BSES Yamuna Power Limited

NOTICE INVITING TENDER (NIT)

FOR

TURNKEY PACKAGE FOR CONVERSION OF 33 KV SYSTEM AT GT ROAD GRID FROM OUTDOOR AIS TO INDOOR GIS WITH DOUBLE BUS BAR SYSTEM, AUGMENTATION OF 1 NO 33/11 kV POWER TRANSFORMER FROM 16 TO 31.5 MVA AND INSTALLATION OF 3 NOS 11KV SWITCHBOARD ALONG WITH ASSOCIATED CIVIL WORKS

NIT NO CMC/BY/22-23/RS/SV/26

Due Date for Submission: 18.07.2022, 14:00 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

Table of Contents

BSES Yamuna Power Limited

VOLUME – I: INFORMATION TO BIDDER (ITB)

1.00 EVENT INFORMATION

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

Sr.	Description	Estimated Cost (₹)	Cost of EMD (₹)
1	TURNKEY PACKAGE FOR CONVERSION OF 33 KV SYSTEM AT GT ROAD GRID FROM OUTDOOR AIS TO INDOOR GIS WITH DOUBLE BUS BAR SYSTEM, AUGMENTATION OF 1 NO 33/11 kV POWER TRANSFORMER FROM 16 TO 31.5 MVA AND INSTALLATION OF 3 NOS 11KV SWITCHBOARD ALONG WITH ASSOCIATED CIVIL WORKS	21.70 Crore	21.70 Lakh

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

All envelopes shall be duly super scribed **"CMC/BY/22-23/RS/SV/26 - TURNKEY PACKAGE FOR CONVERSION OF 33 KV SYSTEM AT GT ROAD GRID FROM OUTDOOR AIS TO INDOOR GIS WITH DOUBLE BUS BAR SYSTEM, AUGMENTATION OF 1 NO 33/11 kV POWER TRANSFORMER FROM 16 TO 31.5 MVA AND INSTALLATION OF 3 NOS 11KV SWITCHBOARD ALONG WITH ASSOCIATED CIVIL WORKS"**

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 **₹ 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 **18.07.2022, 14:00 PM.** at the address given below.
Part A of the Bid shall be opened on **19.07.2022, 12:00 PM**.

Part B of the Bid will be opened in case of Techno-Commercially qualified Bidders and the date of opening of same shall be intimated in due course. It is the sole responsibility of the bidder to ensure that the bid documents reach this office on or before the last date.

Head of Department
Contracts & Materials Deptt.
BSES Yamuna Power Ltd
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 is received after due date and time.
b) Tender fee of requisite value is not submitted.
c) 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.
d) Price Bid as per the Price Schedule mentioned in Annexure-I is not submitted.
e) Incomplete Bids.
f) Necessary documents against compliance to Qualification Requirements mentioned at Section 1 Clause 2.0 of this Tender Document.
g) Complete Technical details are not enclosed as per the Technical Bid Submission Checklist.
h) Filled in Schedule of Deviations as per Annexure.

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.

2.02 **Technical Criteria:**

Sl No.	Criteria	Documents to be submitted by bidder
1	The bidder should be a manufacture of any two major equipment out of three – 33/11KV 31.5 MVA Power Transformer, 33KV GIS and 11KV AIS.	manufacturing and factory incorporation certificate
2	The bidder should have infrastructure in India for providing service & spare support to BYPL. The relevant documents including details of manufacturing units, locations and works from where supply & spares against this tender shall be proposed to be furnished.	i. Details of manufacturing units ii. details of service units
3	The bidder should have established project management, field quality assurance system & safety organization designed to achieve high level of reliability at various stages of field services required for successful erection, testing & commissioning. The bidder should have successfully designed, supplied, installed & commissioned minimum two 33KV GIS Grid substations or higher rating projects in last 5 years. Details of these projects including customer name, PO number (with date), date of completion and rating (Capacity/Voltage etc) shall be provided.	i. Turnkey Purchase order/Work order copy ii. Work completion certificate copy
4	Performance certificate for 2 (two) year satisfactory performance from at least 2 executed projects of 33KV GIS or higher voltage rating should be submitted. In case of bidder has a previous association with BRPL/BYPL for similar product and service, the performance feedback for that bidder by BRPL/BYPL shall only be considered irrespective of performance certificate issued by any third organization.	Performance certificates

5	Bidder shall procure equipment from the approved vendor list of BYPL for individual items (attached in Scope). 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 equipment. The bidder must submit the undertaking for the same.	Undertaking for Back up support by OEM's
6	The bidder must possess valid ISO 9001:2015 certification or above.	Valid copy of Certification
7	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 where copy of valid license shall be submitted to BYPL before the start of the work OR Bidder to give the undertaking that it will be obtained by them before the start of the work at site.	i. Electrical Contractor License Copy ii. Undertaking if not available

2.02 **Commercial Criteria:**

Sl No.	Criteria	Documents to be submitted by bidder
1	Bidder should have Average Annual Sales Turnover of Rs 200 Crores or more in last three (3) Financial Years (i.e., FY 2018-19, 2019-20 & 2020-21)	Balance Sheet and Duly certified CA certificate with UDIN no. to be submitted
2	The Bidder shall submit an undertaking that "No Litigation" is pending with the BYPL or its Group/Associates Companies.	Undertaking
3	An undertaking (self-certificate) that the bidder has not been blacklisted/debarred by any central/state government institution/Electricity utilities.	Undertaking
4	The bidder must have valid PAN No., GST Registration Number, in addition to other statutory compliances. The bidder must submit the copy of registrations and submit an undertaking that the bidder shall comply all the statuary compliances as per the laws/rules etc. before the start of the supply/work.	Relevant Statutory Documents Copy/ Undertaking

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 BYPL website/email.

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 the schedule of deviation, the bid shall be deemed to confirm the BYPL's specifications.

BSES Yamuna Power Limited

3.01 BID SUBMISSION

Please mention our NIT Number: - …… 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 email immediately after 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 Sumit Verma, E-mail: sumit.ra.verma@@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

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

Sr. No	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 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

Sr. No	Descriptions	Type of Documents
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	**No litigation Certificate**	Duly signed No Litigation Certificate as per attached format.
8	**Commercial Terms and Conditions**	Acceptance on Commercial Terms and Conditions viz Delivery schedule/period, Payment terms, PBG etc.
9	**Acceptance on Reverse Auction**	Duly signed Acceptance Form For Participation In Reverse Auction Event as per attached format
10	**Bid Form (Unpriced) Duly Signed**	Duly Signed Bid Form as per attached format
11	**Un price Bid Duly Signed**	Duly Signed Un price Bid as per attached format
Technical:		
12	**Technical Details/ Filled in GTP/Drawings**	Bidder shall submit duly filled GTP with all Technical documents and Drawings.
13	**Field Quality and assurance Plan (QAP)**	Bidder shall submit the detailed QAP plan in their technical proposal.
14	**Type Test Reports**	Bidders shall submit the copy of type test reports in their technical bids in support of PQR conditions
15	**Project Implementation Plan and Methodology**	Bidder shall submit detail Project Implementation plan and methodology in their technical bid.
16	**Testing Facilities**	Bidder shall submit the details of testing facilities available at their works/factory.
17	**Organization Chart & Manpower Details.**	Bidder shall submit the details of Manpower to be deployed for project management with qualification and experience.
18	**List of Current Commitments/ Work In Progress.**	Bidder shall submit the list of projects (Current Commitments/Work in Progress)

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.	Events	Due date & Time
1	Date of sale/ availability of tender documents from BYPL Website	upto 18.07.2022, 14:00 Hours
2	Date & Time of Pre-Bid Meeting Pre-Bid Meeting will be done online, Register in advance for this meeting, Zoom Meeting link: https://zoom.us/meeting/register/tJArf-2prz4qG92Wqfbb7AMtVyxdEXRZ4Isi After registering, you will receive a confirmation email	04.07.2022, 12:00 Hours

S. No.	Events	Due date & Time
	containing information about joining the meeting.	
3	Last Date of receipt of pre-bid queries, if any (Queries to be submitted via e-mail)	06.07.2022 up to 17:00 Hours
4	Last Date of replies to all the pre-bid queries as received	11.07.2022 up to 18:00 Hours
5	Last date and time of receipt of Complete Bids (Tender Fees, EMD, Part A & Part B)	18.07.2022, 14:00HRS
6	Date & Time of Opening of PART A – EMD and Technical Bid	19.07.2022, 12:00HRS
7	Date & Time of opening of Price/RA of qualified bids	Will be notified to the qualified bidders through our website / e-mail

This is a two part bid process. Bidders are to submit the bids in 2(Two) parts
Both these parts should be furnished in separate sealed covers super scribing NIT no. DUE DATE OF SUBMISSION, with particulars as **PART-A TECHNICAL BID & COMMERCIAL TERMS & CONDITIONS** and **Part-B FINANCIAL BID** and these sealed envelopes should again be placed in another sealed cover which shall be submitted before the due date & time specified.

