concept of bay-oriented, distributed intelligence. Functions shall be decentralized, object-oriented and located as close as possible to the process. The main process information of the station shall be stored in distributed databases. The typical SCADA RTU/ DCU & Network Automation system architecture shall be structured in two levels, i.e. station and bay level. At bay level, the IEDs shall provide all bay level functions regarding control, monitoring and protection information, inputs for status indications, outputs for commands and measurand/ analog data. The IEDs should be directly connected to the switchgear without any needs for additional interposition or transducers. Each bay control IED shall be independent from each other and its SCADA functioning shall not be affected by any fault occurring in any of the other bay control units of the station. The data exchange between the electronic devices on bay and station level shall take place via the communication infrastructure. Data exchange is to be realized on PRP using IEC 61850 protocol with a redundant managed layer 2 switched Ethernet communication infrastructure. The Ethernet switch must be IEC 61850 compliant and KEMA, CE and FCC certified. The communication shall be made in 1+1 mode (PRP) for IEC 61850 protocol, including the fiber link between the individual bay IEDs to bay switch and Ethernet link between the bay switch to RTU/ DCU, such that failure of one link shall not affect the normal operation of the SCADA RTU/DCU & Network Automation system. However it shall be alarmed in SCADA RTU/ DCU & Network Automation system. Communication shall be on serial link between IEDs like MFMs, DCDBs and the processor with SPD. Clear control priorities shall prevent operation of a single switch at the same time from more than one of the various control levels, i.e. MCC/ BCC, bay level or apparatus level. The priority shall always be on the lowest enabled control level.

<table>
<tr>
<td>3.d</td>
<td>Communication Interface and Protocol</td>
<td>The communication protocol for gateway to control centers must be on IEC 60870-5-104 protocol. While the communication for sub-station IEDs of Bay level and station level must be on IEC 61850 protocol. In addition the RTU/ DCU should have RTU/ DCU serial Modbus RS485 protocol for communication to MFMs and DCDBs. DCDB, NIDS, NIFPS (8 No. DI signals for integration) and APFC should also interfaced with RTU through hard-wiring.

Different protocols to integrate the SCADA RTU/ DCU & Network Automation system are as given in Table 3.d [1]:

<table>
<tr><th colspan="2">Table 3.d [1]</th></tr>
<tr><td>RTU/ DCU to SCADA Control Centers (MCC/ BCC)</td><td>IEC 104</td></tr>
<tr><td>RTU/ DCU to Transformer Monitoring Unit/ NIDS/ APFC</td><td>IEC 61850</td></tr>
<tr><td>RTU/ DCU to Bay Control Units/ Relays</td><td>IEC 61850</td></tr>
<tr><td>RTU/ DCU to MFMs and DCDB</td><td>RTU/ DCU serial Modbus RS485</td></tr>
</table>

NOTE: Converters (protocol/ media/ power supply) of any sort will not be permitted for RTU/ DCU and Network Automation system.</td>
</tr>
<tr>
<td>3.e</td>
<td>IEC 61850 compliant Managed Ethernet switch & network</td>
<td>The IEC 61850 compliant Managed Ethernet switch shall meet the demand of power system automation systems (IEC 61850-3, IEEE 1613 compliance).

• Ethernet switch shall be layer 2 industrial grade.
• Ethernet switch shall be modular with SFP for copper and fiber port.
• Ethernet switch port shall be approve by engineering in charge of SCADA.
• Ethernet switch shall be 19” rack mounted.
• Ethernet switch shall operate at 36 to 72 VDC power supply.
• Operating Temperature: -40°C to +85°C.
• All port shall be user configurable with minimum configuration of 100Mbps.
• Communication type: Fiber Optics media and ST/LC Connector compatible with IEDs supplied with CRP, As Per Site and Ethernet copper CAT6/ above cable. Further approval at the time of final</td>
</tr>
</table>

		engineering approval. • LED indicators on all ports shall be blinking with data transfer. • The switch should have a diagnostic/ error/ warning LED. • It should support remote user setting configuration. • It should own separate maintenance/ console port. • Latency shall be not more than 10ms. • Should be KEMA, CE and FCC Certified. • Switch should be extendable for future expansion. • Minimum 20% spares of utilized hardware and accessories to be provided by the supplier/ BA. • On-site warranty for the switch must be 5 years. The warranty certificate is required to be submitted by the supplier/ BA to BYPL at the time of SAT. • Shall be suitably mounted in CRP/switchgear panel. • Ethernet Switch shall have required nos. of ports (having RJ45 Ports / FO Ports).Minimum 20% spare ports shall be provided. Final approval at the time of detail engineering. • Power Supply of EFS shall be Dual redundant with pluggable terminal block. • Shall have Environmental conditions compliance as per IEC60068-2-1 COLD TEMPERATURE IEC60068-2-2 DRY HEAT IEC60068-2-30 HUMIDITY IEC60068-21-1 VIBRATION IEC60068-21-2 SHOCK • Shall have Features: Management through Web-based, Telnet, CLI SNMP supported Remote Monitoring Diagnostics with logging and alarms Console ports • Shall have Product conformity acc. to IEEE 802.3-10BaseT Yes acc. to IEEE 802.3u-100BaseTX Yes acc. to IEEE 802.3u-100BaseFX Yes acc. to IEEE 802.3ab-1000BaseT Yes acc. to IEEE 802.3ad-Link Aggregation Yes acc. to IEEE 802.3x-Flow Control Yes acc. to IEEE 802.1d-MAC Bridges Yes acc. to IEEE 802.1d-STP Yes acc. to IEEE 802.1p-class of service Yes acc. to IEEE 802.1Q-VLAN tagging Yes

<table>
<tr>
<td></td>
<td></td>
<td>
acc. to IEEE 802.1Q-2005 (formerly IEEE 802.1s) MSTP Yes
acc. to IEEE 802.1w-RRST Yes
acc. to IEEE 802.1x-port based Network Access Control

• Shall have Mode Store and Forward
• Shall have Protection class IP4X,Conformal Coating,IPV6
• Shall have Authorized Repair center of original Ethernet switch manufacture in India.
• Shall have Uplink Rate 1 GBPS and Downlink Rate 100 MBPS

<table>
<tr><th colspan="2">Table 3.e [1] BYPL approved Makes</th></tr>
<tr><th>S.No.</th><th>Make</th></tr>
<tr><td>1</td><td>Ruggedcom</td></tr>
<tr><td>2</td><td>Hirschmann</td></tr>
</table>

The specified makes are to be strictly adhered to and no change will be considered hereto.
</td>
</tr>
<tr>
<td>3.f</td>
<td>RTU/ DCU Enclosure</td>
<td>
RTU/ DCU enclosure should be suitably sized minimum 800mm to accommodate all RTU/ DCU and network accessories, self-standing, fabricated 14 gauge, CRC sheet, duly powder coated paint (RAL 7032 Siemens Grey Structure Shade) with black color plinth and IP class IP5X protected suitable for both indoor and outdoor installations.

Enclosure Details:

• Panel should have a front toughened glass door behind which the RTU/ DCU racks should be mounted on a swing door frame. Doors should have Ergoform- S lock system with key.
• The whole RTU/ DCU hardware should be housed in an energy-efficient Air Conditioned cabinet with temperature and humidity controller.
• Enclosure should have GI mounting plate fitted on its rear wall. Rear wall shall be fixed.
• It should have gland plates suitably sized, fabricated with 3mm CRC sheet, duly powder coated paint (RAL 7032 Siemens Grey Structure Shade).
• Enclosure should have sufficient illumination system with door interlocks, crankcase heaters, Rat/ Rodents repellent system, drawing pocket etc.
• It should have a roof mounted exhaust fan with a removable screwed
</td>
</tr>
</table>

<table>
<tr>
<td></td>
<td></td>
<td>covering, to be used as an alternative in case of AC failure.
• Copper earth strip of suitable size to be provided for both power and electronics, separately.
• A minimum 30% free space should be provided for spares for future expansion.

Table 3.f [1] BYPL approved Makes
<table><tr><th>S.No.</th><th>Make</th></tr><tr><td>1</td><td>Rittal</td></tr></table>
The specified makes are to be strictly adhered to and no change will be considered hereto.</td>
</tr>
<tr>
<td>3.g</td>
<td>RTU/ DCU System</td>
<td>In general the RTU/ DCU system design should aim to minimize power consumption and heat generation. The RTU/ DCU shall be modular type, housed in a 19” rack consisting of processor, co-processor, Digital Input/ Output and Analog Input/ Output modules, power supply and communication interface module, Ethernet switches etc. The auxiliary supply of RTU/ DCU and network system should be 48VDC nominal range: 36-72 VDC with copper wire of suitable size.

RTU/ DCU system should be completely wired up with all the required accessories like MCB, heavy duty CMRs (miniature contactors), rack mounted DC-DC converters, contactors, screw terminals, PVC duct, galvanized GI mounting channels etc. and should be enclosed in an air-conditioned self- standing enclosure.

RTU/ DCU system:

• RTU/ DCU should be modular and expandable
• RTU/ DCU system should have redundant processor, co-processor, power supply, rack, Ethernet switch, bay and station network level.
• It should have a under voltage and earth leakage detection system.
• RTU/ DCU processor should communicate to MCC and BCC on IEC 60870-5-104 protocol on a single IP address.
• Processor and co-processor should be capable to communicate with IEDs (Protection Relays, Digital RTCC relay, bay controller etc.) on IEC 61850 protocol and MFMs, DCDBs to communicate on RS485 RTU/ DCU Modbus slave. DCDB, NIDS and APFC should also interface with RTU through hard-wiring.</td>
</tr>
</table>

<table>
<tr>
<td></td>
<td></td>
<td>

RTU/ DCU system should have programmable logic capabilities supported by easy to use editing facilities. These capabilities shall enable the RTU/ DCU to perform functions using ladder, FBD and statement language as per IEC standard.
Internal battery backup to hold data in SOE buffer memory & also Maintain the time & date.
RTU shall have Integrated HMI/Web based HMI feature.
RTU shall have security log and event archive feature.
All digital and analog input-output modules should be housed in a separate rack.
Digital input and output modules should be 16 channels, 48VDC and potential free contact respectively.
Analog input should be 8/ 16 channel, 16-bit resolution, and universal type, configurable for all ranges between ±10VDC and ±20mA.
RTU/ DCU system should have minimum 20% spares of utilized RTU/DCU & Network hardware and accessories, completely wired up to the last terminal.

<table>
<tr><th colspan="3">Table 3.g [1] BYPL approved Makes with Type</th></tr>
<tr><th>S.No.</th><th>Make</th><th>Type</th></tr>
<tr><td>1</td><td>ABB Ltd.</td><td>RTU560</td></tr>
<tr><td>2</td><td>Schneider</td><td>Saitel DP</td></tr>
<tr><td>4</td><td>Siemens</td><td>A8000</td></tr>
</table>
The specified makes are to be strictly adhered to and no change will be considered hereto.
</td>
</tr>
<tr>
<td>3.h</td>
<td>Control Wiring, Name Plate and Marking System</td>
<td>
Panel Control Wiring

Suitable size and color control and power wiring to be used for the connection of RTU/ DCU equipment and accessories along with proper and suitable lugs and ferrules. Control wire used inside the panels should be as per international color standards, approved by BYPL.
Field Control Wiring

All control and power cables used in the RTU/ DCU and Network Automation system should be multi-core, FRLS, armored with copper multi-strand.
All communication cables used in the RTU/ DCU and Network Automation system should be tinned copper high density shielded

</td>
</tr>
</table>

or armored with PVC FRLS.
All Optical Fiber Cables (OFC) used in the RTU/ DCU and Network Automation system should be of proper size, armored and suitable for multi/ single mode operations.

- Laying of control and communication cable from field to RTU/ DCU should be in separate cable trays and armored conduit/ duct of suitable size.

- The field wiring material and laying plan is to be submitted by the supplier/ BA and should be duly approved by the engineering staff of SCADA, BYPL before the commencement of work.

- During execution if any replacement/ changes (due to site constraint) are required in the material/ field wiring and laying that shall be duly made by the supplier/ BA without any additional costs within the committed time (maximum one (1) week).
- All field wiring make and model should be approve by SCADA engineering in-charge at the time of detail engineering.

Table 3.h [2] Field Control Wiring

Description	Approved Make
RS485 Wire	Belden or equivalent
Ethernet	D-link, Belden or equivalent
Fiber optic cord	Preston or equivalent

Equipment Name Plate

- All equipment's either in RTU/ DCU panel or field should have proper name plate.
- The name plate material, size, and text font and size are to be submitted by the supplier/ BA and should be duly approved by the engineering staff of SCADA, BYPL before the commencement of work.
- Sample name plates are to submit for approval before field installations, any changes suggested by BYPL shall be duly incorporated.
- During the execution any change in name plate size, text font or size suggested by BYPL shall be duly incorporated without any additional costs within the committed time (maximum one (1) week).

		Marking System • The panel and field control wiring Marking System should be proper for the system. The name plates should be properly engraved and all wires should have proper size ferrule nos. and printing life for both should be of minimum 10 years.
3.i	RTU/ DCU Commissioning	• The supplier/ BA will install all network, control and RTU system as per BYPL approved network system architecture • The supplier/ BA will configure, validate and submit the network as per system requirement which will be verified and approved by SCADA engineering in-charge. • The supplier/ BA will be responsible for commissioning of RTU/ DCU with all IEDs as per Annexure 12.b provided. • RTU/ DCU network commissioning engineer (supplier/ BA) will be responsible for IEC 61850 protocol files. • During the local testing, only and only if the punch points are thorough then only final testing will be done. • Final point-to-point testing from SCADA Center is to be necessarily cleared before SAT.
3.j	Time synchronization and SOE	A dedicated GPS signal from the SCADA MCC & BCC (FEP) will be provided for the synchronization of the entire system. This GPS signal would be available to the RTU/ DCU at regular specified intervals and the RTU/ DCU in turn should synchronize all devices via the inter bay bus using SNTP protocol as defined in IEC 61850 standard. To analyze the chronology or sequence of events occurring in the power system, time tagging of data is required which shall be achieved through SOE feature of RTU. The RTU shall have an internal clock with the stability of 10ppm or better. The RTU time shall be set from time synchronization messages received from master station using IEC 60870-5- 104 protocol. In addition, the message can be transmitted using NTP/SNTP. SOE time resolution shall be 1ms or better. The RTU shall maintain a clock and shall time-stamp the digital status data. Any digital status input data point in the RTU shall be assignable as an SOE point. Each time a SOE status indication point changes the state, the RTU shall time-tag the change and store in SOE buffer within the RTU. A

<table>
<tr><td></td><td></td><td>minimum of 10000 events shall be stored in the SOE buffer. SOE shall be transferred to Master Station as per IEC 60870-5-104 protocol. SOE buffer & time shall be maintained by RTU on power supply interruption.</td></tr>
<tr><td>3.k</td><td>Response Times and I/O Capacities</td><td>The total I/O count in a major substation will become large and it must be ensured that the hardware and communication links have sufficient performance to ensure prompt processing of data, Ref. Tables 3.k [1] and 3.k [2].

As I/O at the bay level, both digital and analog will typically be handled by intelligent relays or specialized IEDs, it is therefore important to ensure that these devices have sufficient I/O capacity and dual communication ports for PRP protocol.

<table>
<tr><th colspan="2">Table 3.k [1] Minimum system response times for a substation</th></tr>
<tr><td>Digital Input</td><td>1s</td></tr>
<tr><td>Analog Input</td><td>1s</td></tr>
<tr><td>Digital Output</td><td>0.75s</td></tr>
<tr><td>Disturbance Record File</td><td>3s</td></tr>
</table>

<table>
<tr><th colspan="2">Table 3.k [2] Typical I/O capacities for a substation</th></tr>
<tr><td>Digital Input</td><td>8192</td></tr>
<tr><td>Digital Output</td><td>2048</td></tr>
<tr><td>Analog Input</td><td>2048</td></tr>
<tr><td>Analog Output</td><td>512</td></tr>
</table>

The above are the minimum capacity which may change during detailed engineering of RTU/ DCU. The RTU/ DCU should have the capability of I/Os expansion.</td></tr>
<tr><td>3.l</td><td>Multi Function Meters (MFM)</td><td>A single network loop of MFMs should not have more than eight (8) MFMs. MFM communication network on RTU/ DCU serial Modbus RS485 should be protected against surges and electrical leakages therefore, it is necessary to install Surge Protection Devices placed in between the RTU/ DCU & MFM serial network loop.

The inter-looping of MFMs to be made by 22 guage Belden 8761 non-screened cable while the extension of the communication network from</td></tr>
</table>

<table>
<tr><td></td><td></td><td>MFM to RTU/ DCU to be made by 22 guage Belden 8761 Belden screened cable. The typical diagram for this connection is mentioned in the System Architecture diagram, Annexure 12.a.

Minimum two (2) spare links from CRP to RTU/DCU to be provided by supplier/ BA for future extension.

All hardware of the RTU/ DCU and Network Automation system and CT & PT wirings to MFMs and its configurations fall in supplier/ BAs scope.

The integration of MFM to be done as per the technical document and parameter configuration as per Annexure 12.b.
<table>
<tr><th colspan="2">Table 3.i [1] Field Control Wiring</th></tr>
<tr><th>Description</th><th>Approved Make</th></tr>
<tr><td>MFM</td><td>Delta energy</td></tr>
<tr><td>SPD</td><td>San-tele quip, Phoenix</td></tr>
</table>
</td></tr>
<tr><td>3.m</td><td>Transformer Monitoring cum Automatic Voltage Regulator (AVR) Unit</td><td>A digital transformer monitoring cum automatic voltage regulator unit is to be provided as per the tender document for each transformer and it should fulfill the following requirements for SCADA integration and configuration:

• As the name suggests, it should have the functionality of automatic voltage control.
• A digital transformer monitoring cum automatic voltage regulator unit should have the facility to measure CT, PT, Oil temperature, winding temperature and tap position etc. further these parameters shall be telemetered to SCADA RTU/ DCU on IEC 61850 protocol.
• It should have facility to control tap position, fan control etc. further these parameters shall be telemetered to SCADA RTU/ DCU on IEC 61850 protocol for monitoring and controlling.
• It shall have Microprocessor based Numerical relay having LCD display along with the software to make the parameters settings of the device and it shall be possible to do the parameter setting through keyboard unit.
• It should have the feature to set the parameters related to voltage regulation and fan control from MCC & BCC.
• The unit shall have suitable interface to communicate with higher level SCADA system as per the protocol proposed in the integrated package solution.</td></tr>
</table>

		• The unit should be capable of taking tap position, oil temperature inputs directly without any transducers. • The parameters configuration should be as per Annexure 12.b.
3.n	Maintenance, Diagnostics and Reliability	**Maintenance:** It is a requirement that all RTU/ DCUs require no routine or planned maintenance. Therefore, no fans or moving parts shall be used in the RTU/ DCU to avoid any need for maintenance. To ensure this, the RTU/ DCU should be constructed to resist the entry of dust. A single technician shall be able to remove and replace for repair purposes, without special tools and test equipment's involved in the operation of RTU/ DCU. Restoration of equipment to full operational use shall be possible within 15 minutes (nominally) of repairs being completed. It should not be necessary to dismantle (remove multiple pieces of) the RTU/ DCU in order to replace a module. **Diagnostics:** The vendor should provide remote maintenance and monitoring diagnostic and configuration tools (Laptop) which should be able to access the RTU/ DCU and all other IEDs using BYPLs TCP/ IP WAN network. The station should use RTU/ DCUs pass through access capability to monitor the station devices and carry out parameterization of the IEDs, Protection Relays and network devices in the station. • The supplier is required to provide diagnostic and licensed configuration software to run in the supplied tools and access the RTU/ DCU. This software tool shall allow building of new configuration file, modification and configuration of RTU/ DCU configuration file along with the below listed facilities: ▪ Monitoring of all inputs, control of all outputs and testing of calculation logic. Monitoring of all inputs and logic at card level, logic level and protocol level. ▪ Display of communication statistics and eavesdropping of communications channels, including Ethernet, IP, IEC103, IEC 104, IEC 61850 and Modbus. ▪ Download & upload of RTU/ DCU software, database configuration and calculations, upload the complete configuration from RTU/ DCU to modify and then download to RTU/ DCU. ▪ On-line help.

<table>
<tr>
<td></td>
<td></td>
<td>

Display time, date, current firmware, software and configuration running in the RTU/ DCU.
Configuration and diagnostic software must run on latest Microsoft Windows version.

The diagnostic and configuration utility software shall be provided on a pen drive which is compatible with laptop/ PC. The current version number of such software shall be provided.

Reliability:

The RTU/ DCU and Network Automation system will normally remain in continuous service, 24X7, to provide SCADA facilities. A high level of reliability is required as failure can result in the interruption of the operation and monitoring of the Power System Control.

Predicted availability of equipment supplied should exceed the following:

<table>
<tr><th colspan="2">Table 3.n [1]</th></tr>
<tr><th>System Function</th><th>System Availability</th></tr>
<tr><td>Control and monitoring of any one breaker/ equipment</td><td>99.99%</td></tr>
<tr><td>Monitoring of any one status & measurand data indication</td><td>99.99%</td></tr>
<tr><td>Monitoring of any one status/ measurand/analog input</td><td>99.99%</td></tr>
</table>
</td>
</tr>
<tr>
<td>3.o</td>
<td>Interchangeability & Future Extendibility</td>
<td>
Interchangeability:

RTU/ DCU parts like processors, co-processors and interface modules and network hardware shall be interchangeable individually, and as a whole RTU/ DCU without the need of re-configuration with pre-programmed flash memory. Any such change or replacement shall not reduce the capability of the equipment to conform to requirements of this specification.

Each module and switch links of the RTU/ DCU and Network Automation system should have Hot Swap feature i.e., at the time of removal/ insertion of modules and switch links, the system should not become faulty and automatically recognize the new module and switch link without any need of system reboot.
</td>
</tr>
</table>

		Future Extendibility: Offered SCADA RTU/ DCU & Network Automation system shall be suitable for extension in future for additional bays. During such requirements, all the drawings and configurations, alarms/ events list etc displayed shall be designed in such a manner that its extension shall be easily performed by the BYPL user. During such event, normal operation of the existing substation shall be unaffected and system shall not require a shutdown. The BA shall provide all the necessary software tools along with the source codes to perform addition of bays in future and complete integration with RTU/ DCU & Network Automation system by the user. These software tools shall be able to configure IEDs, add additional analog variables, alarm list, event list, modify interlocking logics etc. for additional bays/ equipment which shall be added in future. Offered RTU/ DCU & Network Automation System including switches shall have minimum 20% spare of utilized RTU/DCU & Network Automation system hardware and accessories, completely wired up to the last terminal.
3.p	Service life, Warranty and Replacement Support	**Service Life:** BYPL prefers that the major equipment's of RTU/ DCU and Network Automation system shall be capable of complying with this standard, including performing its intended purpose, for a minimum of 10 years from the date of supply. The supplier/BA shall provide a service support letter containing: • The date at which the product was released for sale. • The anticipated date at which the product will be withdrawn from sale, but support will continue to be supplied. • 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. **Warranty and Replacement Support:** During the guaranteed availability period, the spare parts supplied by the supplier/ BA shall be made available to the supplier/ BA for usage subject to replenishment within the committed time (maximum eight (8) weeks). Thus, after the system is revived the inventory of spares with BYPL shall be fully replenished by the supplier/ BA. However, any additional spares required to meet the availability of the system (which is not a part of the above spares supplied by the supplier/ BA) would have to be supplied

		immediately by the supplier/ BA free of cost to BYPL. • RTU/ DCU and Network Automation System Hardware: Minimum 5 years • RTU/ DCU and Network Automation System Accessories: 2 years • Managed Ethernet Switch: 5 years At the time of failure or non-availability of the system, during the warranty period, the supplier/ BA is required to visit the site on BYPLs call within 24hrs, free of cost to revive the system. The supplier/ BA should submit a liability warranty support certificate to BYPL.
3.q	RTU/ DCU & Network Earthing System	Two types of earthing should be provided by the supplier/ BA: power and electronics. Both should be of copper, isolated and suitably sized (as per BYPLs approval). Power earthing should be connected to the RTU/ DCU Enclosure, light, fan, AC while the electronic earthing will be connected to the inside modules of the RTU/ DCU. Color of earthing wire: Green and Yellow/ Green In the receiving station, grid earthing will be used for RTU earthing.
3.r	DR Download	The proposed SCADA network should be configured for remote downloading of DR over WAN from any one (1) location falling under BYPL jurisdiction. All the required configuration settings of the supplied network are to be made by the supplier/ BA.
3.s	RTU Auxiliary Power supply system	Power for the RTU/ DCU & Network Automation system shall be derived from substation 48/ 220V DC system. The power supply system will have a wide range, 48 VDC nominal : 36- 72 V. The supplier/ BA may use DC- DC converter to convert grid control voltage 220VDC to 48VDC with wide operating range. The power supply system should be redundant and distributed through MCB of suitable ratings. Power supply should also be equipped with surge protection device.

Table 3.s [1] Field Control Wiring

Description	Approved Make
DC DC converter	Meanwell or equivalent

3.t	Cyber security	Offered system shall have advance cyber security feature which comply below mentioned standards and certificate shall be provided during detail engineering IEC 62443-4-2 IEC 62443-3-3 IEEE 1686 IEC 62351-3 IEC TS-62351-5 IEC 60870-5-7 security extension
4	**SCADA Commands, Indications & Measurands Data**	As per Annexure 12.b.
5	**Quality Control and Checklist**	The supplier/ BA is required to submit a plan of different stages of manufacturing and testing based on which subsequent reports and certificates shall be submitted. If during this period the manufacturing and quality is found unsatisfactory as to workmanship or material, the same is liable for rejection and the supplier/ BA will be obliged to provide standardized equipment as per BYPLs specifications. **Checklist:** 1. Space required for future expansion 2. Component layout 3. Wiring termination details 4. Equipment/ component make used in the panel with their specifications
6	**Pre- Dispatch Inspection (FAT) & Minimum Testing Facility**	**Pre-Dispatch Inspection (FAT):** After submitting and on BYPLs acceptance of the Test certificate and Quality Report, the supplier/ BA is required to call BYPL for Pre-Dispatch Inspection. The supplier/ BA should ensure the completion of manufacturing and set-up for Pre-Dispatch Inspection. Pre-Dispatch Inspection will be treated as FAT, which will only be carried on if the minimum testing facility has been arranged by the supplier/ BA. In case FAT is waived off, all the below mentioned points will be tested during SAT. The following tests are to be carried out under FAT:

		1) Visual inspection of dimensions, workmanship, quality and specifications of the equipments as per the approved drawing and tender document. 2) Test certificate and Quality Report verification as submitted 3) Simulation of RTU/ DCU & SCADA Network connectivity, data acquisition from IEDs/ MFMs and functionalities like: • Indications, Commands and Measurands data • Time synchronization • Sequence of Events • Redundancy, diagnostic feature • Interchangeability • Hot Swapping • Any other functionality as per the tender document 4) During the Pre-dispatch inspection period if the vendor fails to simulate any of the functionality mentioned above and as per the tender document then BYPL has the rights to scrap the inspection and another FAT will be arranged for which the supplier/ BA will bear the travel expenses including both side airfares, cab rent, food and lodging. **Minimum Testing Facility:** The minimum testing facility should include: 1) Minimum number of each type of relays being supplied by the supplier/ BA for SCADA RTU/ DCU and Network Automation system. 2) Complete SCADA RTU/ DCU and Network Automation system with redundancy connecting to each type of IED, at least two (2), being supplied by the supplier/ BA for the aforementioned system.
7	**Packing & Forwarding**	The supplier/ BA shall ensure that all equipment covered by this specification shall be prepared for rail/ road transport (local equipment) and be packed in such a manner so as to protect it from damage in transit. All equipment/ material are to be transported with proper packing and markings. Any damage to the equipment(s) during the transit will be borne by the supplier/ BA and the replaced damaged equipment(s) will be made available to BYPL within the committed time (maximum eight (8) weeks).

8 System Spares, Tools & Software Tools with Licenses

The bidder is required to list the spares, which may be required for ensuring the availability during the guaranteed availability period. The final list of spares shall form part of scope and accordingly the price thereof shall be quoted by the bidder and shall be considered in the evaluation of the bids.

The list shall include the following:

- Item identification
- Recommended spares quantities (minimum 20% of utilized Hardware of SCADA/ DCU and Network Automation System)
- Base price of proposed spares
- Procurement lead time probability of returning the replaced/ repaired spare parts
- Procurement lead time probability of the spare material BYPL may need to procure apart from this Tender
- Quantity of item held in local office by supplier/ BA as emergency spare parts.

All spare parts shall be fully tested, however BYPL has the right to return the tested spare part on being found faulty for which the BA/ supplier shall provide with replacement within the committed time (maximum eight (8) weeks).

Table 8 [1] Mandatory Spares

S.No.	Item	Qty	UOM
1.	RTU/ DCU & Network Hardware		
1.1	Rack redundant	1	No. each type
1.2	Rack I/O	1	No. each type
1.3	DI module with cable	1	No. each type
1.4	DO module with cable	1	No. each type
1.5	AI module with cable	1	No. each type
1.6	Managed Ethernet switch	1	No. each type
1.7	OFC patch cord	5	No. each type
1.8	Power Supply SMPS	2	No. each type
1.9	MCB	2	No. each type
1.10	Main Processor	1	No. each type
1.11	Co-processor connecting IEC 61850 protocol devices	1	No. each type
1.12	Co-processor connecting serial devices	1	No. each type
1.13	Power supply for RTU rack	1	No. each type
2.	RTU/ DCU Panel	Minimum	No. each type

			Accessories (Converters, Power Supplies etc.)	20% of Utilized Hardware of SCADA/ DCU and Network Automation System	
		3.	Communication Cable- RS485, LAN		
		4.	Control Cable		

Table 8 [2] Software Configuration Tools

S.No.	Item	Qty
1	RTU/ DCU configuration tools with licensed software and cables	2 Nos.
2	Network configuration tools with licensed software and cables	1 Nos.