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

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

Bidder has to submit the item wise price bifurcation in bid. Un priced copy must be attached with the Part A (Technical Bid). Reverse Auction will be carried out on Lump sum Basis/Total Landed Cost i.e. Supply + Services

REVERSE AUCTION CLAUSE :: Purchaser reserves the right to use reverse auction as optional tool through SAP – SRM as an integral part of the entire tendering process. All techno-commercially qualified bidders 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

4.00 AWARD DECISION

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

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

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

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

4.06 Qty Variation: The purchaser reserves the rights to vary the quantities as per the actual requirements.

5.00 MARKET INTEGRITY

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

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

6.00 SUPPLIER CONFIDENTIALITY

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

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

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

7.00 CONTACT INFORMATION

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

Address	Name/ Designation	E-mail Address
Technical		
CES Dept. 3rd Floor, B-Block, BSES Yamuna Power Ltd Shaktikiran Building, Karkardooma, Delhi 110032	Abhishek Harsh DGM (CES)	abhishek.harsh@relianceada.com
	Srinivas Gopu GM (CES)	srinivas.gopu@relianceada.com
	Gaurav Sharma AVP (HOD-CES)	gaurav.a.sharma@relianceada.com
Commercial		
C&M Dept. 3rd Floor, A-Block,	Sumit Verma	sumit.ra.verma@relianceada.com

BSES Yamuna Power Ltd Shaktikiran Building, Karkardooma, Delhi 110032	GM (C&M)	
	Santosh Singh Addl. VP (Head-Procurement)	santosh.kum.singh@relianceada.com
	Robin Sebastian VP (HOD-C&M)	robin.sebastian@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 shall include survey, design, engineering, manufacturing, shop testing, inspection, packing & dispatches, transportation, loading, unloading, storage at site, erection & installation, associated civil works, commissioning, handing over to bypl including comprehensive marine cum storage cum insurance policy (mse) on "single point responsibility basis" for gis grid substation "on turnkey basis"

3.00 **DISCLAIMER**

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

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

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

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

4.00 **COST OF BIDDING**

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

B. BIDDING 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 Eighty (180) 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 Supply with a break-up of prices for individual items. The total Bid Price shall also cover all the Supplier's obligations mentioned in or reasonably to be inferred from the Bidding Documents in respect of Design, Supply, Transportation to site, all in accordance with the requirement of Bidding Documents the Bidder shall complete the appropriate Price Schedules included herein, stating the Unit Price for each item & total Price.

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

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

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 180 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 Duplicate Soft copy in USB flash drive 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 copies) & One Duplicate Soft copy in USB flash drive 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 from the Purchaser, the successful Bidder shall furnish the Performance Bank Guarantee for an amount of 10% (Ten percent) of the Contract Price. The Performance Bond shall be valid upto contract completion. Upon submission of the performance security, the EMD shall be released.

30.0 **CORRUPT OR FRADULENT PRACTICES**

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

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

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

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

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

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

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

31.00 **GENERAL**

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

31.01 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.

31.02 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 any other party.

31.03 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 NIT requirement is incomplete.

31.04 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.

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 it's Corporate Office at Shaktikiran Building, Karkardooma, Delhi -110032, (herein after called —the "Purchaser")in the sum of Rs..... (Rupees..... only) for which payment well and truly to be made to the said Purchaser, the Bank binds itself, its successors, and assigns by these presents.

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

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 Eighty (180) 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 in Section IV from the date of award of purchase order/letter of intent.

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

5 We agree to abide by this Bid for a period of 180 days from the due date of bid submission and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

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

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

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

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

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

Signature..... In the capacity of ……

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

(IN BLOCK CAPITALS) .....

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

LITIGATION HISTORY

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

CURRENT CONTRACT COMMITMENTS / WORK IN PROGRESS

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

FINANCIAL DATA
(Duly Certified by Chartered Accountant)

	Actual in previous 5 financial years				
	FY 20-21	FY 19-20	FY 18-19	FY 17-18	FY 16-17
Total assets					
Current assets					
Total Liability					
Current Liability					
Profit before taxes					
Profit after taxes					

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:

Technical Deviations:-

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

Commercial Deviations:-

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

By signing this document we hereby withdraw all the deviations whatsoever taken anywhere in this bid document and comply to all the terms and conditions, technical specifications, scope of work etc. as mentioned in the standard document except those as mentioned above.

Seal of the Bidder:

Signature:

Name:

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 submitted in Box file/spiral binding. Any other format is not acceptable	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

SPECIAL CONDITIONS OF CONTRACT (SCC)

BSES Yamuna Power Limited

Table of Contents

BSES Yamuna Power Limited

SPECIAL CONDITIONS OF CONTRACT

1.0 PRIORITY OF CONTRACT DOCUMENTS:

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

1. The Contract Agreement
2. The Letter of Acceptance/ Intent
3. Agreed Minutes of the Contract Negotiation Meetings
4. Agreed Minutes of the contract Technical Meetings
5. Instruction To Bidders (ITB)
6. Special Condition of Contract (SCC)
7. General Condition of Contract (GCC)
8. Erection Conditions of Contract (ECC)
9. Civil Conditions of Contract
10. The Priced Bill of Quantities
11. The Particular Technical Specifications
12. The General Technical Specifications
13. The Submitted Tender, including all Appendices and/or Addenda, the latest taking precedence.

2.0 SCOPE OF WORK:

The scope of work under this contract shall include the turnkey execution on End to End Basis, including but not limited to design, manufacturing, inspection & testing, dispatches, loading, unloading, storage at site, erection & installation, testing of the installation, associated civil work, commissioning, Handing over to the purchaser including comprehensive marine cum storage cum erection Insurance (MSE) on "Single Point Responsibility Basis"

The entire scope of work under the contract shall be executed strictly as per the NIT conditions and the technical specification.

Scope of work shall mainly include:

1. The Scope of work under the package shall include all Supply, Survey , Design, Engineering , Manufacturing, Shop testing, Inspection, packing, dispatch, loading, unloading and storage at site, Marine cum Storage cum Erection Insurance policy, assembly, Erection, Structural and Civil work, complete pre-commissioning checks, testing and commissioning at site, obtaining statutory clearance & certification from Electrical Inspector and any other statutory authority for charging the substation and handing over of complete package.

2. The scope shall also include supply at site of all barricading, free-issued materials if any (including installation, transportation, loading & unloading), dewatering, watch and ward and transportation of scrap (generated at Site), balance free-issued material, dismantled material from site to site , site to BYPL store including loading & unloading and no additional

charges shall be paid against these activities. Used barricading material will be taken back by contractor soon after job is handed over or as directed by BYPL Engineering Incharge. No additional cost for these items will be paid to the Bidder. Any leakage, pilferage and damage of the material shall be in vendor's scope.

3. Contractor shall submit the detailed PERT chart/L2 Network for the execution of the package awarded for BYPL review and approval with major intermediate milestone as mentioned in Annexure- I. Contractor shall strictly adhere to the implementation schedule as per the project plan submitted and approved.