9	**Drawings & Documents, Configuration Backup and Certificates**	**Drawings & Documents:** Following drawings and documents shall be prepared on BYPLs specifications and statutory requirements and shall be submitted before the starting of manufacturing: 1. Completely filled in Technical Particulars 2. General description of the equipment and all components including brochures 3. Bill of material 4. Type test certificates 5. System Design Architecture Drawing 6. Layout drawings of Control cable, communication cable and cable tray linking RTU/ DCU panel, communication panels/ hardware 7. Hardware Specification 8. Sizing Calculations of various components 9. Response Time Calculations 10. Functional Design Document 11. Power Distribution Schematic Diagrams for each RTU 12. Standard documentation per IED, according to IEC 61850 13. MICS document (Model Implementation Conformance Statement) 14. PICS document (Protocol Implementation Conformance Statement) 15. Conformance Test certificate 16. ICD File (IED Capability Description file) 17. SCD file (Substation Configuration Description)

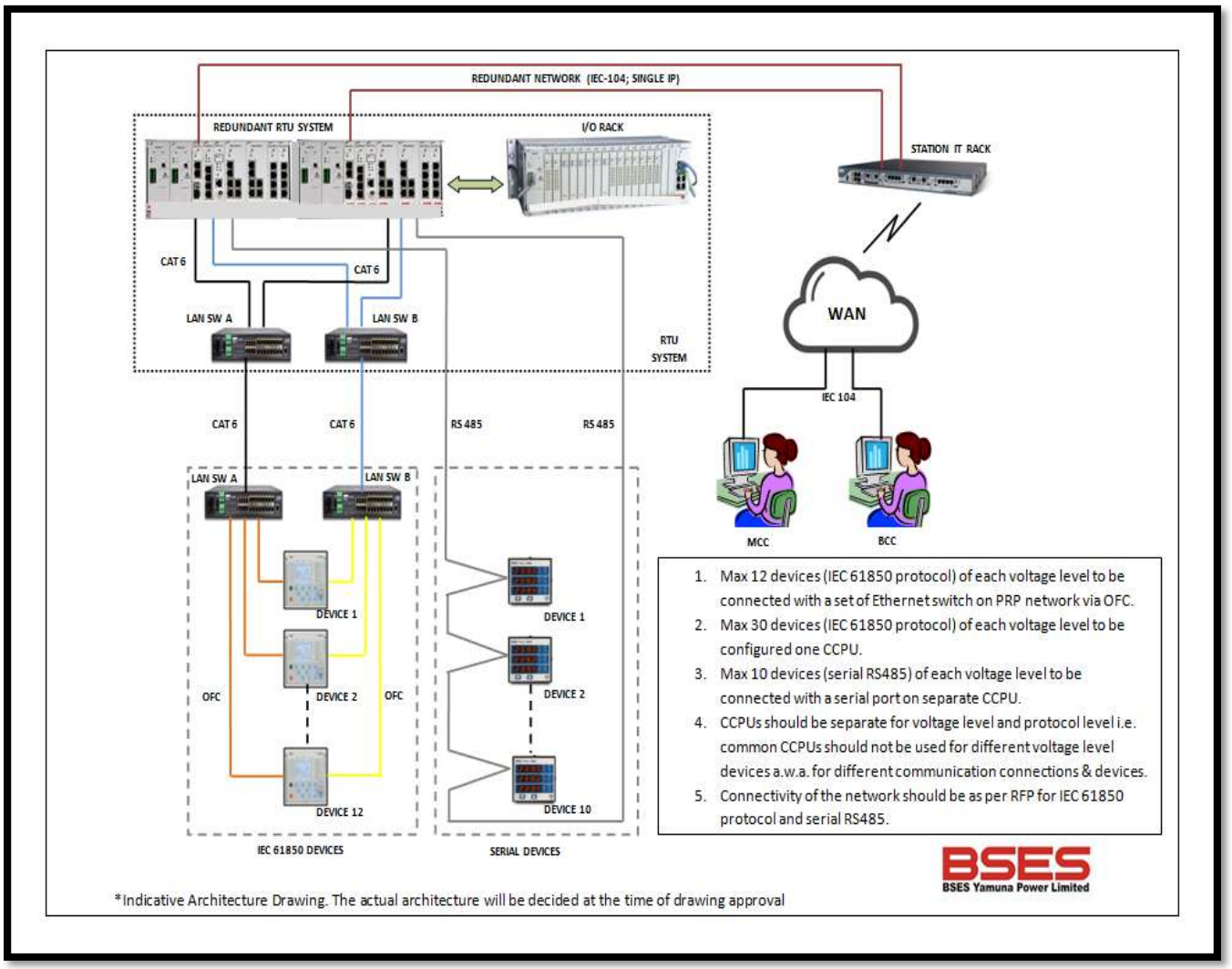
		After the award of the contract four (4) copies of drawings, drawn to scale, describing the equipments in detail shall be forwarded for approval and the supplier/ BA shall subsequently provide four (4) complete sets of final drawings, one of which shall be auto-positive suitable for reproduction, before the dispatch of the equipments. Soft copy (Pen drive) of the drawings, GTP, Test certificates shall be submitted after the final approval of the same to BYPL. All the documents and drawings shall be in English language. After execution any minor/ major change(s) made at the site to be incorporated in the documents and drawings and duly submitted to BYPL in the form of hard and soft copy. **Instruction Manuals:** Bidder shall furnish two (2) soft copies (Pendrive) and four (4)hard copies of nicely bound manuals (in English language) covering erection and maintenance instructions and all relevant information and drawings pertaining to the main equipments as well as the auxiliary devices. **Configuration Backup:** All Configuration files for RTU/ DCU and network automation system should be provided to BYPL. **Certificates:** 1. Test certificates of all the tests required and conducted by the supplier/ BA. 2. System and equipments warranty certificates 3. Maintenance and Service Agreement Certificates The supplier/ BA shall ensure that all the certificates mentioned in this document along with SAT document are submitted to BYPL at the time of SAT.
10	**Trainings and Hands-on**	The supplier/ BA personnel who are experienced instructors and who speak understandable English shall conduct training. The supplier/ BA shall arrange on its own cost all hardware training platform required for successful training and understanding at BYPLs works. The supplier/BA

		shall provide all necessary training material. Each trainee shall receive individual copies of all technical manuals and all other documents used for training. These materials shall be sent to BYPL at least two (2) months before the scheduled commencement of the particular training course. Class materials, including the documents sent before the training courses as well as class handouts, shall become the property of BYPL. BYPL reserves the right to copy such materials, but for in-house training and use only. Hands-on training shall utilize equipment identical to that being supplied to BYPL. The schedule, location, and detailed contents of each course will be finalized during BYPL and supplier/ BAs discussions. If the supplier/ BA have 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. **System Hardware Course** A computer system hardware course shall be offered, but at the system level. The training course shall be designed to give BYPL hardware personnel sufficient knowledge of the overall design and operation of the system, so that they can correct obvious problems, configure the hardware, perform preventive maintenance, run diagnostic programs, and communicate with contract maintenance personnel. The following shall be covered: • System hardware design architecture overview: Configuration of the system hardware. • 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. • System Expansion: Techniques and procedures to expand and add equipment such as loggers, monitors and communication channels. • System Maintenance: Theory of operation, maintenance techniques and practices, diagnostic procedures and (where applicable) expansion techniques and procedures. Classes shall include hands-on training for the specific subsystems that are part of BYPLs equipment or part of similarly designed and configured subsystems. All interfaces to the computing equipment shall be taught in detail. • Operational Training: Practical training on preventive and corrective maintenance of all equipment, including use of special tools and instruments. This training shall be provided on BYPLs equipment or on similarly configured systems.

		System Software Course The contractor shall provide a computer system software course that covers the following subjects: • 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. • 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. • System Initialization and Failover: Including design, theory of operation and practice • Diagnostics: Including the execution of diagnostic procedure and the interpretation of diagnostic outputs. • Software Documentation: Orientation in the organization and use of system software documentation. • 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. **Application Software Course** The supplier/ BA shall provide comprehensive application software courses covering all applications including the database and display building course. The training shall include: • Overview: Block diagrams of the application software and data flows. Programming standards and program Interface conventions. • Application Functions: Functional capabilities, design and major algorithm. Associated maintenance and expansion techniques. • Software Development: Techniques and conventions to be used for the preparation and integration of new software functions. • Software Generation: Generation of application software from source code and associated software configuration control procedures. • Software Documentation: Orientation in the organization and use of functional and detailed design documentation and of

		programmer and user manuals. • 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. **Requirement of Training** The supplier/ BA shall provide training for a batch (maximum of 10 people) for five (5) days in two slots (Time of which will be decided by BYPL and supplier/ BA) on the following courses. Name of Course: • System Hardware • System Software • Application Software
11.	**SAT**	This document exclusively covers the SAT for SCADA RTU/ DCU and Network Automation system. After the successful commissioning and testing of the SCADA RTU/ DCU & Network Automation 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 RTU/ DCUs performance due to configuration and/ or hardware does not meet the criteria as per points 3.k and 3.n, the cycle will be reset. During the cycle, availability and operational efficacy of the system will be checked and after successful validation SAT will be concluded. SAT will include the validation of the following: 1. Communication Network 2. SCADA RTU/ DCU and Network redundancy 3. Validation of SOE 4. All approved Indication, Command and Measurand data. BYPL reserves the right to financially penalize the supplier/ BA on failure of SAT as per the technical and tender document.

Annexure 12.a (RTU/ DCU System Architecture Drawing)



Annexure 12.b (Signal List- 11/33/66kV)

A. 11kV Outgoing feeders- IEC 61850 Protocol

S.No.	Signal List	DI/ AI soft through N.Relay/ BCU	DO soft through N.Relay/ BCU	Signal Type
1.	Breaker ON	✓		DPI
2.	Breaker OFF			SPI
3.	Trip Ckt Healthy 1	✓		SPI
4.	Trip Ckt Healthy 2	✓		SPI
5.	Spring Charge	✓		SPI
6.	Breaker in Service	✓		SPI
7.	Breaker in Test	✓		SPI
8.	Auto Trip (86) Operated	✓		SPI
9.	Panel DC Fail	✓		SPI
10.	Panel AC Fail	✓		SPI
11.	L/R switch in SCADA	✓		SPI
12.	Relay Int Fault	✓		SPI
13.	Over Current Operated(ALL STAGES)	✓		SPI
14.	Earth Fault Operated(ALL STAGES)	✓		SPI
15.	BKR Close COMMAND		✓	DCO
16.	BKR Open COMMAND			
17.	Auto Trip (86) relay reset from Remote		✓	SCO
18.	3Phase R, Y, B- Current & Voltage, Active Power, Reactive Power, Power factor, Max. Demand, Neu. Current	✓		AI/ MV
19.	Fault current and phase indication of faulty phase viz. R, Y, B, Earth, Unbalance (O/C & E/F Relay), Disturbance Records, Fault Graphs for Remote diagnosis purpose	✓		AI/MV

Note:
1.Signals like Panel DC Fail and Relay Int Fault to be taken from adjacent panel.
2.Final signals list will be approved with CRP/Switchgear panel drawing.

B. 11kV Incomers: IEC 61850 Protocol

S.No.	Signal List	DI/ AI soft through N.Relay/ BCU	DO soft through N.Relay/ BCU	Signal Type
1.	Breaker On	✓		DPI
2.	Breaker OFF			
3.	Trip Ckt Healthy 1	✓		SPI
4.	Trip Ckt Healthy 2	✓		SPI
5.	Panel AC Fail	✓		SPI
6.	Spring Charge	✓		SPI
7.	Breaker in Service	✓		SPI
8.	Breaker in Test	✓		SPI
9.	Auto trip (86) Operated	✓		SPI
10.	VT fuse Blown- Metering	✓		SPI
11.	VT fuse Blown- Protection	✓		SPI
12.	Panel DC Fail			SPI
13.	L/R Switch in SCADA	✓		SPI
14.	Relay Int Fault	✓		SPI
15.	Over Current Operated (All Stages)	✓		SPI
16.	Earth Fault Operated (All Stages)	✓		SPI
17.	Under Voltage Prot. Operated	✓		SPI
18.	Over Voltage Prot. Operated	✓		
19.	REF Operated	✓		SPI
20.	BKR Close COMMAND		✓	DCO
21.	BKR Open COMMAND			
22.	Auto trip (86) relay reset from Remote		✓	SCO
23.	3Phase R, Y, B- Current & Voltage, Active Power, Reactive Power, Power factor, Max. Demand, Neu. Current	✓		AI/ MV
24.	Fault current and phase indication of faulty phase viz. R, Y, B, Earth, Unbalance (O/C & E/F	✓		AI/MV

	Relay), Disturbance Records, Fault Graphs for Remote diagnosis purpose			

Note:
1. Signals like Panel DC Fail and Relay Int Fault to be taken from adjacent panel
2. Final signals list will be approved with CRP/Switchgear panel drawing.

C. 11kV Bus Coupler: IEC 61850 Protocol

S.No.	Signal List	DI/ AI soft through N.Relay/ BCU	DO soft through N.Relay/ BCU	Signal Type
1.	Breaker On	✓		**DPI**
2.	Breaker OFF			
3.	Trip Ckt Healthy 1	✓		**SPI**
4.	Trip Ckt Healthy 2	✓		SPI
5.	Panel AC Fail	✓		SPI
6.	Spring Charge	✓		**SPI**
7.	Breaker in Service	✓		**SPI**
8.	Breaker in Test			**SPI**
9.	Auto trip (86) Operated	✓		**SPI**
10.	Panel DC Fail	✓		**SPI**
11.	L/R Switch in SCADA	✓		**SPI**
12.	Relay Int. Fault	✓		**SPI**
13.	PT MCB- Metering operated	✓		**SPI**
14.	PT MCB- Protection operated	✓		**SPI**
15.	Over Current Operated	✓		**SPI**
16.	Earth Fault Operated	✓		**SPI**
17.	BKR Close COMMAND		✓	**DCO**
18.	BKR Open COMMAND			
19.	Auto trip (86) relay reset from Remote		✓	SCO
20.	3Phase R, Y, B- Current & Voltage, Active Power, Reactive Power, Power factor, Max. Demand, Neu. Current	✓		AI/ MV

21.	Fault current and phase indication of faulty phase viz. R, Y, B, Earth, Unbalance (O/C & E/F Relay), Disturbance Records, Fault Graphs for Remote diagnosis purpose	✓		**AI/MV**

Note:
1. Signals like Panel DC Fail and Relay Int Fault to be taken from adjacent panel
2. Final signals list will be approved with CRP/Switchgear panel drawing.

D. 11Kv Capacitors: IEC 61850 Protocol

S.No.	Signal List	DI/ AI soft through N.Relay/ BCU	DO soft through N.Relay/ BCU	Signal Type
1.	Breaker On	✓		**DPI**
2.	Breaker OFF			
3.	Bank ISO ON	✓		**DPI**
4.	Bank ISO OFF			
5.	Trip Ckt Healthy 1	✓		**SPI**
6.	Trip Ckt Healthy 2	✓		SPI
7.	Panel AC Fail	✓		SPI
8.	Spring Charge	✓		**SPI**
9.	Breaker in Service	✓		**SPI**
10.	Breaker in Test	✓		**SPI**
11.	Master Trip (86) Operated	✓		**SPI**
12.	Bus PT fuse Blown-Metering	✓		**SPI**
13.	Bus PT fuse Blown-Protection	✓		**SPI**
14.	Panel DC Fail	✓		**SPI**
15.	L/R Switch in SCADA	✓		**SPI**
16.	Over Current Operated	✓		**SPI**
17.	Earth Fault Operated	✓		**SPI**
18.	Under Volt. Prot. Operated	✓		**SPI**
19.	Over Volt. Prot. Operated	✓		**SPI**
20.	Neg. Phase sequence	✓		**SPI**

	Operated			
21.	Timer Relay operated/ Normal	✓		**DPI**
22.	Relay Int. Fault	✓		**SPI**
23.	BKR Close COMMAND		✓	**DCO**
24.	BKR Open COMMAND			
25.	BANK ISO OPN		✓	**DCO**
26.	BANK ISO CLS			
27.	Master trip (86) reset from remote		✓	**SCO**
28.	3phase R, Y, B- Curr & Volt, React. Pow, Neu. Curr	✓		**AI/ MV**
29.	Fault current and phase indication of faulty phase viz. R, Y, B, Earth, Unbalance (O/C & E/F Relay), Disturbance Records, Fault Graphs for Remote diagnosis purpose	✓		**AI/MV**

Note:
1. Signals like Panel DC Fail and Relay Int Fault to be taken from adjacent panel
2. Final signals list will be approved with CRP/Switchgear panel drawing.

E. 33 & 66 kV Incomers/ Outgoing- IEC 61850 Protocol

S.No.	Signal List	DI/ AI soft through N.Relay/ BCU	DO soft through N.Relay/ BCU	Signal Type
1.	Breaker On	✓		**DPI**
2.	Breaker OFF			
3.	Bus ISO (89A) ISO ON	✓		**DPI**
4.	Bus ISO (89A) ISO OFF			
5.	Bus ISO (89B) ISO ON	✓		**DPI**
6.	Bus ISO (89B) ISO OFF			
7.	LINE ISO (89L) ON	✓		**DPI**
8.	LINE ISO (89L) OFF			
9.	EARTH SWITCH (89LE)	✓		**SPI**

	CLOSE			
11.	EARTH SWITCH (89AE) CLOSE	✓		**SPI**
13.	Breaker in Service (In-case of I/D BKR)	✓		**SPI**
14.	Breaker in Test (In-case of I/D BKR)	✓		**SPI**
15.	Trip Ckt Healthy	✓		**SPI**
16.	Spring Charge	✓		**SPI**
17.	Master Trip (86) Operated	✓		**SPI**
18.	SF6 Pressure Low & SF6 Lock Out	✓		**SPI**
19.	VT fuse Fail	✓		
20.	L/R Switch in Remote	✓		**SPI**
21.	LBB Operated	✓		**SPI**
22.	Panel DC Fail	✓		**SPI**
23.	Relay Int. Fault	✓		**SPI**
24.	Over Current Operated (All Stages)	✓		**SPI**
25.	Earth Fault Operated (All Stages)	✓		**SPI**
26.	DIFF. Prot Operated	✓		**SPI**
27.	DIST. Prot Operated	✓		**SPI**
28.	BKR Close COMMAND		✓	**DCO**
29.	BKR Open COMMAND			
30.	Bus ISO (89A) ISO ON CMD		✓	**DCO**
31.	Bus ISO (89A) ISO OFF CMD			
32.	Bus ISO (89B) ISO ON CMD		✓	**DCO**
33.	Bus ISO (89B) ISO OFF CMD			
34.	LINE ISO (89L) ON CMD		✓	**DCO**
35.	LINE ISO (89L) OFF CMD			
36.	Master trip (86) relay reset from remote		✓	**SCO**
37.	3phase R, Y, B- Curr & Volt,Active & React. Pow, Pow Factor, Max Demand, Neu. Curr etc.	✓		**AI/ MV**
38.	Fault current and phase indication of faulty phase viz. R, Y, B, Earth, Unbalance (O/C & E/F Relay), Disturbance Records, Fault	✓		**AI/MV**

	Graphs for Remote diagnosis purpose			

Note:
1. Signals like Panel DC Fail and Relay Int Fault to be taken from adjacent panel
2. Final signals list will be approved with CRP/Switchgear panel drawing.

F. 33 & 66 kV Transformer- IEC 61850 Protocol

S.No.	Signal List	DI/ AI soft through N.Relay/ BCU	DO soft through N.Relay/ BCU	Signal Type
1.	Breaker On	✓		**DPI**
2.	Breaker OFF			
3.	Bus ISO (89A) ISO ON	✓		**DPI**
4.	Bus ISO (89A) ISO OFF			
5.	Bus ISO (89B) ISO ON	✓		**DPI**
6.	Bus ISO (89B) ISO OFF			
7.	LINE ISO (89T) ON	✓		**DPI**
8.	LINE ISO (89T) OFF			
9.	EARTH SWITCH (89TE) CLOSE	✓		**SPI**
10.	EARTH SWITCH (89AE) CLOSE	✓		**SPI**
13.	Breaker in Service (In-case of I/D BKR)	✓		**SPI**
14.	Breaker in Test (In-case of I/D BKR)	✓		**SPI**
15.	Trip Ckt Healthy- 1	✓		**SPI**
16.	Trip Ckt Healthy- 2	✓		**SPI**
17.	Panel AC Fail	✓		**SPI**
18.	Spring Charge	✓		**SPI**
19.	Auto Trip (86) Operated	✓		**SPI**
20.	Differential Operated	✓		**SPI**
21.	LBB Operated	✓		**SPI**
22.	REF/SEF Prot Operated	✓		**SPI**
23.	SF6 Pressure Low & SF6 Lock Out	✓		**SPI**
24.	Panel DC Fail	✓		**SPI**

25.	L/R Switch in Remote	✓		**SPI**
26.	LBB Operated	✓		**SPI**
27.	Relay Int. Fault	✓		**SPI**
28.	Over Current Operated	✓		**SPI**
29.	Earth Fault Operated	✓		**SPI**
30.	BKR CLS COMMAND		✓	**DCO**
31.	BKR OPN COMMAND			
32.	Bus ISO (89A) ISO ON CMD		✓	**DCO**
33.	Bus ISO (89A) ISO OFF CMD			
34.	Bus ISO (89B) ISO ON CMD		✓	**DCO**
35.	Bus ISO (89B) ISO OFF CMD			
36.	LINE ISO (89T) ON CMD		✓	**DCO**
37.	LINE ISO (89T) OFF CMD			
38.	Master trip (86) relay reset from remote		✓	**SCO**
39.	3phase R, Y, B- Curr & Volt,Active & React. Pow, Pow Factor, Max Demand, Neu. Curr etc.	✓		**AI/ MV**
40.	Fault current and phase indication of faulty phase viz. R, Y, B, Earth, Unbalance (O/C & E/F Relay). Fault voltage and phase indication of faulty phase viz. R,Y,B (Voltage Protection Relay). Fault Differential and Bias current in Line and T/F Differential Relay, Fault distance (in distance relay), Disturbance Records, Fault graphs for remote diagnosis purpose.	✓		**AI/MV**

Note:

1. Signals like Panel DC Fail and Relay Int Fault to be taken from adjacent panel

2. Final signals list will be approved with CRP/Switchgear panel drawing.

G. Signals Related with CRP

Sr. No.	Signal Detail	Type of Signal on IEC61850
1	**Signals of Differential Relay**	
	Digital Input Signals	
1	Differential Trip Bph	Single Point Information
2	Differential Trip Rph	Single Point Information
3	Differential Trip Yph	Single Point Information
4	Differential Highset Trip	Single Point Information
5	Differential Trip	Single Point Information
6	Inrush detected	Single Point Information
7	REF Trip	Single Point Information
8	Trafo. Differential lockout operated	Single Point Information
9	Trafo. Differential watchdog operated	Single Point Information
10	Trafo. Differential communication fail	Single Point Information
11	Trafo Trouble Trip	Single Point Information
	Measurement Signals	
1	Current Bph	Measured Float
2	Current Rph	Measured Float
3	Current Yph	Measured Float
4	Fault Current Bph	Measured Float
5	Fault Current Rph	Measured Float
6	Fault Current Yph	Measured Float
7	Fault Current Nph	Measured Float
8	Fault locator in some relays	Measured Float
9	Sigma kA square	Measured Float
2	**Signals of Distance Relay**	
	Digital Input Signals	
1	Distance Relay Lockout Operated	Single Point Information
2	Distance Trip	Single Point Information
3	Distance Zone-1 operated	Single Point Information
4	Distance Zone-2 operated	Single Point Information
5	Distance Zone-3 operated	Single Point Information
6	Line Distance Relay Communication Fail	Single Point Information
7	Line Distance Relay watchdog operated	Single Point Information
3	**Signals of Line Differential Relay**	
	Digital Input Signals	
1	Conductor Broken	Single Point Information
2	Differential Trip	Single Point Information
3	Rph Differential Trip	Single Point Information
4	Yph Differential Trip	Single Point Information
5	Bph Differential Trip	Single Point Information

6	Distance Trip	Single Point Information
7	Distance Zone-1 operated	Single Point Information
8	Distance Zone-2 operated	Single Point Information
9	Distance Zone-3 operated	Single Point Information
10	Earth Fault high set trip	Single Point Information
11	Earth Fault IDMT trip	Single Point Information
12	General Trip	Single Point Information
13	Inter-trip	Single Point Information
14	Line differential block	Single Point Information
15	Line differential Channel-1 fail	Single Point Information
16	Line differential Channel-2 fail	Single Point Information
17	Line differential operated	Single Point Information
18	Line differential relay watchdog operated	Single Point Information
19	Phase fault high set trip	Single Point Information
20	Phase fault IDMT trip	Single Point Information
21	PT Fuse Fail	Single Point Information
22	Sync fail	Single Point Information
	Digital Output Signals	
1	General trip	Single Command Output
2	Line Diff. Operated	Single Command Output
	Measurement Signals	
1	Active Power	Measured Float
2	Current Bph	Measured Float
3	Current Rph	Measured Float
4	Current Yph	Measured Float
5	Fault Current Bph	Measured Float
6	Fault Current Rph	Measured Float
7	Fault Current Yph	Measured Float
8	Fault Current Nph	Measured Float
9	Fault Locator in some relays	Measured Float
10	Frequency	Measured Float
11	Power Factor	Measured Float
12	Reactive Power	Measured Float
13	Sigma kA square	Measured Float
14	Voltage BR	Measured Float
15	Voltage RY	Measured Float
16	Voltage YB	Measured Float
4	**Signals of Overcurrent Earthfault Relay**	
	Digital Input Signals	
1	50BF/LBB Operated	Single Point Information
2	86 Supervision	Single Point Information

3	Relay Communication fail	Single Point Information
4	Relay watchdog operated	Single Point Information
5	Isolator A status	Double Point Information
6	Isolator B status	Double Point Information
7	Cable door open	Single Point Information
8	CB in Remote	Single Point Information
9	CB Status	Double Point Information
10	Earth Fault General Trip	Single Point Information
11	Earth Fault High set Trip	Single Point Information
12	Earth Fault IDMT Trip	Single Point Information
13	Earth Switch AE status	Double Point Information
14	Earth Switch BE status	Double Point Information
15	Earth Switch LE status	Double Point Information
16	Line Isolator status	Double Point Information
17	Breaker L/R switch	Single Point Information
18	Negative Phase Sequence	Single Point Information
19	Phase Fault General Trip	Single Point Information
20	Phase Fault Highset Trip	Single Point Information
21	Phase Fault IDMT Trip	Single Point Information
22	Phase Fault Overload Trip	Single Point Information
23	PT Fuse Failure	Single Point Information
24	Relay Reset	Single Point Information
25	SF6 Gas Pressure Low	Single Point Information
26	SF6 Lockout Operated	Single Point Information
27	Spring Charged	Single Point Information
28	TCS Alarm-1	Single Point Information
29	TCS Alarm-2	Single Point Information
	Digital Output Signals	
1	CB Command	Double Command Output
2	Relay Reset	Single Command Output
	Spare Output	
	Measurement Signals	
1	Active Power	Measured Float
2	Current Bph	Measured Float
3	Current Rph	Measured Float
4	Current Yph	Measured Float
5	Fault Current Bph	Measured Float
6	Fault Current Rph	Measured Float
7	Fault Current Yph	Measured Float
8	Fault Current Nph	Measured Float
9	Fault Locator in some relays	Measured Float

10	Frequency	Measured Float
11	Power Factor	Measured Float
12	Reactive Power	Measured Float
13	Sigma kA square	Measured Float
14	Voltage BR	Measured Float
15	Voltage RY	Measured Float
16	Voltage YB	Measured Float

H. Transformer- TM cum AVR relay Signals- IEC 61850 Protocol

S.No.	Signal List	DI/ AI soft through TM cum AVR	DO soft through TM cum AVR	Signal Type
1.	DC Fail	✓		**SPI**
2.	Oil Temp Alarm	✓		**SPI**
	Relay Int Fault	✓		**SPI**
3.	Oil Temp Trip	✓		**SPI**
4.	Winding Temp Alarm	✓		**SPI**
5.	Winding Temp Trip	✓		**SPI**
6.	Buchholz Alarm	✓		**SPI**
7.	Buchholz Trip	✓		**SPI**
8.	PRV Trip	✓		**SPI**
9.	OLTC OSR	✓		**SPI**
10.	MOG/LOW Oil Level Alarm	✓		**SPI**
11.	SPR Trip	✓		**SPI**
12.	OSR Main Tank	✓		**SPI**
13.	L/R Switch in Local	✓		**DPI**
14.	L/R Switch in Remote	✓		
15.	Auto Mode	✓		**DPI**
16.	Manual Mode	✓		
17.	Fan Fail	✓		**SPI**
18.	Tap Changer Fail	✓		**SPI**
19.	OLTC Out of Step/ Stuck up/ Motor trip	✓		**SPI**
20.	Tap Rise/ Low Command		✓	**RCO**
21.	Oil Temp	✓		**AI**
22.	Winding Temp	✓		**AI**
23.	Tap Position	✓		**AI**

Note:
1. Signals like Panel DC Fail and Relay Int Fault to be taken from adjacent panel
2. Final signals list will be approved with CRP/Switchgear panel drawing.

I. 33 & 66kV Bus Coupler- IEC 61850 Protocol

S.No.	Signal List	DI/ AI soft through N.Relay/ BCU	DO soft through N.Relay/ BCU	Signal Type
1.	Breaker On	✓		DPI
2.	Breaker OFF			
3.	Bus ISO (89A) ISO ON	✓		DPI
4.	Bus ISO (89A) ISO OFF			
5.	Bus ISO (89B) ISO ON	✓		DPI
6.	Bus ISO (89B) ISO OFF			
7.	EARTH SWITCH (89AE) CLOSE	✓		SPI
8.	EARTH SWITCH (89BE) CLOSE	✓		SPI
9.	Breaker in Service (In-case of I/D BKR)	✓		SPI
10.	Breaker in Test (In-case of I/D BKR)	✓		SPI
11.	Trip Ckt Healthy- 1	✓		SPI
12.	Trip Ckt Healthy- 2	✓		SPI
13.	Panel AC Fail	✓		SPI
18.	Spring Charge	✓		SPI
19.	Auto Trip (86) Operated	✓		SPI
20.	SF6 Pressure Low	✓		SPI
21.	SF6 Lock Out	✓		SPI
22.	VT fuse-1 Blown	✓		SPI
23.	VT fuse-2 Blown	✓		SPI
24.	Panel DC Fail	✓		SPI
25.	L/R Switch in Remote	✓		SPI
26.	LBB Operated	✓		SPI
27.	Relay Int. Fault	✓		SPI
28.	Over Current Operated (All Stages)	✓		SPI
29.	Earth Fault Operated (All Stages)	✓		SPI
30.	BKR Close COMMAND		✓	DCO
31.	BKR Open COMMAND			

32.	BUS (89A) ISO OPN COMMAND		✓	**DCO**
33.	Bus (89A) ISO CLS COMMAND			
34.	Bus (89B) ISO OPN COMMAND		✓	**DCO**
35.	Bus (89B) ISO CLS COMMAND			
36.	Auto trip (86) relay reset from remote		✓	**SCO**
37.	3phase R, Y, B- Curr, BUS PT-01 & BUS PT-02 3 phase voltages	✓		**AI/ MV**
38.	Fault current and phase indication of faulty phase viz. R, Y, B, Earth, Unbaethernetce (O/C & E/F Relay). Fault voltage and phase indication of faulty phase viz. R,Y,B (Voltage Protection Realy). Fault Differential and Bias current in line and T/F Diff Relay, Fault distance (in Distance Relay), Disturbance Records, Fault Graphs for Remote diagnosis purpose	✓		**AI/ MV**

Note:
1. Signals like Panel DC Fail and Relay Int Fault to be taken from adjacent panel
2. Final signals list will be approved with CRP/Switchgear panel drawing.