4. All the materials supplied against this contract shall be as per BYPL approved "Makes" and "Specifications" ONLY.

5. Permission for road cutting from Road owning agencies, Tree cutting and other statutory clearances (including all coordination and liasoning) shall be obtained by Bidder. However, All direct Fee shall be borne by BYPL.

6. Wherever BYPL specifications are not available, relevant IS/IEC to be followed. All Drawings mentioned in the Tender Specification and others required for completion of the work shall be submitted and approval of BYPL Engineer in Charge obtained before commencement of any job. Drawing submission process shall not be deemed complete until all the requirements are complied during the submission of the same.

7. The Contractor shall have own Safety equipment like Neon Tester, Portable Earth, Earthing discharge rod etc. along with valid Calibration Certificates of all the equipment.

8. Any material not specifically mentioned In BOQ but required for successful Erection, Testing and Commissioning of the package awarded shall be deemed to be in the scope of the bidder.

9. Successful Bidder shall depute Safety officer and Quality officer at site separately for each package and for the entire duration of the project and they shall submit the safety report and quality report to BYPL Site In charge on weekly basis.

10. Any item/work, not specifically mentioned in the NIT condition and technical specification but essentially required for completion of the work shall be the responsibility of the contractor

11. All Statuary Compliances (wherever applicable) required to complete the work as defined above are in the scope of contractor.

12. Electrical inspection clearance certification from BSES Electrical Inspector and any other statutory authority for charging the substation are in scope of Contractors.

3.0 CONTRACT PRICES:

The contract price shall be including all the detailed scope as specified in the contract for the package awarded and shall be inclusive of all taxes and duties (GST) as applicable.

Prices are inclusive of all taxes and duties including labour cess.

However, IT as per applicable rate will be deducted from your bills as Tax Deduction at Source (TDS).

GST is included in the contract price awarded , however GST payment shall be made on submission of GST Registration and self declaration on your letter head stating that contractor have deposited/or will deposit the Tax as per the applicable GST laws. Contractor shall furnish your GST registration number.

4.0 QUANTITIES VARIATION UNDER THE AWARDED CONTRACT:

Contract Unit rate shall applicable for the any addition/reduction in quantities:
Quantities may vary as per the site requirements

5.0 FIRM CONTRACT PRICES:

The contract price shall remain "Firm" throughout the contract execution. No Price Variation and/or escalation on any account shall be payable to the Contractor for any reason whatsoever.

6.0 STATUARY VARIATION IN TAXES:

The total order value shall remain **FIRM**. However in case of any statutory variation in GST, or Taxes, duties and Levies imposed by Competent Authorities by way of fresh notification(s) shall be borne by BYPL on submission of the documentary evidence.

Any variation in taxes shall be applicable only to the direct/price breakup as mentioned in the contract.

7.0 COMPLETION TIME:

Package Name	Total Months for Handing over of the Package, From Zero Date	Total No. of Day for Handing over of the Package From Zero Date
TURNKEY PACKAGE FOR CONVERSION OF 33 KV SYSTEM AT GT ROAD GRID FROM OUTDOOR AIS TO INDOOR GIS WITH DOUBLE BUS BAR SYSTEM, AUGMENTATION OF 1 NO 33/11 kV POWER TRANSFORMER FROM 16 TO 31.5 MVA AND INSTALLATION OF 3 NOS 11KV SWITCHBOARD ALONG WITH ASSOCIATED CIVIL WORKS	10 months	300 days

Detailed Execution schedule, including intermediate milestone for the execution of the Package is attached as "**Annexure- I**".

8.0 BANK GUARANTEE:

Bank Guarantee	To be submitted on	Valid Upto (tentative)
Contract Performance Guarantee (10% of total Contract value)	Within 15 days of Issue of Order.	Valid till 90 days beyond the Project Completion period/Handing Over.
Bank Guarantee against Advance (For the advance amount)	Invoice for Advance amount along with advance bank guarantee.	Valid till Completion of supplies/work under the contract.
Equipment Performance Bank Guarantee (10% of total Contract value)	Time of claiming the last payment and Issuance of Final Taking over certificate from Purchaser / Owner.	Valid till Completion of Defect Liability Period plus 3 months.

9.0 LIQUIDATED DAMAGES:

9.1 LD FOR DELAY IN COMPLETION OF WORK:

Time is essence of the Contract.
After issuance of the Letter of Intent, the contractual network / L2 network will be finalized and approved by the BYPL. Contractor shall strictly adhere to the completion schedule and intermediate milestones agreed.

If the Contractor fails to successfully hand over the Packages awarded within the agreed contract completion schedule the contractor shall pay to the Purchaser/ Owner, Liquidated damages for the delayed period at the rate of 0.5% of the total contract price per each week of delay or Pro-rata thereof, by which the Completion is delayed.

Maximum LD for delay is 10% of Contract Value.

It is agreed that liquidated damages are a genuine Pre-estimate of damages and not by way of penalty.

9.2 LD ON INTERMEDIATE MILESTONE:

Liquidated Damages shall be applicable on the delay in achieving Intermediate milestone as agreed in the L2 Network which shall be at the rate of **0.5% of the total contract price per each week of delay of Intermediate milestone or Pro-rata** thereof, by which the Milestones are delayed.

LD on delay in milestone activities shall be redeemable if the delays are covered subsequently and the package is handed over within the agreed schedule .

9.3 OVER ALL LIQUIDATED DAMAGES:

The overall Maximum LD for delay is 10% of Contract Value.

However, the total Liquidated Damages for delay will be limited as hereinafter provided below.

Notwithstanding the above, in the event the Contractor fails to complete the package as per the schedule; and delays the "Handling Over" of the package up to a period for which the liquidated damage for time delay becomes more than ten percent (10%) of the Contract Price, then the Purchaser at his sole discretion, shall be entitled to treat the failure as an act of default by the Contractor and same shall entitle the Purchaser to terminate the Contract.

The liquidated damages for delay will be recovered at the sole discretion of the Purchaser from the Contract Price or from other securities/BG's available with the Purchaser or jointly.

10.0 LIABILITY & DAMAGES:

10.1 Limitation of Liability for Clause 9.1 and 9.2 above: The aggregate amount of Supplier liability to Purchaser for all Late Completion Liquidated Damages and Performances (Considered in aggregate), shall not exceed 10% of Contract Price.

10.2 Aggregate Liability of Supplier: Supplier's / Contractor liability to Purchaser under or in connection with the Supply and Erection Contract shall not exceed 100% of the respective Contract Price.

11.0 WARRANTEE/DEFECT LIABILITY PERIOD:

Warranty /Defect Liability Period shall be of **Twenty Four (24) months** from the date of Final Take over of Packages by Purchaser.
The Contractor shall be liable to rectify all defects in the works done by the Contractor under this Contract, or from any act or omission of the contractors during Warranty / Defect Liability Period.

Contractor shall replace/ Repair all the materials / items supplied under the contract against any defect or failure, which arise due to faulty materials, workmanship or design for the entire defects liability period.

If during the defects liability period any materials / items are found to be defective, these shall be replaced or rectified by the bidder at his own cost within the agreed time schedule from the date of receipt of intimation. The bidder shall depute their service personnel within 48 hours in case of emergency and shall ensure the availability of manpower/spares for the same during warranty period.

12.0 LATENT DEFECT LIABILITY PERIOD:

At the end of warranty period, the Supplier's Liability ceases except for latent defects.

Notwithstanding the completion of the Warranty Period, the Supplier shall be responsible for expeditiously making good by repair or replacement at its option and at its cost and expense any Latent Defect which appears before the expiry of the Latent Defects Liability Period.

The Contractor's Liability for latent defects warranty shall be limited to a period of Five (5) years from end of Warranty Period for all the supply items and the work executed under the contract.

For the purpose of this clause, the latent defects shall be the defects inherently lying within the material or arising out of design deficiency or the design deficiency of the implementation process adopted, which do not manifest themselves during Warranty period.