J. 33 & 66kV CAP Bank- IEC 61850 Protocol

S.No.	Signal List	DI/ AI soft through N.Relay/ BCU	DO soft through N.Relay/ BCU	Signal Type
1.	Breaker On	✓		**DPI**
2.	Breaker OFF			
3.	Bus ISO (89A) ISO ON	✓		**DPI**

4.	Bus ISO (89A) ISO OFF			
5.	Bus ISO (89B) ISO ON	✓		**DPI**
6.	Bus ISO (89B) ISO OFF			
7.	LINE ISO (89C) ON	✓		**DPI**
8.	LINE ISO (89C) OFF			
9.	EARTH SWITCH (89CE) CLOSE	✓		**SPI**
10.	EARTH SWITCH (89AE) CLOSE	✓		**SPI**
11.	Trip coil Ckt Healthy- 1	✓		**SPI**
12.	Trip coil Ckt Healthy- 2	✓		**SPI**
13.	Panel AC Fail	✓		**SPI**
12.	Spring Charge	✓		**SPI**
13.	Auto Trip (86) Operated	✓		**SPI**
14.	SF6 Pressure Low & SF6 Lock Out	✓		**SPI**
15.	VT fuse Blown	✓		**SPI**
16.	Cap Discharge Time	✓		**SPI**
17.	Neutral Displacement	✓		**SPI**
18.	Panel DC Fail	✓		**SPI**
19.	L/R Switch in Remote	✓		**SPI**
20.	LBB Operated	✓		**SPI**
21.	Relay Int. Fault	✓		**SPI**
22.	Over Current Operated	✓		**SPI**
23.	Earth Fault Operated	✓		**SPI**
24.	Under Voltage Prot. Operated	✓		**SPI**
25.	Over Voltage Prot. Operated	✓		**SPI**
26.	BKR Close COMMAND		✓	**DCO**
27.	BKR Open COMMAND			
28.	Bus (89A) ISO OPN COMMAND		✓	**DCO**
29.	Bus (89A) ISO CLS COMMAND			
30.	Bus (89B) ISO OPN COMMAND		✓	**DCO**
31.	Bus (89B) ISO CLS COMMAND			
32.	CAP Bank ISO OPN Command		✓	**DCO**
33.	CAP Bank ISO CLS			

	Command			
34.	3phase R, Y, B- Curr & voltage, Reactive Pow, Neu Curr	✓		**AI/ MV**
35.	Fault current and phase indication of faulty phase viz. R, Y, B, Earth, Unbaethernetce (O/C & E/F Relay). Fault voltage and phase indication of faulty phase viz. R,Y,B (Voltage Protection Realy). Fault Differential and Bias current in line and T/F Diff Relay, Fault distance (in Distance Relay), Disturbance Records, Fault Graphs for Remote diagnosis purpose	✓		**AI**

Note:
1. Signals like Panel DC Fail and Relay Int Fault to be taken from adjacent panel
2. Final signals list will be approved with CRP/Switchgear panel drawing.

K. BUS PT-1 & 2- IEC 61850 Protocol

S.No.	Signal List	DI/ AI soft through N.Relay/ BCU	DO soft through N.Relay/ BCU	Signal Type
1.	BUS A (89A) ON	✓		**DPI**
2.	BUS A (89A) OFF			
3.	BUS B (89B) ON	✓		**DPI**
4.	BUS B (89B) ON			
5.	Earth Switch (89LE)-1 ON	✓		**DPI**
6.	Earth Switch (89LE)-1 OFF			
7.	Earth Switch (89LE)-2 ON	✓		**DPI**
8.	Earth Switch (89LE)-2 OFF			
9.	BUS-A ISO OPN COMMAND		✓	**DCO**
10.	BUS-A ISO CLS COMMAND			
11.	BUS-B ISO OPN		✓	**DCO**

	COMMAND			
12.	BUS-B ISO CLS COMMAND		✓	**DCO**

L. Smoke Detector- ALL sensors, Manual Call Points- Modbus Protocol

S.No.	Signal List	Soft Signals	Signal Type
1.	All Sensors Alarm operated Signalsll Sensors Alarm operated Signals (10 to 20 Sensors)	✓	**SPI**
2.	All Manual Call Points- MCP- 1, MCP- 2, etc.	✓	

M. Battery Charger- Modbus Protocol

S.No.	Signal List	DI/ AI soft through RTU	Signal Type
1.	Battery CHG Mains AC Fail	✓	**SPI**
2.	Charger A AC MCCB Trip	✓	**SPI**
3.	Charger A DC MCCB Trip	✓	**SPI**
4.	Charger B AC MCCB Trip	✓	**SPI**
5.	Charger B DC MCCB Trip	✓	**SPI**
6.	Charger A/B in boost	✓	**SPI**
7.	Charger A/B rectifier Capacitor Fuse Blown	✓	**SPI**
8.	Battery MCCB Trip	✓	**SPI**
9.	DC system Earth	✓	**SPI**
10.	Insulation Fault	✓	**SPI**
11.	Charger A Current	✓	**AI**
12.	Charger A Voltage	✓	**AI**
13.	Charger B Current	✓	**AI**
14.	Charger B Voltage	✓	**AI**
15.	Battery Current	✓	**AI**
16.	Battery Voltage	✓	**AI**

N. LT Board

S.No.	Signal List	DI Hard Wire to RTU	Signal Type
1.	LT AC Fail	✓	SPI
2.	R,Y,B Phase Current		AI/ MV/ MFI

O. Fire Fighting (All T/Fs)

S.No.	Signal List	DI Hard Wire to RTU	Signal Type
1.	SYSTEM OPERATED	✓	SPI
2.	SYSTEM OUT OF SERVICE	✓	SPI
3.	TCIV CLOSED	✓	SPI
4.	FIRE DETECTOR TRIP	✓	SPI
5.	N2 CYLINDER PRESSURE LOW	✓	SPI
6.	FIRE SYSTEM ALARM	✓	SPI
7.	DC SUPPLY FAIL	✓	SPI

P. MFM- BUS PT- 1, 2 Signals (Front & Rear Bus)- Modbus Protocol

S.No.	Signal List	Data Type
1.	R-Ph Current	MV/ MFI
2.	Y-Ph Current	MV/ MFI
3.	B-Ph Current	MV/ MFI
4.	Neutral Current	MV/ MFI
5.	R-Y Ph Voltage	MV/ MFI
6.	Y-B Ph Voltage	MV/ MFI
7.	B-R Ph Voltage	MV/ MFI

Q. MFM- Signals- All Feeders (Including Bus Section/ Coupler)- Modbus Protocol

S.No.	Signal List	Data Type
1.	R-Ph Current	MV/ MFI

2.	Y-Ph Current	MV/ MFI
3.	B-Ph Current	MV/ MFI
4.	Neutral Current	MV/ MFI
5.	R-Y Ph Voltage	MV/ MFI
6.	Y-B Ph Voltage	MV/ MFI
7.	B-R Ph Voltage	MV/ MFI
8.	Active Power	MV/ MFI
9.	Active Energy	MV/ MFI
10.	Reactive Power	MV/ MFI
11.	Power Factor	MV/ MFI
12.	Max Demand	MV/ MFI
13.	Phase angle 1	MV/ MFI
14.	Phase angle 2	MV/ MFI
15.	Phase angle 3	MV/ MFI
16.	THD Mean Current	MV/ MFI
17.	THD Mean Voltage	MV/ MFI

Annexure 12.c (List of Abbreviations)

1. SCADA: Supervisory Control and Data Acquisition
2. RTU: Remote Terminal Unit
3. DCU: Data Concentrator Unit
4. C&R: Control and Relay
5. BA: Business Associates
6. I/O: Input/ Output
7. MFM: Multi Function Meter
8. TM: Transformer Monitoring
9. BYPL: BSES Yamuna Power Ltd.
10. MCC: Master Control Center
11. BCC: Business Continuity Center
12. IED: Intelligent Electronic Devices
13. NCR: National Capital Region
14. IEC: International Electrotechnical Commisssion
15. KEMA: Keuring van Elektrotechnische Materialen te Arnhem
16. CE: Conformité Européene
17. FCC: Federal Communications Commission
18. PRP: Parallel Redundancy Protocol
19. LAN: Local Area Network
20. NIDS: Network Intrusion Detection System
21. NIFPS: Nitrogen Injection Fire Protection System
22. DCDB: DC Distribution Board
23. APFC: Automatic Power factor Controller
24. HMI: Human Machine Interface
25. TCP/ IP: Transmission Control Protocol/ Internet Protocol
26. GPS: Global Positioning System
27. FEP: Front-End processor
28. SNTP: Simple Network Time Protocol
29. CRC: Cold Rolled Close
30. MCB: Miniature Circuit Breakers
31. CMR: Contact Multiplying Relay
32. PVC: Polyvinyl Chloride
33. GI: Galvanized Iron
34. RTCC: Remote Tap Changer Control
35. CT: Current Transformer
36. PT: Potential Transformer
37. WAN: Wide Area Network
38. DI: Digital Input
39. DO: Digital Output
40. AI: Analog Input
41. FRLS: Fire Retardant Low Smoke

42. OFC: Optical Fiber Cable
43. GTP: Guaranteed Technical Particulars
44. DCO: Double Command Input
45. DPI: Double Point Indication
46. MV: Measured Value
47. SCO: Single Command Input
48. SPI: Single Point Indication
49. BCU: Bay Control Unit
50. SAT: Site Acceptance Test
51. AVR: Automatic Voltage Regulator
52. SPD: Surge Protection Device

TECHNICAL SPECIFICATION

FOR

VIDEO SURVEILLANCE SYSTEM

1. Technical Specifications

1.1. General

- Offered camera makes to be integrated with Milestone and Genetec VMS at SDK/driver level.
- Cameras will be integrated with BYPL VMS system.
- Camera count to be limited to 4-5 as camera feeds to be transferred to the BYPL VMS over the WAN.
- Cisco Layer-2 Manageable PoE Network switch should be offered along with the cameras
- CAT6 cable to be used for the camera installation
- Cameras should be with 5 years OEM warranty
- **Camera to support:**
    - **Edge Recording:**Camera to have feature of Memory Card for local storage
        - Memory card for recording of 15 days' continuous video (min 32GB or more) should be supply along with cameras
    - **Edge Analytics:**Analytics to be in built at camera side like –Trip Wire, Counter, Object Removal, Motion Detection
    - System to be intelligent to record on memory card present on camera in case of network failure and restore to Central Server whenever the link is established
    - Camera model offered should be international model
    - Cameras to be True Day/Night function IP camera
    - Cameras should have in-built microphones to record audio
    - Cameras to support Variable bit rate (VBR) / Constant bit rate (CBR)
    - Cameras to be weather proof (IP66)& Vandal proof(IK 10)
    - Camera should support Codec H.265or H.264 or better
    - ONVIF Profile-S& G Certified
    - The MAC id of camera should be in the name of proposed camera OEM/vendor

1.2. Camera Specifications

1.2.1. Dome Camera: For indoor use (Approved Make: Axis, Pelco, Bosch, Sony, Cisco, Panasonic, Tyco)

Sr. No.	Feature	Description	Response	Comments
		Indoor Dome (Vandal Proof)	Make & Model No:	
1	Imaging device/ Sensor	1/3" 1 Megapixel progressive scan CMOS or Higher	Comply/ Partially comply/ Not available	
2	Frame rate	30 FPS		
3	Minimum Illumination	Color mode: F1.2 @ 0.4 lux Black and white mode: F1.2 @ 0.2 lux		
4	Shutter Speed	1/1s~1/10000s		
5	White Balance Auto	Auto		
6	Lens	Fixed lens/ Variable lens		
7	Zoom	Not applicable		
8	Zoom Ratio	Digital:4x		
9	Gain Control (AGC)	Auto/Manual		
10	Wide dynamic range (WDR)	120 dB or higher		
11	White Balance Auto	Auto		
12	Gain Control (AGC)	Auto/Manual		
13	Snapshot	Yes		
14	Video Compression	H.264, MPEG-4 Part 10 or better		
15	Focus	Autofocus		
16	Bit rate / Compression	Support CBR/VBR		
17	Range of Bit Rate Setting	64 Kbps to 32 Mbps		
18	Alarm IN	1 Input		
19	Alarm Out	1 Output		
20	Noise reduction	Not applicable		
21	Remote Operation	Not applicable		
22	Night vision (Day Night)	True day night		
23	Video Streaming	Dual Streaming or higher		
24	Video Resolution	• 960 x 544 @ 30 fps • 704 x 480 or 576 @ 30 or 25 fps (4CIF) • 640 x 368 @ 30 fps • 352 x 240 or 288 @ 30 or 25 fps (CIF)		
25	Video Output	Required		
26	Analytics	In built at camera side like – Tampering, Trip Wire, Auto tracking, Counter, Object removal, Motion detection,		
27	Interface	RJ-45 (10/100Base-T) & RS485		
28	Security	IP address filtering, Password protection, User access log		
29	Edge Storage	Yes		
30	Memory card	Yes, Minimum 32 GB or higher		
31	Microphone	Yes, Built-in for audio recording		
32	IR	Not applicable		
33	Image Stabilizer	Not applicable		

34	Heater	Not applicable		
35	Weatherproof/ Waterproof	IP66 rated weather proofing standards		
36	Vandal Proof	Yes , IK10		
37	ONVIF Certificate	Profile –S, G Certified		
38	Power Source	AC 24V/3A (±10%)/ DC12V & with Power over Ethernet		
39	Supported Web Browser for remote viewing etc	Windows – Microsoft Internet Explorer 6.x or later, Firefox, safari, Google Chrome. The camera on its Web GUI should provide facility to initiate video recording &audio recording (if activated) even without the Video management Software.		
40	Operating Temperature	0°C~+50°C		
41	Certifications	UL, CE, FCC and RoHS		

1.2.2. Bullet Camera: For outdoor use (Approved Make: Axis, Pelco, Bosch, Sony, Cisco, Panasonic, Tyco)

Sr. No.	Feature	Description	Response	Comments
		Outdoor bullet	Make & Model No:	
1	Imaging device/ Sensor	1/3" 1 Megapixel progressive scan CMOS or Higher	Comply/ Partially comply/ Not available	
2	Frame rate	30 FPS		
3	Minimum Illumination	Color mode: F1.2 @ 0.4 lux Black and white mode: F1.2 @ 0.2 lux		
4	Shutter Speed	1~1/10000s		
5	White Balance Auto	Auto		
6	Lens	3–9mm or better, Built-in varifocal lens		
7	Zoom	Yes, Motorize		
8	Zoom Ratio	Optical:3x, Digital:4x, Total:12x		
9	Gain Control (AGC)	Auto/Manual		
10	Wide dynamic range (WDR)	120 dB or higher		
11	White Balance Auto	Auto		
12	Gain Control (AGC)	Auto/Manual		
13	Snapshot	Yes		
14	Video Compression	H.265, H.264, MPEG-4 Part 10		
15	Focus	Autofocus		
16	Bit rate / Compression	Selectable VBR /CBR		
17	Range of Bit Rate Setting	64 Kbps to 32 Mbps		
18	Alarm IN	1 Input		
19	Alarm Out	1 Output		
20	Noise reduction	Not applicable		

21	Remote Operation	Not applicable		
22	Night vision (Day Night)	True day night		
23	Video Streaming	Dual Streaming or higher		
24	Video Resolution	• 960 x 544 @ 30 fps • 704 x 480 or 576 @ 30 or 25 fps (4CIF) • 640 x 368 @ 30 fps • 352 x 240 or 288 @ 30 or 25 fps (CIF)		
25	Video Output	Required		
26	Analytics	In built at camera side like –Trip Wire, Auto tracking, Counter, Object removal, Motion detection		
27	Interface	RJ-45 (10/100Base-T) & RS485		
28	Security	IP address filtering, Password protection, User access log		
29	Edge Storage	Yes		
30	Memory card	Minimum 32 GB or higher		
31	Microphone	Yes, Built-in for audio recording		
32	IR	Internal /External 60 Feet		
33	Image Stabilizer	Required		
34	Heater	Built in		
35	Weatherproof/ Waterproof	IP66 rated weather proofing standards		
36	Vandal Proof	Yes , IK10		
37	ONVIF Certificate	Profile –S, G Certified		
38	Power Source	AC 24V/3A (±10%)/ DC12V & with Power over Ethernet		
39	Supported Web Browser for remote viewing etc	Windows – Microsoft Internet Explorer 6.x or later, Firefox, safari, Google Chrome. The camera on its Web GUI should provide facility to initiate video recording &audio recording (if activated) even without the Video management Software.		
40	Operating Temperature	0°C~+50°C		
41	Certifications	UL, CE, FCC and RoHS		

SPECIFICATION
FOR
THREE PHASE OIL TYPE DISTRIBUTION TRANSFORMER OF RATING 25 KVA TO 100 KVA

Specification No – SP-TPDT-98-R0

PREPARED BY	REVIEWED BY	APPROVED BY	REV	00
SG	GS	AA	DATE	18.05.2017
			PAGE	01 OF 38

INDEX

Record of Revision

SI No.	Revision No	Item/Clause No.	Nature of change	Approved by

1 SCOPE OF SUPPLY

1.1 This specification covers design, engineering, manufacturing, assembly, testing at manufacture's works, packing, transportation and delivery to store and submission of complete documentation for three phase conventional oil filled distribution transformer of rating between 25KVA to 100KVA rating.