13.0 INSURANCE:

Contractor shall, at his own cost shall take Comprehensive Marine cum Storage cum Erection insurance policy for the total Project cost.

Contractor shall take, at his own cost, Third party insurance and suitable insurance policy for his own men and material.

The insurance covers to be taken by the Contractor shall be in a joint name of Purchaser and the Contractor. The Contractor shall, however, be authorized to deal directly with Insurance Company or companies during the contract period and shall be responsible in regard to maintenance of all insurance covers.

Any loss or damage to the equipment during handling, transportation, storage, erection, putting into satisfactory operation and all activities to be performed till the successful completion of and handling over Performance Guarantee tests of the plant shall be to the account of the Contractor. The Contractor shall be responsible for preference of all claims and make good for the damage or loss by way of repairs and/or replacement of the equipment, damaged or lost.

For all the insurance policies taken, Contractor shall be responsible for settlement of claims with the underwriters without any liability on the purchaser and will arrange replacements / rectification expeditiously without waiting for the settlement of insurance claim, at contractor's own cost and this shall not entitle the Contractor for any extension of Time and Cost Overrun.

Marine Transit risk on supply of material on 100% of captioned value & Erection all risk cover on 100% of Project cost which cover include any loss or damage not limited to AOG perils, earthquake and act of terrorism.

14.0 DRAWINGS/DOCUMENTS:

Drawings will be supplied to the Contractor by Purchaser as per Agreed Master Documents List (MDL), Technical Specifications, BOQ and as mentioned in GCC.

15.0 TERMS OF PAYMENT:

A) FOR SUPPLY OF EQUIPMENT AND MATERIALS:

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

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

C. 65% 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.

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

E. Balance 10% on account of supply value of the actual executed value shall be paid in 45 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.

B) FOR ERECTION, INSTALLATION AND TESTING & COMMISSIONING/CIVIL:

Payment shall be made to you as under:

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

(ii) 85% prorata of total services value shall be payable against R/A bills payable within 45 days after completion duly certified by Engineer in charge.

(iii) Balance 10% on account of total services value of the actual executed value shall be paid in 45 days after completion of successful acceptance testing, commissioning and handing over of complete systems duly certified by BYPL Engineer-in-Charge specified in the tender and on submission of performance Bank Guarantee of 10% amount, in our format valid up to a defect liability period for 24 months from the date of handing over of the scheme including submission of Electrical Inspector Clearance Certificate, Compliance of final punch point, No Demand Certificate, Letter of Indemnity by the supplier (The format of No Demand Certificate and Letter of Indemnity are attached as Annexure) and after reconciliation & adjustments of payments, if any towards quantities of materials issued from purchaser's stock and consumed by the contractor for expeditious completion of the job.

16.0 ARBITRATION:

The venue of arbitration shall be New Delhi.

17.0 UNFORESEEBLE SUB-SURFACE CONDITIONS:

Notwithstanding anything contained elsewhere in the contract, if during the execution stage, the Contractor encounters on the Site any sub-surface conditions that are different from those envisaged from the soil testing / data available at the site, or the Contractor's own testing, which necessitates corrective action / changes in the method(s) of work, all costs related with such changes shall be borne by the Contractor. These conditions shall no way be compensated either for time, or costs, by the Purchaser.

18.0 FORCE MAJEURE:

Force Majeure Events:

For the purpose of this Agreement, Force Majeure means any act, event or circumstance, or combination of acts, events or circumstances, which materially and adversely affects the affected

Party's performance of its obligations pursuant to the terms of this Agreement, but only if and to the extent that such acts, events or circumstances are not within the affected Party's reasonable control, were not reasonably foreseeable and could not have been prevented or overcome by the affected Party through the exercise of reasonable skill or care.

18.1 Political Force Majeure Events:

Which shall comprise the following acts, events and circumstances:
i) Act of war (whether declared or undeclared), invasion, armed conflict or act of foreign enemy, blockade, embargo, revolution, riot insurrection, civil commotion, act of terrorism or sabotage, in each case occurring inside or directly involving India:

ii) Strikes, lockouts or other difficulties, which are politically motivated (rather than motivated primarily by a desire to improve compensation or working conditions of those involved) or are caused in whole or part by another event of Political Force Majeure or are part of a nation-wide or regional strike, or other generalised labour action occurring within India; (excluding such events which are site specific and attributable to the Supplier);

iii) Radioactive contamination or ionising radiation or chemical contamination originating from a source in India or resulting from another Political Force Majeure Event;

18.2 Non Political Force Majeure events comprising the following acts, events and circumstances:

i) Flood, cyclone, lightning, earthquake, drought, storm or any other extreme effect of the natural elements;

ii) Epidemic, or plague;

iii) Fire or explosion;

iv) Strikes, lockouts or other labour difficulties not included above (excluding such events which are Site specific and attributable only to the contractor)

v) Air crash, shipwreck or trainwreck or loss of or damage to any major component of the Facility arising in the course of transit.

18.3 Burden of Proof:

In the event that the Parties are unable in good faith to agree that a Force Majeure Event has occurred, the Parties shall submit the dispute for resolution pursuant to clause , provided that the burden of proof as to whether a Force Majeure Event has occurred shall be upon the Party claiming a Force Majeure Event.

18.4 Excused Performance:

The Party claiming Force Majeure shall give notice to the other Party of any Force Majeure Event as soon as reasonably practical after becoming aware of its existence, but not later than **twenty four (24)hours** after the date on which such Party knew or should reasonably have known of the commencement of the Force Majeure Event. Notwithstanding the above, if the Force Majeure Event results in a breakdown of

communications rendering it not reasonably practicable to give notice within the applicable time limit specified herein, then the Party claiming Force Majeure shall give such notice as soon as reasonably practicable after the reinstatement of communications, but not later than forty eight (48) hours after such reinstatement.

(a) The Party claiming Force Majeure shall give notice to the other Party of:
i)The cessation of the relevant Force Majeure Event; and
ii) The cessation of the effects of such Force Majeure Event on the enjoyment by such Party of its rights or the performance by it of its obligations under this Agreement; as soon as practicable after becoming aware thereof.

(b) The suspension of performance shall be of no greater scope and of no longer duration than is reasonably required by the Force Majeure Event.

(c) No liability of either Party which arose before the occurrence of the Force Majeure Event causing the suspension of performance shall be excused as a result of the occurrence, including, without limitation, liability for the timely payment of money otherwise due and earned by performance of tasks required under this Agreement by any Party.

(d) Any Party claiming Force Majeure shall use its reasonable efforts to mitigate and overcome the effects of any act, event or circumstance of Force Majeure as soon as practicable after the occurrence of a Force Majeure Event, including by mutual agreement the expenditure of reasonable sums of money, and to co-operate with the other Party to develop and implement a plan of remedial and reasonable alternative measures to remove the Force Majeure Event, provided, however, that no Party shall be required under this provision, to settle any strike or other labour dispute on terms it reasonably considers to be unfavourable to it. The Party claiming Force Majeure shall furnish weekly written reports to the other Party with respect to its progress in overcoming the effects of the act, event or circumstance of Force Majeure together with such supporting documentation and information as the other Party reasonably requires regarding the claim of Force Majeure.

(e) When the affected Party is able to resume performance of its obligations under this Agreement that Party shall give the other Party written notice to that effect and shall promptly resume performance hereunder.

18.5 Limitations:

Anything in this Agreement to the contrary notwithstanding:

(a) The affected Party shall not be relieved from obligations under this Agreement to the extent that the gross negligence of the affected Party (or, in the case of Supplier, The

Purchaser's Suppliers or any Subcontractor) contributes to or aggravates the Force Majeure Event ; and

(b) The existence of a Force Majeure Event shall not excuse the affected Party from its obligations to make payment of any monies otherwise due and payable by the affected Party pursuant to this Agreement.

18.6 Consequences of Force Majeure

Neither Party shall be considered in default or in breach of its obligations under this Agreement to the extent that performance of such obligations is prevented by any circumstances of a Force Majeure Event.