1.2 Supervision of erection, testing & commissioning of these transformers may be included in the scope of the supplier as OPTIONAL scope.

1.3 The transformer shall be complete with all components and accessories, which are necessary or usual for their efficient performance and trouble free operation under the various operating and atmospheric conditions specified in Annexure I : Data sheet of client requirement.

1.4 Such of the parts that may have not been specifically included, but otherwise form part of the transformer as per standard trade and/or professional practice and/or are necessary for proper operation of transformer, will be deemed to be also included in this specification. The successful bidder shall not be eligible for any extra charges for such accessories etc. notwithstanding the fact that at the time of an initial offer bidder had segregated such items and quoted for them separately.

2 CODES AND STANDARDS

2.1 All equipment and material shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards, IEC standard and CBIP manuals enlisted in the Appendix-A, except where modified and / or supplemented by this specification.

2.2 Equipment and material conforming to any other standard, which ensures equal or better quality, may be accepted. In such case copies of English version of the standard adopted shall be submitted by the vendor with the offer.

2.3 The electrical installation shall meet the requirement of Indian Electricity Rules as amended upto date, relevant IS code of practice and Indian electricity act. In addition other rules & regulations applicable to the work shall be followed. In case of any discrepancy, the most stringent & restrictive one shall be binding.

2.4 The equipment offered shall in general comply with the latest issues including amendments of the standards enlisted in Appendix-A but not restricted to it.

2.5 Vendor shall possess valid BIS Certification.

3 DESIGN CRITERIA

The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life. The features and construction details of each transformer shall be in accordance with the requirements stated herein under.

3.1 APPLICATION

The transformers are intended to be used for normal operation in Delhi Distribution system for making available three phase and/or single phase supply to the consumers at voltage as indicated in Annexure-I.

3.2 RATINGS

The transformer shall be of rating as indicated in Annexure-I.

3.3 NORMAL SITE CONDITIONS

The distribution transformers to be supplied against this Specification shall be suitable for satisfactory continuous operation under the conditions as per Annexure-I: Data sheet of client requirement.

3.4 TRANSFORMER TANK

3.4.1 The Transformer tank shall be of plain rectangular / octagonal and made of good quality sheet steel of adequate thickness suitably stiffed to provide sturdy and robust construction to withstand extreme pressure conditions. The tank shall be capable of withstanding pressure as per values specified in IS: 1180 (Part - I) in Appendix-A for non-sealed type Transformers.

3.4.2 The tank cover shall have plasticized surface at the top to guard against bird age faults. Alternatively, suitable insulating shrouds shall be provided on the bushing terminals.

3.4.3 Steel surface of the tank shall be prepared by sand/shot blast or chemical cleaning including phosphating as per IS: 3618

3.4.4 Heat resistance paint (Hot oil proof) shall be provided inside the tank.

3.4.5 On external surfaces two coats of zinc chromate primer followed by two coats of anti condensation type polyurethane paint, having minimum dry film thickness of 80 microns. Paint of shade conforming to No.632, battle ship grey of IS-5 of 1961 as in Annexure-1 shall be provided.

3.4.6 The transformer shall have a self pressure venting system.

3.5 BUSHING AND TERMINALS

3.5.1 All bushings shall be porcelain clad, and shall be sealed to prevent ingress of moisture and to facilitate removal. The HV bushings shall be fitted with moulded heat shrinkage insulating covers suitable for bare overhead conductor / Aerial bunched cables / U/G cables.

3.5.2 The HV Bushing shall be of open type terminal and LV Terminals shall be inside the Cable Box. The bushing stems/terminals for all HV phases, made of suitable copper alloy shall be so designed as to directly receive aluminium stranded overhead conductors with bolted type clamping arrangement both in horizontal and vertical

directions. In case of copper/copper alloy stems, suitable bimetallic clamps with bolted type arrangement described above shall be used. If HT Underground Cables or Aerial bunched cables are used, then all the terminals shall be connected with suitable Al. lugs. Bimetallic washers shall be provided in between connection of Copper and Aluminium conductors. LV cable box shall be provided with the proper facilities for taking out 3 phase and neutral supplies to the LV distribution board. Additional neutral terminal bushing shall be made available on the cable box for connection to separate earth.

3.5.3 Suitable gland plate, cable glands and lugs as required shall be supplied with the cable box.

3.6 **CONSERVATOR**

3.6.1 In the distribution transformers of 63 and 100 kVA, rating the provisions of conservator is mandatory and for 25 kVA transformers the manufacturers may adopt their standard practices.

3.6.2 When a conservator is fitted, the conservator shall be provided with a drain plug and a filling hole with a cover. In addition, the cover of the main tank shall be provided with an air release plug to enable trapped air to be released unless the conservator is so located as to eliminate the possibility of air being trapped within the main tank.

3.6.3 The inside diameter of the pipe connecting the conservator to the main tank shall be within 20 to 50 mm and it should projected into the conservator so that its end is approximately 20 mm above the bottom of the conservator, so as to create a sump for collection of impurities. The minimum oil level (corresponding to –5deg. C) should be above the sump level.

3.7 FITTINGS

The following standard fittings shall be provided for both sealed and non sealed type transformers.

a) Two earthing terminals with facility to connect 50x6 MM GI Strip. The terminals shall be located on the lower side of the transformer and be of M12 size. Each shall be clearly indicated with an engraved ‘Earth’ symbol.
b) Two Nos heavy duty lifting lugs.
c) Rating and terminal marking plate(s) as per this specification and IS 1180 part 1
d) Plain breathing device comprising an inverted U-pipe with wire gauze at the open end (to prevent entry of insects). Silica gel breather or any other type of breather as required.
e) Drain-cum-sampling valve (steel) welded to the tank. Special tool for operating this valve shall be supplied with the transformer. All valves shall have locking arrangement.
f) Oil filling hole, with cover having 1-1/4” nominal size threads on the transformers body/conservator.
g) Oil level gauge indicating oil levels.
h) Thermometer pocket with cap.
i) Terminal connectors.
j) Pressure relief device or explosion vent.

3.8 CORE AND WINDINGS

3.8.1 The core shall be constructed from high grade cold rolled, non-ageing, grain oriented silicon sheet steel and shall be properly annealed to relieve stresses.

3.8.2 The HV and LV windings for these transformers shall be wound using high conductivity Copper of electrolytic grade.

3.8.3 DPC insulation shall be used for HV and LV winding wires and electrical grade plain insulation Kraft paper for interleaving, no material which can be deleteriously affected by the action of oil under the operating conditions of the transformers shall be used in the transformers or leads of the bushings.

3.8.4 The core and coil assembly shall be securely held in position to avoid any movement under short-circuit conditions.

3.8.5 All turns of windings shall be adequately supported to prevent movement, in cases where turns are spaced out, a suitable inter-turn packing shall be provided. The insulation between core and bolts and core & clamps shall be suitable for withstanding 2000 Volts minimum, for one minute.

3.8.6 Winding Connections

The primary winding shall be connected in delta and the secondary winding in star (Vector Symbol Dyn11), so as to produce a positive displacement of 30^{O} from the primary to the secondary vector of the same phase. The neutral of the secondary winding shall be connected to a separate insulated terminal.
Off circuit taps shall be provided on HV winding with tapings of ± 5% (5 Nos. taps in steps of +5%,+2.5%, 0, -2.5% & - 5%) etc. Tapping switch shall only be provided for 100KVA transforms.

3.9 TAPS

The tap switch shall be of rotary type with operating voltage of 11KV & continuous current rating of 60Amps for 100KVA rating transformer.

3.10 MOUNTING ARRANGEMENT

The transformers are to be mounted on MS channel on PCC pole DP structure or steel pole DP structure. The transformer therefore shall be provided with suitable and robust mounting arrangement. The underbase of transformer shall be provided with two nos. 75 x 40mm MS channel, 460mm long with slots / holes 18 mm x 21mm for fixing on a platform on plinth. The mounting arrangement drawing shall be furnished for approval.

3.11 RATING AND TERMINAL MARKING PLATE

The transformer shall be provided with non-detachable rating marking plate / Diagram plate(s) of non corroding, weather proof material, fitted in a visible position and showing the complete information as in IS : 1180 (Part - I).

Rating plate shall also include Transformer Actual %Z, No-Load Loss & Full-Load Loss at 75°C and total losses(No load losses+load losses at 75 °C) at 50 % of rated load and at 100 % of rated load along with details like PO No, date, name of the company BRPL. The name plate marking shall be done with fluorescent colour. Serial No. of the transformer shall be written with fluorescent paint on the body of each transformer so that the same can be read from the ground.

3.12 LIMITS OF TEMPERATURE RISE

The temperature rise over the maximum ambient temperature of 50^0C shall not exceeds the limits of 40^0C (measured by resistance) for transformer windings and 35^0C (measured by thermometer) in top oil, when tested in accordance with IS:2026.

3.13 LOSSES, CAPITALIZATION, PENALTY AND IMPEDENCE VALUES

3.13.1 The total losses (no load and load losses at 75^0C) at 50% and 100% of rated load shall not exceed the maximum total load values given in below table.

KVA	Maximum total losses (Watts)	
	50 % load	100 % load
25	190	635
63	340	1140
100	475	1650

These losses are maximum allowable and there would not be any plus tolerance.

3.13.2 Penalty clause for losses

The transformers will be evaluated against no load and load losses guaranteed by the bidders with capitalization of losses as per CBIP guidelines for loss capitalization. The corresponding capitalization figures for no load and losses shall be as follow.

i) No load loss capitalization figure. – Rs. 4,09,979 per KW
ii) Load loss capitalization figure. – Rs. 2,26,718 per KW

However, the maximum loss figures acceptable are as per Annexure -1, GTP. In the event of measured loss figure during testing exceeds the guaranteed loss figures of the successful bidder, penalty shall be applied at a rate of 1.25 times the figures mentioned above for both no load and load losses.

3.13.3 The percentage impedance at 75o C shall be 4.5% with IS tolerances as per IS 2026.

3.14 OVERFLUXING

The transformer shall be suitable for over fluxing (due to combined effect of voltage and frequency) up to 12.5%, without injurious heating or saturation at full load conditions.
The maximum flux density in any part of the core under such condition shall not exceed 1.9 Tesla. The supplier shall furnish necessary design data in support of this stipulation.

3.15 TRANSFORMER OIL

Should be in accordance with specification as per Annex III of this document One sample of oil drawn from every lot of transformer offered for inspection should be tested at NABL accredited lab for tests as listed under Table-1 of IS:1866 (2000). The cost of this testing should be included within the cost of transformer. The results shall be confirming to BSES specification Annex III

4 QUALITY ASSURANCE

4.1 General

The Supplier shall adopt suitable quality assurance program and procedures to ensure that all activities are being controlled as necessary. The Supplier shall indicate following in the quality assurance plan – **Hold Point** "A stage in the material procurement or workmanship process beyond which work shall not proceed without the documented approval of designated individuals or organizations."
The Purchaser's written approval is required to authorize work to progress beyond the Hold Points indicated in approved quality plans.
Notification Point "A stage in material procurement or workmanship process for which advance notice of the activity is required to facilitate witness." If the Purchaser does not attend after receiving documented notification in accordance with the agreed procedures and with the correct period of notice then
work may proceed.

4.2 Quality Plans

The Supplier shall draw up for each section of the work quality plans which shall be submitted to the Purchaser for approval at least two weeks prior to the commencement of work on the particular section. Each quality plan shall set out the activities in a logical sequence and, unless advised otherwise, shall include the following:

- An outline of the proposed work and programme sequence
- The structure of the Supplier's organisation for the contract
- The duties and responsibilities assigned to staff ensuring quality of work for the contract
- Hold and notification points
- Submission of engineering documents required by the specification
- The inspection of materials and components on receipt
- Reference to the Supplier's work procedures appropriate to each activity
- Inspection during fabrication/construction
- Final inspection and test

4.3 Sub-suppliers

The Supplier shall ensure that the quality assurance requirements of this specification are followed by any sub-suppliers appointed by him under the Contract.
The Supplier shall assess the sub-supplier's quality assurance arrangements prior to his appointment to ensure compliance with the specification.
Auditing of the sub-supplier's quality assurance arrangements shall be carried out by the Supplier and recorded in such a manner that demonstrates to then Purchaser the extent of the audits and their effectiveness.

4.4 Guarantee

The Supplier shall guarantee the following:

- Quality and strength of materials used.
- Satisfactory operation during the guarantee period of one year from the date of commissioning, or 18 months from the date of acceptance of the equipment by the Purchaser following delivery, whichever is the earlier.
- Performance figures as supplied by the Bidder in the schedule of guaranteed particulars.
- The offered surface treatment shall protect the treated metal from corrosion for a period of not less than five years from the date of delivery.

5 INSPECTION AND TESTING

5.1 INSPECTION

5.1.1 The manufacture shall carry out comprehensive inspection and testing during manufacturing of the transformer.

5.1.2 The manufacturer shall carry out all type tests and routine tests on the transformer and special test if required any, shall be carried out as per IS by mutual arrangement between purchaser and supplier. The charges, if any, for conducting each of the type tests and special tests shall be indicated separately in the tender.

5.1.3 The purchaser reserves the rights to waive off certain or all tests.

5.1.4 All external components and fittings that are likely to affect the performance of the transformer during the test shall be in its place.

5.2 TESTS

5.2.1 ROUTINE TESTS:

All transformers shall be subjected to the following routine tests at the manufacturer's works and in accordance with IS: 2026 and IS: 1180 (Part – I & II) (Appendix-A) and shall be deemed to be included in the supplier's scope:

- Measurement of winding resistance at all taps.
- Measurement of voltage ratio and check of voltage vector relationship at all taps
- Measurement of impedance voltage/short-circuit impedance and load loss at 50 % &100 % of load.
- Measurement of no-load loss and no load current
- Measurement of insulation resistance and polarization index.
- Magnetic balance test.
- Induced over voltage withstand test
- Separate source voltage withstand test
- Oil breakdown voltage test.
- Over voltage withstand capability Test.
- Pressure test
- Oil leakage test

5.2.2 TYPE TESTS

The product offered must be of type tested quality. In case the product offered is never type tested the same as per below list, type test to be conducted by bidder at his own cost at CPRI/ERDA as per relevant IS. Type test carried out in last five year will be valid.

- Lightning impulse test
- Heat run test
- Short-circuit test (Dynamic short circuit tests & Thermal withstand test)
- Air Pressure test

PRESSURE TEST FOR TRANSFORMER TANK

The tank shall be subjected to following pressure:

- 0.8 kg/cm2 above atmospheric pressure for 30 minutes
- A vacuum of 250 mm of mercury for 30 minutes
  Permanent deflection of flat plate, after pressure has been released, shall not exceed the values given below:

Length of Plate Deflection

Up to 750 mm: 5 mm
Up to 1250 mm: 6.5 mm

If records of a type test on a transformer, which is representative of the one being purchased, are furnished, the purchaser may accept this as evidence of the type test instead of actual test

The supplier shall furnish calculations in accordance with IS: 2026 to demonstrate the thermal ability of the transformers to withstand short circuit.

6 PACKING, SHIPPING, HANDLING AND STORAGE

6.1 Packing shall be sturdy and adequate to protect all assemblies, components and accessories from injury by corrosion, dampness, heavy rains, breakage and vibration encountered during transportation, handling and storage at the plant site.All accessories, which are likely to get damaged during transit if transported mounted on the equipment, shall be removed, adequately packed and shipped separately. All openings shall be sealed. Spare parts shall be packed separately and clearly marked. They shall be specially packed for long storage without injury.

6.2 The bidder shall after proper painting, pack and crate all plant equipment for sea shipment/air freight in a manner suitable for export to a tropical humid and saline air borne climate region as per Internationally accepted export practice in such a manner so as to protect it from damage and deterioration in transit by road, rail and/or sea and during storage at site till the time of erection. The bidder shall be held responsible for all damages due to improper packing.

6.3 The bidder shall give complete shipping information concerning the weight, size, contents of each package including any other information the Purchaser may require. The weight and size of the package shall be such that they can be easily transported from the maker's works to the plant site by ship/air, road ways and railways.

6.4 The bidder shall ascertain at an early date and definitely before the commencement of manufacture, any transport limitations such as weights, dimensions, road culverts, overhead lines, free access etc. from the manufacturing plant to the project site; and furnish to the Purchaser confirmation that the proposed packages can be safely transported, as normal or oversize packages, upto the plant site. Any modifications required in the infrastructure and cost thereof in this connection shall be done and borne by the bidder.

6.5 The bidder shall prepare detailed packing list of all packages and containers, bundles and loose materials forming each and every consignment dispatched to 'site'. The bidder shall further be responsible, for making all necessary arrangements for loading, unloading and other handling right from his works; and from Indian port for equipment under the Off-shore Supply till the 'site' and also till the equipment is erected, tested and commissioned. The bidder shall be solely responsible for proper storage and safe custody of all equipment.
Each packing case shall be indelibly marked, on two adjacent sides and on the top, with the following:

- Individual serial number.
- Purchaser's name.
- Contract number.
- Destination.

- A colour coded marking to indicate destination.
- Supplier's name.
- Name and address of Supplier's agent.
- Description and number of contents.
- Manufacturer's name.
- Country of origin.
- Case measurements.
- Gross and net weights in kilograms.
- All necessary slinging and stacking instructions.

Each crate or container shall be marked clearly on the outside of the case to show TOP and BOTTOM positions with appropriate signs to indicate where the mass is bearing and the correct positions for slings. Six copies of each packing list shall be sent to the Purchaser prior to dispatching the equipment.

APPENDIX-A
LIST OF APPLICABLE CODES AND STANDARDS

All Material against this specification shall conform in all respect to the relevant Indian standard specification / International Standard Specification, with latest amendments from time to time, thereof, some of which are listed below:

Indian Standard	**Title**
IS-2026/2011	Specification for Power Transformer
IS-1180/2014	Outdoor distribution transformer up to and including 2500 KVA
IS-335/1983 REC Specification 39/1993	Specification for oil
IS-2099-1986	Specification for High voltage Porcelain Bushings
IS-7421/1976	Specification for Low voltage Bushings
IS-3347	Specification for Outdoor Bushings
IS-12444	Specification for Cu Wire rods
IS-5484	Specification for Al Wire rods
IS-5/1961 No. 632	Specification for Colors for ready mixed paints.
IS-6600/1972	Guide for loading of oil immersed Transformers.
IS-13947-Part 2	Low voltage switchgear and control gear.
IS-10028/1985	Code of Practice for Selection, Installation and Maintenance of Transformers.
IS-5 / 1994	Colours for ready mixed paints and enamels
IS-3618 / 1966	Specification for phosphate treatment of iron and steel for protection against corrosion
IEC Standard	**Title**
IEC 60296	Specification for unused and reclaimed mineral Insulating oil for transformer and switchgear.
IEC 60076	Specification for power transformer.
IEC 60076-1	General
IEC 60076-2	Specification for temperature rise requirement
IEC 60076-3	Specification for insulation levels and dielectric tests.
IEC 60076-4	Specification for tapping and connections
IEC 60076-5	Specification for ability to withstand short circuit
IEC 60551	Determination for transformer and reactor sound levels
IEC 60354	Guide to loading of oil immersed power transformer
IEC 60137	Insulated bushings for alternating voltage above 1kV
Other International and Internationally recognized star	**Title**
BS148, ASTM D-1275 D-1473, D-1533-1934	Specification for oil
DIN 42531 to 33	Specification for Outdoor Bushings
ASTM B-49	Specification for Cu Wire rods
ASTM B-233	Specification for Al Wire rods

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 Owner. 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. 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 1) Indian Standards, 2) IEC Standards, 3) Other alternative standards.

APPENDIX-B

DRAWINGS SUBMITTAL REQUIREMENT OF THE SUPPLIER

Drawings, Data and Manuals shall be submitted with the bid and after the bid in quantities and procedures as specified in this specification for approval and subsequent distribution after the issue of Notice to proceed.

S.No	Description Of Drawing / Data / Manuals	With bid	Post bid	
		(2 sets of hard copies)	For review & approval (2 sets of hard copies)	Prior to Despatch (2 sets of hard copies and 1 CD-Rom)
1	Completed technical data schedule;	Y		
2	Descriptive literature giving full technical details of equipment offered;	Y		
3	Outline dimension drawing for each major component, general arrangement drawing showing component layout and general schematic diagrams;	Y		
4	Type test certificates, where available, and sample routine test reports;	Y		
5	Detailed reference list of customers already using equipment offered during the last 5 years with particular emphasis on units of similar design and rating;	Y		
6	Details of manufacturer's quality assurance programme and ISO 9000 series or equivalent national certification;	Y		
7	vii) Deviation from this specification. Only deviations approved in writing before award of contract shall be accepted	Y		
8	Recommended spare parts and consumable items for five years of operation with prices and spare parts catalogue with price	Y		

	list for future requirements			
9	Quality Assurance Program	Y		
10	Programme for production and testing (A)		7	
11	Guaranteed Technical Particulars (A)		7	
12	General description of the equipment and all components, including brochures (R)		7	
13	Calculations to substantiate choice of electrical, structural, mechanical component size/ratings (A)		7	
14	Detailed loading drawing to enable the buyer to design and construct foundations for the transformer (R)		7	
15	Transport / shipping dimensions with weight , wheel base details , untanking height etc (R)		7	
16	Terminal arrangements and cable box		7	
17	Drawings of major components like Bushing, Ct etc (A)		7	
S.No	**Description Of Drawing / Data / Manuals**	**With bid**	**Post bid**	
		(2 sets of Hard copies)	**For review & approval (2 sets of hard copies)**	**Prior to Despatch (2 sets of hard copies and 1 CD-Rom**
19	List of makes of all fittings and accessories (A)		7	
20	Statement drawing attention to all exposed points in the equipment at which contact with or in close proximity to other metals and stating clearly what protection is employed to prevent corrosion at each point (A)		7	
21	Detailed installation and commissioning instructions		7	
22	Quality Plan		7	
23	Inspection and test reports carried			Y

	out in manufacturer's works (A)			
24	Test certificates of all bought out items			Y
25	Operation and maintenance Instruction as well as trouble shooting charts / manual			Y

Legend:

Y : The drawing / document is required from the supplier.

7 : Within 7 days of LOI / PO / award of contract.

'A' → Means required for review and approval.

'R' → Means required for reference only.

NOTES:

1 The delivery period shall be reckoned from the date of placement of the order and not from the date of approval of drawings. Thus the delay in the submission of drawings for approval shall result in invoking the provisions of the penalty clause and the no. of days by which the delay has occurred shall be reckoned as delay in delivery. Accordingly it is the responsibility of the bidder to ensure that drawings are submitted within the stipulated number of days.

2 Two (2) sets of all drawings, data sheets shall be furnished in HARD COPY (with a forwarding letter, listing therein all the documents furnished for review / approval) to the Head –Engineering BRPL / BYPL, Bldg. No.-20,Nehru Pace .Drawing submittal by e-mail (soft copies) shall NOT be considered for review.

3 Accordingly the entire review / approval cycle shall be completed within 10 working days from the date of receipt of the first submittal from the supplier.

ANNEXURE- I

DATA SHEET OF CLIENT REQUIREMENT

1 Electrical System Data

Sl. No.	Continuous rated capacity	25 kVA	63 kVA	100 kVA
1	Location of equipment	Generally outdoor but may be located indoor also with poor ventilation		
1.1	Reference design ambient temperature	50^0C		
1.2	Type	Oil immersed, core type, step down		
1.3	Type of cooling	ONAN		
1.4	Tank	Non-Sealed Type- with Conservator Radiators : presses steel tube radiators		
1.5	Reference standard	IS: 2026- Part-1 / 2011 & IS-1180/2014		
1.6	No. of phases	3		
1.7	No. of windings per phase	2		
1.8	Rated voltage HV	11kV		
1.9	Highest System voltage – H.V	12kV		
1.10	Highest system voltage LV side	476 Volt		
1.11	HV system voltage variation	+/-10%		
1.12	Frequency variation	+/- 5%		
1.13	Combined voltage frequency variations	-20% or +10%		
1.14	Power frequency withstand voltage (kV rms) –H.V	28kV		
1.15	Impulse withstand voltage (kVpeak)- H.V	75kV (peak)		
1.16	Rated voltage LV	433 V		
1.17	Line current HV	1.31A	3.306A	5.25A
1.18	Line current LV	33.33A	84.0A	133.0 A
1.19	% Impedance (at 75°C)	4.5% with IS tolerance		
1.20	Guaranteed Total Losses			
1.21	Guaranteed Losses(no load +load losses at 75 °C) (watts) @ 50 % rated load	190	340	520
1.22	Guaranteed Losses(no load +load losses at 75 °C) (watts) @ 100 % rated load	635	1140	1650
1.22	No. of phases	Three		
1.23	Connection HV	Delta		
1.24	Connection LV	Star with Neutral brought out for external earth		
1.25	Vector Group reference	Dyn11		
1.26	No load voltage ratio	11kV/433V		

1.27	Max. System fault level at HV Side	500 MVA
3	Short circuit Withstand capacity of the transformer	
3.1	Three phase dead short circuit at secondary terminal with rated voltage maintained on the other side	For 3 sec
3.2	Single phase short circuit at secondary terminal with rated voltage maintained on other side	For 3 sec
4	Noise Level	48/51/51 db for 25,63,100 KVA transformers respectively.
5	Power frequency withstand voltage kV rms	
5.1	Lighting impulse voltage for nominal system votage of 11KV	75 KV
5.2	For nominal system voltage of 415V	3 KV
6	Clearances Phase to Phase,mm	
6.1	For nominal system voltage of 11KV	280MM.
6.2	For nominal system voltage of 415V	25 MM.
7	Clearances Phase to earth, Mm	
7.1	For nominal system voltage of 11KV	140 MM
7.2	For nominal system voltage of 415V	25 MM
8	System Fault Level, LV side	35MVA
9	HV	Solidly earthed
9.1	LV	Solidly earthed
10	Maximum overall dimension acceptable (Length x Width x height) mm x mm x mm	(1150 X 1010 X 1380) mm
11	Overload Capability	As per IS 6600
12	Radio Influence Voltage	Maximum 25 microvolt
13	Harmonic suppression	Transformer to be designed for suppression of 3rd, 5th, 7th harmonic voltages and high frequency

		disturbances.
14	Partial Discharge	Transformer to be free from partial discharge upto 120% of rated voltage as the voltage is reduced from 150% of rated voltage i.e. there shall be no significant rise above background level
15	Tappings for 100kVA	Off circuit taps on HV winding,+/-5 % in steps of 2.5%,change of taps by externally operated switch
16	Rotary tap switch operating voltage	11Kv
16.1	Rotary tap switch current rating Amp.	60AMP
17	Loss capitalization formulae	As per CBIP manual
17.1	No load loss capitalization Figure	Rs. 4,09,979 per KW
17.2	Load loss capitalization figure	Rs. 2,26,718 per KW
18	Temperature rise over reference ambient of 50^0C	
18.1	Top oil by thermometer ^{0}C	35^0C
18.2	Winding by resistance ^{0}C	40^0C
19	Thickness of radiator tubes, Mm	Minimum 1.2mm
20	Details of Tank	
20.1	Material	Robust mild steel plate without pitting and low carbon content
20.2	Vacuum mm of Hg./ (kN/m2)	As per IS
20.3	Pressure mm of Hg.	
20.4	Is the tank lid sloped	Yes
21	Type	Core
21.1	Core material grade	Premium grade minimum M4
21.2	Insulation of lamination	With insulation coating on both sides
21.3	Design Flux density	1.6Tesla
21.3.1	Maximum flux density at 10%over excitation / over fluxing,Tesla	1.9Tesla
22	Conductor material	Electrolytic Copper
22.1	Current density (HV/LV)	Maximum allowed 3.0 A per sqmm at all taps
23	Bushing / Support Insulator	
23.1	HV side Bushing /Support Insulator	12kV
23.2	LV side line and neutral bushing / Support Insulator	1.1kV
23.3	Creepage factor for all bushing / Support Insulator mm/KV	31 mm / kV
24	Rated thermal short time current	

24.1	HV bushing	25 times rated current for 2 secs
24.2	LV line and neutral bushing	25 times rated current for 2 secs
25	LV Cable termination arrangement	With LT cable box, (with O/G cable termination arrangement)
25.1	Suitable for cable type, size	Outgoing LT cable of size of 4C x150sqmm
25.2	Termination height, mm	As per cable box design
25.3	Gland Plate dimension, mm x mm	As per cable box design
25.4	Gland Plate material	MS / Aluminum
25.5	Gland Plate thickness, mm	5mm minimum
25.6	Phase to clearance inside box, mm	25 mm minimum
25.7	Phase to earth inside, mm	25 mm minimum
26	L.V neutral Cable termination arrangement	Additional LV Neutral shall be provided on LV Cable Box for direct earthing on separate pit.
27	Painting of transformer, Radiator, cable boxes etc.	
27.1	Surface preparation	By 7 tank pre-treatment process or shot/ sand blasting method
27.2	Finish on internal surfaces of the transformer	Bright Yellow heat resistant and oil resistant paint two coats. Paint shall neither react nor dissolve in hot transformer insulating oil.
27.3	Finish on inner surface of the CT terminal box, HV/ LV/LVN cable box	White Polyurethane paint ant condensation type two coats, minimum dry film thickness 80 microns
27.4	Finish on outer surface of the transformer, radiator, CT terminal box, HV/LV/LVN cable box	Battle ship Grey shade 632 Polyurethane paint two coats, minimum dry film thickness 80 microns
27.5	Frame parts	Battle ship shade- 632 IS 5, with 80 microns (min.), insulating oil resistant paint. Paint shall neither react nor dissolve in hot transformer insulating oil.
28	Fittings and Accessories on Transformer	
28.1	Rating and Diagram Plate	Required
28.2	Material	Anodized aluminum 16SWG
28.3	Background	SATIN SILVER
28.4	Letters, diagram & border	Black
28.5	Process	Etching
28.6	Rating and Diagram Plate details	Following details shall be provided on rating and diagram plate as a minimum, requirement.
		i) type/kind of transformer with winding material
		ii) Standard to which it is manufactured
		iii) Manufacturer's name
		iv) Transformer serial number
		v) Month and year of manufacture
		vi) Rated frequency in HZ

		vii) Rated in kV
		viii) Number of phases
		ix) Rated power in kVA
		x) Type of cooling (ONAN)
		xi) rated currents in A
		xii) Vector group connection symbol
		xiii) 1.2/ 50 wave impulse voltage withstand level in kV
		xiv) Power frequency withstand voltage in kV
		xv) Impedance voltage at rated current and frequency in percentage at principal, minimum and maximum tap
		xvi) Max. Total losses at 50 % rated load & at 100% rated load
		xvii) No-load loss at rated voltage and frequency
		xviii) Continuous ambient temperature rise at rated load in deg C
		xix) Top oil and winding temperature rise at rated load in deg. C
		xx) Winding connection diagram with taps and table of tapping voltage, current and power
		xxi) Transport weight of transformer
		xxii) Energy efficiency level.