19.0 SUSPENSION OF WORK:

Purchaser reserves the right to suspend and reinstate execution of the whole or any part of the Works without invalidating the provisions of the Contract. Orders for suspension or reinstatement of the works will be issued to the Contractor in writing. The time for Completion of the Works will be extended for a period equal to duration of the suspension.

For an aggregate suspension period of less than Six (6) months the Contractor shall not claim any reimbursement. Any necessary and demonstrable costs incurred by the Contractor, as a result of suspension of the Works beyond the above period, will be paid by The Purchaser, provided such costs are substantiated to the satisfaction of The Purchaser. For this purpose, only the direct costs incurred shall be considered and this shall exclude any overheads, incidentals or profit. The Purchaser's decision in this regard will be final and binding. The Purchaser shall not be responsible for any liability if suspension or delay is due to some default on the part of the Contractor or its sub-contractor. Purchasers decision in this regard shall be final and binding. Purchaser shall not be responsible for any liability if suspension is caused due to some default on the part of the supplier and its sub suppliers.

20.0 FINAL TAKING OVER OF THE PACKAGES:

Upon successful completion of testing and Commissioning of the all the items/work under the package awarded and all the testing conducted to the Purchaser/Owner's satisfaction, the Purchaser shall issue to the Contractor a "Taking over Certificate" as a proof of the final acceptance of the packages only after receipt of such certificate from the Owner to Purchaser.

21.0 CONSTRUCTION WATER AND POWER:

Construction Water and power shall be arranged by Contractor at his own cost.

BSES Yamuna Power Limited

ANNEXURE - I

EXECUTION SCHEDULE

Contractor shall submit the detailed PERT chart/L2 Network for the execution of the package awarded for BYPL review and approval.

However the major milestone shall be as under:

SL NO	DESCRIPTION OF MATERIAL	TIMELINE
1	Zero Date (Letter of Award)	Zero Date
2	Mobilization of manpower	15 days from Zero Date
3	Submission of Drawings/Documents/calculations for Engineering Approval	30 days from Zero Date
4	Engineering Approval	60 days from Zero Date
5	Civil Works	130 days from Zero Date
6	Procurement/Supplies	210 days from Zero Date
7	Equipment Erection	240 days from Zero Date
8	Commissioning of 1st Power Transformer	255 days from Zero Date
9	Commissioning of 2nd Power Transformer	270 days from Zero Date
10	Testing & Commissioning of entire substation	285 days from Zero Date
11	Handing Over	300 days from Zero Date

BSES Yamuna Power Limited

GENERAL CONDITIONS OF CONTRACT (GCC-SUPPLY)

BSES Yamuna Power Limited

Table of Contents

BSES Yamuna Power Limited

GENERAL CONDITIONS OF CONTRACT (GCC)-SUPPLY

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

1. PRIORITY AND CONTENT OF CONTRACT DOCUMENTS:

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

1. The Contract Agreement
2. The Letter of Acceptance/ Intent
3. Agreed Minutes of the Contract Negotiation Meetings.
4. Agreed Minutes of the contract Technical Meetings.
5. Instruction To Bidders (ITB)
6. Special Condition of Contract (SCC)
7. General Condition of Contract (GCC)
8. Erection Conditions of Contract (ECC)
9. Civil Conditions of Contract
10. The Priced Bill of Quantities
11. The Particular Technical Specifications
12. The General Technical Specifications
13. The Submitted Tender, including all Appendices and/or Addenda, the latest taking precedence.

All the materials, literature, data and information of any sort given by the contractor along with its bid proposal subject to the approval of the purchaser.

2. CONTRACT LANGUAGE:

All documents, instructions, catalogues, brochures, pamphlets, design data, norms and calculations, drawings, operation, maintenance and safety manuals, reports, labels, on deliveries and any other data shall be in English Language only.

The Contract documents and all correspondence between the BYPL, Third Parties associated with the contract, and the Bidder shall be in English language.

However, all signboards required indicating "Danger" and/or security at site and otherwise statutory required shall be in English, Hindi.

3. DEFINITIONS AND INTERPRETATION:

Definitions TO BE FOLLOWED UNDER THE CONTRACT shall have following meanings:

3.1 COMPANY / PURCHASER / OWNER: Means BSES Yamuna Power Ltd, a company incorporated under the Companies Act 1956 and having its office at Shaktikiran Building, Karkardooma, Delhi -110032, which expression shall include its authorized representatives, agents, successors and assigns.

3.2 CONTRACTOR: Shall mean the successful Tenderer / vendor to whom the contract has been awarded.

3.3 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.

3.4. 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.

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

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

3.7 APPLICABLE LAW: Applicable Laws means the constitution of India and any act, rule, regulations, directive, notification, code, order or instruction having its force of law enacted or issued by any competent legislature or Governmental Agency (including those related to taxes, duties, assessments, expropriation and compulsory acquisition) as may be in effect from time to time the implications thereof shall be deemed a Change in Law or Change in Permits.

3.8 OTHER CLEARANCES: Means any consent, approval, permit or other authorisation which is required to be granted by authorities (local, government or any other) essential to start/complete the work.

3.9 DEFECT LIABILITY PERIOD: Shall mean the period during which the contractor shall remain liable for repair or replacement of any defective part of the work performed under the contract, free of cost.

3.10 TENDER SPECIFICATION: The terms "Tender Specification" shall mean the Indian Standard specification of the work and description of work as detailed in Tender document/Tender enclosed and all such particulars mentioned directly/referred to or implied as such in the Tender.

3.11. CONTRACT PRICE shall mean the price referred to in the "Letter of Intent/Purchase Order".

3.12 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.

3.13 CODES AND SPECIFICATION shall mean all the applicable codes and standards as indicated in the Specification.

3.14 CHANGE OF WORK means any addition to, deletion from, suspension of or other modification, to the Work, or to the quality, function or as delineated in this Contract, including any such addition, deletion, suspension or other modification, which requires a change in one or more of the Technical Specifications and the completion schedule

3.15 EPC means Engineering, Procurement and Construction wherein the EPC contractor is made responsible for all the activities from design, procurement, supply, storage construction, commissioning and handover of the project to owner.

3.16 EFFECTIVE DATE OF CONTRACT means the date of issue/award of contract shall be the Effective Date of Contract or Contract Commencement date.

3.17 CONTRACT COMMENCEMENT DATE means the date of issue/award of contract shall be the Effective Date of Contract or Contract Commencement date.

3.18 CONTRACT COMPLETION DATE means the date of expiry of Guarantee/defect liability Period shall be deemed as the Contract Completion Date.

4. EXAMINATION OF SITE AND LOCAL CONDITIONS:

The contractor is deemed to have visited the site of the work and ascertained therefore all site conditions and information pertaining to his work.

Before submitting the bid, all bidders will at their expenses make or obtain any additional information, investigations, explorations, test and studies and obtain any additional information and data which pertains to the physical conditions at or contiguous to the site or otherwise which may affect cost, progress, performance of the work and which the bidder deems necessary to determine its Bid for performing the work in accordance with the time and other terms and conditions of the tender/contract documents.

The company shall not accept any claim whatsoever arising out of the difficult site/terrain/local conditions, if any

5. LANGUAGE AND MEASUREMENT:

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

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

6. TIME – THE ESSENCE OF CONTRACT:

The time and the date of Contract Execution completion of the "Package" as stipulated in the Letter of Intent/ Purchase order issued to the Supplier shall be deemed to be the essence of the "Contract". The "Entire Package"has to be completed and handed over not later than the aforesaid Schedule.

7. PROGRESS REPORT:

The supplier shall submit weekly/fortnightly/monthly progress report as desired by the Purchaser's Engineer in Charge and in the format mutually agreed between the parties.