2 Transformer Requirements

Type of transformer	Conventional distribution transformer
Type of construction	Core type, Oil immersed
Type of cooling	Oil Natural Air Natural (ONAN)
No of phases	Three phase on primary & secondary side
No of windings	Two (one each for 3 phase primary & 3 phase secondary)
Type of service	Outdoor application
Type of mounting	Suitable for pole mounting, Double pole structure

The transformer shall be capable of withstanding the thermal and dynamic effects of short circuits, as specified in -"IEC 76-5: Ability to withstand short circuits" Each transformer shall be capable of withstanding for 3 seconds a bolted metallic short circuit on the terminals of either winding, with rated voltage on the other winding.

The transformers will be installed outdoor.

The transformers shall be capable of continuous operation of rated output under the operating conditions of voltage and frequency variations.

3 SERVICE CONDITIONS

3.1 Site Conditions

S.No.	Description	Details
1	Relative humidity	
	a) Maximum	100%
	b) Minimum	10%
2	Average annual rainfall	750mm
3	Average no. of rainy days	50 per annum
4	Temperature max/min/year average	50^0C / 40^0C
5	Average no. of thunder storm days	40 per annum
6	Rain Months	June to October
7	Wind pressure	195 kg/m2 up to an elevation of 30 mt. As per IS:875/ 975

4 GENERAL PARTICULARS AND GUARANTEES

4.1 COMPLIANCE WITH SPECIFICATION

The transformers shall comply in all respects with the requirements of this specification. However, any minor deviations from the provisions of the specification shall be disclosed at the time of tendering.

4.2 COMPLIANCE WITH REGULATIONS

All the equipment shall comply in every respect with the Indian Regulations and acts in force.

The equipment and connections shall be designed and arranged to minimise the risk of fire and any damage which might be caused in the event of fire.

5 SPARE PARTS AND SPECIAL TOOLS

The bidder shall quote separately for the following mandatory spares;

- HV Bushing
- LV Bushing.

The Bidder shall provide a list of recommended spare parts together with their individual prices and shall include HV and LV bushings and bi-metallic connectors for HV and LV bushings. This list shall identify all essential spares and consumable items for any recommended maintenance for a period of five years after commissioning.
Spare parts shall be delivered suitably packed and treated for long periods in storage. Each pack shall be clearly and indelibly marked with its contents, including a designation number corresponding to the spare parts list in the operation and maintenance instructions.

ANNEXURE II
VENDOR DATA

(GURANTEED TECHNICAL PARTICULARS)

Note: This GTP is to be filled by the supplier in accordance with the given specification. Any deviation from the same shall be clearly highlighted and shall be supported with relevant documents.

S. No.	Description	UNIT	25kVA	63kVA	100kVA
1	Name of manufacturer				
2	Type				
3	Ratings				
(a)	Rated output	kVA			
(b)	Rated voltage-HV	Volts			
(C)	Rated voltage-LV	Volts			
(d)	No load voltage ratio				
(e)	Number of phases				
(f)	Frequency	Hz			
4	Connections				
(a)	High voltage				
(b)	Low voltage				
(c)	Vector group symbol				
5	Method of cooling				
6	Internal dimensions of tank				
(a)	Length	mm			
(b)	Breadth	mm			
(C)	Height	mm			
(d)	Thickness of tank sheet				
	i)Sides	mm			
	ii)Top	mm			
	iii)Bottom	mm			
7	Details of core				
(a)	Diameter	mm			
(b)	Cross sectional area				
	i) Gross	mm^2			
	ii)Net	mm^2			

(c)	Window height	mm			
(d)	Limb center	mm			
(e)	Maximum flux density at rated voltage and frequency(to be supported by calculations)	Tesla			
(f)	Material and thickness of lamination	mm			
(g)	Weight of stamping in core and yoke separately				
	i)Core	Kgs			
	ii)Yoke	Kgs			
	iii)Total	Kgs			
8	HV coil constructional details				
(a)	Type of winding	mm			
(b)	Size of conductor (Bare)	mm^2			
(C)	Cross sectional area of conductor				
	i) Gross				
	ii) Net				
(d)	Number of coils per limb				
(e)	Outer diameter of coil	mm			
(f)	Inner diameter of coil	mm			
(g)	Mean diameter of coil	mm			
(h)	Insulation of conductor				
(i)	Interlayer reinforcement detail				
(j)	Current at full load	Amp			
(k)	Normal working current density	Amp/ mm^2			
(l)	End turn				

	insulation				
(m)	Weight of bare conductor used in one leg of HV	Kg			
(n)	Weight of insulated conductor used in one leg of HV	Kg			
(o)	Number of turns per leg				
(p)	Length of mean turns	mm			
(q)	**I^2R at 75^{O}C (To be supported by calculations)**				
(r)	Axial length	mm			
(s)	Resistance per phase at **75^{O}C** (Max)	Ohms			
(t)	Weight of winding with insulation in one leg of HV	Kg			
9	LV coil constructional details				
(a)	Type of winding				
(b)	Size of conductor (Bare)	mm			
(C)	Cross sectional area of conductor	mm^2			
	i) Gross				
	ii) Net				
(d)	Number of coils per limb				
(e)	Outer diameter of coil	mm			
(f)	Inner diameter of coil	mm			
(g)	Mean diameter of coil	mm			
(h)	Insulation of conductor				

(i)	Interlayer reinforcement detail				
(j)	Current at full load	Amp			
(k)	Normal working current density	Amp/ mm^2			
(l)	End turn insulation				
(m)	Weight of bare conductor used in one leg of LV	Kg			
(n)	Weight of insulated conductor used in one leg of LV	Kg			
(o)	Number of turns per leg				
(p)	Length of mean turns	mm			
(q)	**I^2R at 75°C (To be supported by calculations)**				
(r)	Axial length	mm			
(s)	Resistance per phase at **75°C** (Max)	Ohms			
(t)	Weight of winding with insulation in one leg of LV	Kg			
10	Insulation details material and size				
(a)	HV coil end packing				
(b)	LV coil end packing				
(C)	Inter coil spacer of HT sections				
(d)	Bottom core strip insulation				

(e)	Yoke insulation				
(f)	Clamp insulation				
(g)	Inter phase barrier				
(h)	Core wrap				
(i)	Cylindrical insulation between HT & LT				
(j)	Type of blocks used between coils				
11	Details of clearances				
(a)	Internal clearance between inner walls of tank and core coil assembly unit	mm			
	i) On length (Bushing side)				
	ii) On breadth (Non Bushing side)				
(b)	Radial clearance between LV and HV winding	mm			
(C)	Phase to phase clearance between HV limb	mm			
(d)	Clearance from top of the yoke to the inside of the top cover of tank	mm			
(e)	Radial clearance of LV coil from core	mm			
(f)	Horizontal duct between HT sectional coil				
(g)	End clearance	mm			

	of HT coil from yoke				
(h)	Minimum clearance between core and tank bottom	mm			
12	Impulse test voltage of winding for 1.2/50 micro seconds wave according to relevant ISS				
(a)	HV				
(b)	LV				
13	Volts per coil of HV winding	Volts			
14	Approximate volts per layer of HV winding	Volts			
15	Performance reference temperature	Deg. C			
16	No load loss at rated primary voltage and frequency.(Guaranteed value without any positive tolerance)	Watts			
17	Total losses				
17.1	Total losses(no load load losses at **75^{O}C @ 50 % load)** (Guaranteed value without any positive tolerance)	Watts			
17.2	Total losses(no load load losses at **75^{O}C @ 100 %**				

	load) (Guaranteed value without any positive tolerance)				
18	Induced over voltage test at double frequency				
19 (a)	No load current at 100% rated voltage and rated frequency as percentage of full load current.				
(b)	No load current at 112.5% of rated voltage as percentage of full load current				
20	Regulation at normal full load and UPF at 75^{O}C				
21	Regulation at normal full load and 0.8 Lag PF at 75^{O}C				
22	Impedance voltage at rated voltage and frequency at 75^{O}C	Volts			
23	Percentage reactance at rated voltage and frequency at **75^{O}C**				
24	Percentage resistance at **75^{O}C**				

25	Percentage impedance at 75^{O}C								
(a)	With respect to high voltage								
(b)	With respect to low voltage								
26	Unbalance current as percentage of full load current								
27	Percentage efficiency		**At UPF**	**At 0.8 Lag PF**	**At UPF**	**At 0.8 Lag PF**	**At UPF**	**At 0.8 Lag PF**	
(a)	Full load								
(b)	¾ full load								
(c)	½ full load								
(d)	¼ full load								
28	Permissible duration of overload following continuous running at normal rated load in ambient temperature of 50^{O}C								
(a)	10%overload								
(b)	20%overload								
(c)	30%overload								
29	RMS value of symmetrical short circuit current which the transformer can withstand and its duration according to clause 9.1 of ISS-2026 or clause –1001 of BSS with latest amendment.								

30	Increase in temperatureof winding at full load by resistance method in an ambient temperature of 50°C				
31	Increase in temperature of oil by thermometer at full load in an ambient temperature of 50°C				
32	Temperature of hottest spot in the winding at full load in an ambient temperature of 50°C				
33	Terminal arrangement of HV side				
34	Terminal arrangement of LV side				
35	Particulars of HV bushing				
(a)	Name of manufacturer				
(b)	Type				
(c)	Dry withstand voltage for one minute				
(d)	Wet withstand voltage for thirty minutes				
(e)	Voltage rating				
(f)	Impulse withstand voltage 1.2/50 micro second wave				

	i)Positive				
	ii)Negative				
(g)	Total creepage distance in air	mm			
(h)	Height of bushing above transformer tank				
36	Particulars of LV neutral bushing				
(a)	Name of manufacturer				
(b)	Type				
(c)	Voltage rating				
(d)	Dry withstand voltage for one minute				
(e)	Wet withstand voltage for thirty minutes				
(f)	Total creepage distance in air	mm			
(g)	Height of bushing above transformer tank	mm			
37	Time constant of transformer				
38	Transformer oil				
(a)	Dielectric strength				
(b)	Resistivity				
(c)	Acidity				
(d)	Tan delta				
(e)	Name of supplier				
39	Quantity of transformer oil	Litres			
40	Weight of the following				
(a)	Tank and fittings	Kgs			
(b)	Core and windings	Kgs			
(c)	Transformer oil	Kgs			
(d)	Total weight of transformer including	Kgs			

	oil				
41	Overall dimensions of transformer				
(a)	Length	mm			
(b)	Breadth	mm			
(c)	Height	mm			
42	Name of material and size used for clamping of core winding				
(a)	Core clamp				
(b)	Tie rod				
(c)	Core bolt				
(d)	Bottom plate				
43	Size of conservator				
(a)	Volume				
(b)	Length/ diameter				
(c)	Sheet thickness				
44	Size of material of delta and line leads				
45	Core earthing material				
46	Silica gel breather				
	i)Make				
	ii)Size				
47	Clearance between phases and phases to earth in air				
(a)	Phase to phase(HV side)	mm			
(b)	Phase to phase (LV side)	mm			
(c)	HV to earth	mm			
(d)	LV to earth	mm			
48	Type testing				
(a)	Is the offered 11kV/433V, conventional distribution				

	transformer type tested? (Yes, No)				
(b)	If yes, when and where was it type tested?				
(c)	Is there any deviation in the technical specification of offered 11kV/433V conventional type distribution transformer? If yes, give details.				
	Name of test	Date of test	test report enclosed or not(Y/N)	test report enclosed or not(Y/N)	test report enclosed or not(Y/N)
i)	Unbalance current test				
ii)	Impulse voltage withstand test				
iii)	Temperature rise test				
iv)	Short circuit test				
v)	Thermal ability test				
vi)	Air pressure test				
49	Whether you will use specified aluminum alloy or brass copper with suitable bimetallic arrangement for HV/LV connector				
50	Have you submitted drawing and calculation of cross sectional area of core?				

	(Yes/No)				
51	Have you submitted calculation for computation of no load and load loss at 750Cas per design data of offered transformers? (Yes/No)				
52	Any other information				

ANNEXURE III
TRANSFORMER OIL

The insulating oil shall have following features:

2.1	Appearance	Clear, transparent and free from suspended matter or sediments
2.2	Density at 29.5 deg C Max	0.89 g/cm3
2.3	Kinematics viscosity Max	16 cSt at 27 deg C
		11 cSt at 40 deg C
2.4	Interfacial tension at 27 deg C	0.04 N/m
2.5	Flash point pensky- marten (closed)	140 deg C
2.6	Pour Point, Max	-15 deg C
2.7	Neutralization value	
	i) Total acidity, Max	0.03 mg KOH/g
	ii) Inorganic acidity / Alkalinity	Nil
2.8	Corrosive Sulfur	Non-corrosive
2.9	Electric strength breakdown voltage	Average value of six samples
	i) New unfiltered oil. Min	30 kV (rms) min
	ii) After filtration Min	60 kV (rms)
2.10	Dielectric dissipation factor (tan δ)	0.002 at 90 deg C, Max
		0.0005 at 27 deg C, Max
2.11	Oxidization Stability	
	i) Neutralization value after oxidation, Max	0.15 mg KOH/g
	ii) Total sludge, after oxidation, Max	0.03 % by weight
	iii) Max Tan delta at 70 deg C	0.1
2.12	Specific resistance (resistivity)	
	a. 27 deg C	150 X 10^12 ohm-cm
	b. 90 deg C	3000 X 10 ^12 ohm-cm
2.12	Ageing characteristics after accelerated ageing	(open breaker method with copper catalyst)
	i) Specific resistance (resistivity)	
	a. 27 deg C	27 X 10^12 ohm-cm
	b. 90 deg C	2 X 10 ^12 ohm-cm
	ii) Dielectric dissipation factor (tan δ) at 90 deg C Max	0.1
	iii) Total acidity, Max	0.05 mg KOH/g
	iv) Total sludge, Max	0.05 % by weight
2.13	Presence of oxidation inhibitor	no antioxidant additives
2.14	Water content, Max	40 ppm
2.15	Max PCA (Poly cyclic aromatics) content	3%
2.16	PCB (Poly chlorinated biphenyl) content	Not detectable
2.17	Tests	As per IS 335