8. SCOPE OF WORK:

The scope of work under this contract shall include the turnkey execution on End to End Basis, including but not limited to design, manufacturing, inspection & testing, dispatches, loading , unloading ,storage at site, erection & installation, testing of the installation, associated civil work ,commissioning ,handing over to the purchaser

including comprehensive marine cum storage cum erection Insurance (MSE) on "Single Point Responsibility Basis" on turnkey Basis

Brief Scope of Work related to all the supplies for the successful completion, testing & commissioning and final handover for the above packages shall be as per the NIT conditions with the following salient details.

Any item/work, not specifically mentioned in the NIT condition and technical specification but essentially required for completion of the work shall be the responsibility of the contractor. 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.

9. QUANTITY VARIATION AND EXTRA ITEM/WORK:

The purchaser reserves the rights to vary the quantity as per the site requirements.

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

Payment will be made on the basis of actual quantity of supplies/actual measurement of works accepted by BYPL and not on the basis of contract quantity.

10. FIRM CONTRACT PRICES:

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.

11 CONTRACT RATES:

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

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

The unit rates finalized are also inclusive of Insurance policy taken as defined in Special Conditions Contracts (SCC) Though Bidders shall indicate the value separately.

Cost of operation as per the requirement specified in NIT , for the duration of Six (6) months are included in the contract prices, However Bidder shall indicate the separate value for the same.

12 TAXES AND DUTIES:

Prices are inclusive of all taxes and duties including labour cess.

GST is included in the contract price awarded , however GST payment shall be made on submission of GST Registration and self declaration on your letter head stating that contractor have deposited/or will deposit the Tax as per the applicable GST laws. Contractor shall furnish your GST registration number.

13 STATUTORY VARIATION:

Any statutory variations i.e. increase/decrease in Taxes / Duties introduces by central Govt. / State Govt. of shall be reimbursed/recovered to/from Contractor against documentary evidence and proof. Any variation in taxes shall be applicable only to the direct/price breakup as mentioned in the contract.

14 CHANGE OF LAW:

"Change in Law" means:

a) any enactment or issue of any new Applicable Law,
b) any amendment, alteration, modification, or repeal of any existing Applicable Law or any new or modified directive or order there under,
c) any change or variation in taxes payable in connection with and under this Agreement in each case with respect to a), b), and c) above coming into effect after the date of this Agreement.

15 SPECIFICATIONS AND STANDARDS:

The Bidder shall follow all codes and standards referred in the Contract Document. Codes and standards not specifically mentioned in the Contract Document may be followed by the Bidder with the prior written approval of BYPL, provided materials, supplies and equipment according to the standard are equal to or better than the corresponding standards specified in the Contract.

Product manufactures /makes names mentioned in the Contract documents are for the purpose of establishing the type and quality of products to be used. The Bidder shall not change the brand name and qualities of the bought out items without the prior written approval of the BYPL. All such products and equipment shall be used or installed in strict accordance with original manufacturer's recommendations, unless otherwise directed by the BYPL. In any circumstances the codes, specimen and standards prescribed by any government agency should not be violated.

16 QUALITY ASSURANCE AND INSPECTION:

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

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.
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.

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

All in-house testing and inspection shall be done without any extra cost. The in-house inspection shall be carried out in presence of BYPL/BYPL authorized third party inspection agency. Cost of Futile/abortive visit(s) shall be debited from the invoices.

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.

17 ERRORS AND OMISSIONS:

The Supplier shall be responsible for all discrepancies, errors and omissions in the drawings, documents or other information submitted by him, irrespective of whether these have been approved, reviewed or otherwise accepted by the BYPL or not. However any error in design/drawing arising out of any incorrect data/written information from BYPL will not be considered as error and omissions on part of the Supplier.

18 PACKING, PACKING LIST & MARKING:

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. All the packaging materials as prescribed shall be supplied preferably with bio-degradable packing- materials.

Packing List: The contents of each package shall be itemized on a detailed list showing the exact weight, extremeoutside 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.

19 PRICE BASIS FOR SUPPLY OF MATERIALS:

Bidders shall quote their prices on Landed Cost Basis and separate price for each item.

Bidders shall quote FIRM prices for supply to BYPL Delhi/New Delhi stores inclusive of all packing, forwarding, loading at manufacturer's premises, unloading at site/stores and payment of GST.
Storage of material is under the bidder Scope. Bidder shall arrange transit Insurance as per clause nos. 8 mentioned in Volume -1 Special Condition of Contract (SCC).

20 TERMS OF PAYMENT AND BILLING – SUPPLY:

Terms of payment and Billing shall be as specified in Volume –I, Special Condition of Contract.

21 COMMISSIONING SPARES AND TOOLS & TACKLES:

Commissioning Spares shall be deemed to be included in the quoted price.

22 RETURN, REPLACEMENT OR SUBSTITUTION:

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.

23 PERFORMANCE GUARANTEE:

Performance Guarantee shall be as specified in Volume –I, Special Condition of Contract.

24 WARRANTY/DEFECTS LIABILITY PERIOD:

All supplies made/Work executed shall be guaranteed against any defect or failure which may arise due to faulty materials, design or workmanship for a period of 24 months from the date of final handing over of the entire package as defined in SCC.

If during the Defect Liability Period any work are found to be defective, shall be immediately rectified or repaired, upto BYPL satisfaction, by the contractor at his own cost within 10 days from the date of receipt of intimation from BYPL.

Under no circumstances any extra claim in terms of time and cost shall be entertained for such repair/rectification.

25 SUPPORT BEYOND THE GUARANTEE PERIOD:

The Bidder shall ensure availability of spares and necessary support for a period of at least Twenty (20) years post completion of guarantee period of equipments supplied against the contract.

26 DOCUMENTATION:

The Bidder's shall procure all equipment from BYPL approved sources as per attached specifications. The Bidder shall submit 5 copies of Material/Type Test Certificates, O&M Manuals, and Approved & As-

built drawings. The Bidder shall ensure for the strict compliance to the specifications and Field Quality Procedures issued by BYPL Engineer in-charge.

27 FORFEITURE:

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.

28 SUSPENSION OR EXTENSION:

Purchaser reserves the right to suspend and reinstate execution of the whole or any part of the Works without invalidating the provisions of the Contract. Orders for suspension or reinstatement of the works will be issued to the Contractor in writing. The time for Completion of the Works will be extended for a period equal to duration of the suspension.

For an aggregate suspension period of less than Six (6) months the Contractor shall not claim any reimbursement. Any necessary and demonstrable costs incurred by the Contractor, as a result of suspension of the Works beyond the above period, will be paid by The Purchaser, provided such costs are substantiated to the satisfaction of The Purchaser. For this purpose, only the direct costs incurred shall be considered and this shall exclude any overheads, incidentals or profit. The Purchaser's decision in this regard will be final and binding. The Purchaser shall not be responsible for any liability if suspension or delay is due to some default on the part of the Contractor or its sub-contractor. Purchasers decision in this regard shall be final and binding. Purchaser shall not be responsible for any liability if suspension is caused due to some default on the part of the supplier and its sub suppliers.

29 TERMINATION DUE TO CONTRACTORS DEFAULT:

The Purchaser may terminate the contract after giving 7(seven) days notice if any of following occurs

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

30 EVENTS OF DEFAULT:

BYPL 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 BYPL, 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 BYPL.

d) Failing to comply with any reasonable instructions or orders issued by BYPL in connection with the works.

e) Failing to comply with any of the terms or conditions of this work order.

(f) Supplier fails or refuses to deliver supplies conforming to this NIT / specifications, or fails to deliver supplies within the period specified in PO or any extension thereof

(g) 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;

(i) 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.

In the event BYPL terminates this work order, in whole or in part, on the occurrence of any event of default, BYPL 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 BYPL 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 BYPL for any additional costs that may be incurred by COMPANY for the execution of the Work.

31 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;

(c) present for encashment to the bank the relevant Performance Bond;

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

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

32. RISK & COST:

If the Contractor of fails to execute the work as per NIT specification / as agreed in the contract within the scheduled period and even after the extended period, the contract shall got terminated and BYPL 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 Contract.

33 ARBITRATION:

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

34 TERMINATION FOR CONVENIENCE OF BYPL:

BYPL at its sole discretion may terminate the contract by giving 30 days prior notice in writing or through email to the Supplier. BYPL shall pay the Supplier for all the supplies/ services rendered till the actual date of contract termination against submission of invoice by the Supplier to that effect.

35 LIQUIDATED DAMAGES:

Liquidated damages shall be as per Volume –I, Special Condition of Contract.

36 TRANSFER AND SUB-LETTING:

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

37 RECOVERIES:

Whenever under this contract any money is recoverable from and payable by the bidder, the purchaser shall be entitled to recover such sum by appropriating in part or in whole by deducting 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.

38 WAIVER:

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

39 INDEMNIFICATION:

Notwithstanding contrary to anything contained in this NIT, 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.

40 PATENT RIGHTS AND ROYALTY:

If, in the course of performance of its functions and duties as envisaged by the scope of the present GCC, the Bidder acquires or develops, any unique knowledge or information which would be covered, or, is likely to be covered within the definition of a trademark, copyright,
patent, business secret, geographical indication or any other form of intellectual property right, it shall be obliged, under the terms of this present GCC, to share such knowledge or information with BYPL. All rights, with respect to, or arising from such intellectual property, as afore mentioned, shall solely vest in BYPL.

Moreover, the Bidder undertakes not to breach any intellectual property right vesting in a third party/parties, whether by breach of statutory provision, passing off, or otherwise. In the event of any such breach, the Bidder shall be wholly liable to compensate, indemnify or make good any loss suffered by such third party/parties, or any compensation/damages arising from any legal proceeding/s, or otherwise. No liability of BYPL shall arise in this respect, and any costs, damages, expenses, compensation payable by BYPL in this regard to a third party/parties, arising from a legal proceeding/s or otherwise, shall be recoverable from the Bidder.

41 CONFIDENTIALITY:

Bidder and its employees or representatives thereof shall strictly maintain the confidentiality of various information they come across while executing the contract as detailed below.

Documents

All maps, plans, drawings, specifications, schemes and other documents or information related to the Contract/Project and the subject matter contained therein and all other information given to the Bidder by BYPL in connection with the performance of the contract shall be held confidential by the Bidder and shall remain the property of the BYPL and shall not be used or disclosed to third parties by the Bidder for any purpose other than for which they have been supplied or prepared. The Bidder may disclose to third parties, upon execution of confidentiality agreements, such part of the drawings, specifications or information if such disclosure is necessary for the performance of the Work provided such third parties agree in writing to keep such information confidential to the same extent and degree as provided herein, for the benefit of the BYPL.

Geographical Data

Maps, layouts and photographs of the site including its surrounding regions showing vital installation for national security of country or those of BYPL shall not be published or disclosed to the third parties or taken out of the country without prior written approval of the BYPL and upon execution of confidentiality agreements satisfactory to the BYPL with such third parties prior to disclosure.

Violation

In case of violation of this clause, the Bidder is liable to pay compensation and damages as may be determined by the competent authority of BYPL.

42 DISPUTE RESOLUTION & ARBITRATION:

To the best of their ability, the parties hereto shall endeavor to resolve amicably between themselves all disputes arising in connection with this contract. 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 the provisions of the Indian Arbitration & Conciliation Act, 1996 and the venue of such arbitration shall be in the city of New Delhi only. The language of proceedings, documents and communication shall be English.

Suspension of Work on Account of Arbitration

The reference to negotiation/arbitration shall proceed notwithstanding that the Works shall not then be or be alleged to be complete, provided always that the obligations of the Purchaser and the Supplier shall not be altered by reasons of arbitration being conducted during the progress of the Works. In no event shall the Supplier be entitled to suspend the Execution of the Works or part of the Works to which the Dispute relates on account of arbitration and payments to the Supplier shall continue to be made in terms of the Contract.

The laws and jurisdiction of contract

Where recourse to a Court is to be made in respect of any matter, the courts at Delhi shall have exclusive jurisdiction.

BSES Yamuna Power Limited

ERECTION CONDITIONS OF CONTRACT (ECC)

BSES Yamuna Power Limited

Table of Contents

BSES Yamuna Power Limited

GENERAL TERMS & CONDITIONS - ERECTION, TESTING & COMMISSIONING

The Erection Condition of the contract shall form a part of the specifications, contract documents.

1. PRIORITY OF CONTRACT DOCUMENTS:

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

1. The Contract Agreement
2. The Letter of Acceptance/ Intent
3. Agreed Minutes of the Contract Negotiation Meetings.
4. Agreed Minutes of the contract Technical Meetings.
5. Instruction to Bidders (ITB)
6. Special Condition of Contract (SCC)
7. General Condition of Contract (GCC)
8. Erection Conditions of Contract (ECC)
9. Civil Conditions of Contract
10. The Priced Bill of Quantities
11. The Particular Technical Specifications
12. The General Technical Specifications
13. The Submitted Tender, including all Appendices and/or Addenda, the latest taking precedence.

All the materials, literature, data and information of any sort given by the contractor along with its bid proposal subject to the approval of the purchaser.

2. DEFINITIONS AND INTERPRETATION:

Definitions TO BE FOLLOWED UNDER THE CONTRACT shall have following meanings:

2.1 COMPANY / PURCHASER / OWNER: Means BSES YAMUNA Power Ltd, a company incorporated under the Companies Act 1956 and having its office at Shaktikiran Building, Karkardooma, Delhi -110032, which expression shall include its authorized representatives, agents, successors and assigns.

2.2 CONTRACTOR: Shall mean the successful Tenderer / vendor to whom the contract has been awarded.

2.3 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.

2.4. 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.

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

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

2.7 APPLICABLE LAW: Applicable Laws means the constitution of India and any act, rule, regulations, directive, notification, code, order or instruction having its force of law enacted or issued by any competent legislature or Governmental Agency (including those related to taxes, duties, assessments, expropriation and compulsory acquisition) as may be in effect from time to time the implications thereof shall be deemed a Change in Law or Change in Permits.

2.8 OTHER CLEARANCES: Means any consent, approval, permit or other authorisation which is required to be granted by authorities (local, government or any other) essential to start/complete the work.

2.9 DEFECT LIABILITY PERIOD: Shall mean the period during which the contractor shall remain liable for repair or replacement of any defective part of the work performed under the contract, free of cost.

2.10 TENDER SPECIFICATION: The terms "Tender Specification" shall mean the Indian Standard specification of the work and description of work as detailed in Tender document/Tender enclosed and all such particulars mentioned directly/referred to or implied as such in the Tender.

2.11. CONTRACT PRICE shall mean the price referred to in the "Letter of Intent/Purchase Order".

2.12 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.

2.13 CODES AND SPECIFICATION shall mean all the applicable codes and standards as indicated in the Specification.

2.14CHANGE OF WORK means any addition to, deletion from, suspension of or other modification, to the Work, or to the quality, function or as delineated in this Contract, including any such addition, deletion, suspension or other modification, which requires a change in one or more of the Technical Specifications and the completion schedule

2.15EPC means Engineering, Procurement and Construction wherein the EPC contractor is made responsible for all the activities from design, procurement, supply, storage construction, commissioning and handover of the project to owner.

2.16 EFFECTIVE DATE OF CONTRACT means the date of issue/award of contract shall be the Effective Date of Contract or Contract Commencement date.

2.17 CONTRACT COMMENCEMENT DATE means the date of issue/award of contract shall be the Effective Date of Contract or Contract Commencement date.

2.18 CONTRACT COMPLETION DATE means the date of expiry of Guarantee/defect liability Period shall be deemed as the Contract Completion Date.

3 EXAMINATION OF SITE AND LOCAL CONDITIONS:

The contractor is deemed to have visited the site of the work and ascertained therefore all site conditions and information pertaining to his work.

Before submitting the bid, all bidders will at their expenses make or obtain any additional information, investigations, explorations, test and studies and obtain any additional information and data which pertains to the physical conditions at or contiguous to the site or otherwise which may affect cost, progress, performance of the work and which the bidder deems necessary to determine its Bid for performing the work in accordance with the time and other terms and conditions of the tender/contract documents.

The company shall not accept any claim whatsoever arising out of the difficult site/terrain/local conditions, if an

4 LANGUAGE AND MEASUREMENT:

The CONTRACT issued to the contractor by the company and all correspondence and documents relating to the CONTRACT placed on the Contractor shall be written in English language.
Metric System shall be followed for all dimension, units etc.

5 SCOPE OF WORK:

The scope of work under this contract shall include the turnkey execution on End to End Basis , including but not limited to design, manufacturing, inspection & testing, dispatches, loading , unloading ,storage at site, erection & installation, testing of the installation, associated civil work ,commissioning ,handing over to the purchaser including comprehensive marine cum storage cum erection Insurance (MSE) on "Single Point Responsibility Basis.

Brief Scope of Work related to Erection and Installation work including testing and commissioning and final handover for the above packages shall be as per the NIT conditions with the following salient details.

5.1 Survey, design, engineering, manufacture, shop testing, inspection, packing, dispatch, loading, unloading and storage at site including comprehensive SCE (Storage cum Erection) insurance, assembly, erection, civil structural, architectural work, complete pre-commissioning checks, testing & commissioning at site, also includes all statutory clearances & certification from Electrical Inspector, Municipal corporation department, Fire officer, Horticulture department , various local bodies like RWA and handing over to the Owner after satisfactory commissioning of complete Packages as defined above **on Turnkey Basis.**

- Schedule of work shall be as mentioned in the Bill of quantity attached herewith.

- After completion of Erection, Testing & Commissioning of the package awarded, contractor has to obtain the Electrical Inspectorate's Clearance from the Electrical Inspector of BYPL.

- Contractor shall arrange any permission like Road cutting clearance etc. from the Delhi Civic authorities. All Statutory charges and direct fees shall be borne by BYPL.

- All the Labour, plant appliance, ladder, scaffoldings, materials, tool, tackles etc are included 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 (within seven days) after award of contract. Detailed Organisation chart, along with the qualification of the manpower to be deployed shall submitted along with Bid.

- The Contractor shall also make his own arrangement for the accommodation/conveyance requirements for its staff at site.

- Contractor shall arrange storage for storing the materials, tools, tackles etc. Contractor shall be responsible for all the unloading of the material, marking, staking and storage at site. The insurance for all the storage material shall be included in the policy taken by Contractor. Contractor shall submit the copy of insurance policy to BYPL. In case of any mishappening/damage to the storage material contractor shall be responsible to lodge the claim. Under no circumstances no delay in execution shall be allowed and contractor shall immediately arrange for the replacement without waiting for the settlement.

- All the incoming and outgoing materials, equipment, tools, tackles and any other items related to said work shall be entered into the register kept for this purpose and shall be in the custody of Contractor, however company does not hold any responsibility for any loss or damage of Contractor's material etc.

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

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

6 CONTRACT RATES:

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

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

The unit rates finalized are also inclusive of barricading and watch & ward during execution and no separate charges shall be paid for the same.
The cost of training of BYPL Official shall be included in the prices quoted by vendor.

7 TAXES AND DUTIES:

Prices are inclusive of all taxes and duties including labour cess.

However, IT as per applicable rate will be deducted from your bills as Tax Deduction at Source (TDS).

GST is included in the contract price awarded , however GST payment shall be made on submission of GST Registration and self declaration on your letter head stating that contractor have deposited/or will deposit the Tax as per the applicable GST laws. Contractor shall furnish your GST registration number.
Any statutory variations i.e. increase/decrease in Taxes / Duties introduces by central Govt. / State Govt. of shall be reimbursed/recovered to/from Contractor against documentary evidence and proof.

Any variation in taxes shall be applicable only to the direct/price breakup as mentioned in the contract.

CHANGE OF LAW:

"Change in Law" means:

a) any enactment or issue of any new Applicable Law,

b) any amendment, alteration, modification, or repeal of any existing Applicable Law or any new or modified directive or order there under,

c) any change or variation in taxes payable in connection with and under this Agreement in each case with respect to a), b), and c) above coming into effect after the date of this Agreement.

8 ACCOMODATION & CONVEYENCE FOR THE STAFF:

The Contractor shall also make his own arrangement for the accommodation/conveyance requirements for its staff at site.

9 STORAGE AT SITE:

Contractor shall arrange the storage at site with the adequate open space / closed storage for contractor's site store for storing the materials, tools, tackles etc.

All the Contractor's storage will be within the site premises. All the incoming and outgoing materials, equipment, tools, tackles and any other items related to said work shall be entered into the register kept for this purpose and shall be in the custody of Contractor, however company does not hold any responsibility for any loss or damage of Contractor's material etc. All loading/unloading, of materials at work-site shall be your responsibility. Involvement of Crane/Hydra/Tractor/Trailer for this type of work shall be in your scope.

Adequate weather protection shall be provided by the contractor to keep the materials safe from sun & rain by providing covered storage space as well as using tarpaulins. Water and Electricity Power shall be arranged by the Contractor at his own. 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 including in the above mentioned

Tender value. The unit rates mentioned in annexure is inclusive of barricading and watch & ward during execution and no separate charges shall be paid for the same.

10 SECURITY, WATCH & WARD:

The contractor, at his own cost, shall arrange for the security and watch and ward of the materials, men and machineries at site. Round the clock security alongwith the CCTV shall be provided for the materials stored at the site.

11 DEFECT LIABILITY PERIOD:

Work executed shall be guaranteed against any defect or failure which may arise due to faulty materials, design or workmanship for a period of Twenty Four (24) months from the date of final handing over of the entire package as defined in SCC.
If during the Defect Liability Period any works are found to be defective, shall be immediately rectified or repaired, upto BYPL satisfaction, by the contractor at his own cost within Ten (10) days from the date of receipt of intimation from BYPL.

Under no circumstances any extra claim in terms of time and cost shall be entertained for such repair/rectification.

12 PERFORMANCE GUARANTEE:

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

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

12.03 Contractor shall submit the workmanship / equipment performance bank guarantee equivalent to the 10% of the contract value at the time of claiming the last payment as per TERMS OF PAYMENT (Erection, Testing & Commissioning)), with the validity of the bank guarantee till Defect Liability Period i.e. 24 months from the date of Handing over of entire package plus 3 months.

13 COMPLETION PERIOD:

Contractor is required to mobilize your manpower and Tools & Tackles and furnish a list of equipments to be used for erection and commence the execution activity as per instructions of Engineer In-charge. The detailed schedule and milestone completion dates would be as per the contract schedules given from time to time by Engineer In-charge at site.

The time schedule for carrying out this work and period for mobilization shall be as under:

13.1 The Contractor's team should be mobilized at site for commencement of work immediately on receipt of the order.

13.2 The entire work under this order as indicated in the scope of work shall be carried out and completed within 300 days for entire package as defined in SCC. Total completion schedule for Engineering, manufacturing, inspection & testing, packing and forwarding and Transportation till site and Erection Testing & Commissioning shall be as per the milestones timelines defined in SCC.

13.3 A detailed L2 Schedule shall be submitted by the supplier within Fifteen (15) days of LOI. The contractor shall plan parallel working (round the clock working) for completion of work as per schedule and mobilize manpower accordingly.

13.4 Progress Review Meeting between the Contractor and the Engineer In charge shall be held at site at least once in a week. Also a weekly progress report giving the details of the manpower engaged at site and the details of the major job completion shall be submitted to Engineer In-charge.

13.5 The above time schedule must be strictly adhered to and improved upon wherever possible. In the event we find that your work is not progressing in quality or time frame as per above agreed schedule and to our satisfaction, we reserve the right to withdraw the work in whole or in part without further notice and liability of the Company.

13.6 The completion of the work shall have to be certified by Engineer In charge.

13.7 In order to maintain the time schedule, if necessary the Contractor shall carry out the work on all Sunday & Holiday except National Holiday with prior written permission from Engineer-in-Charge.

14 CLEANLINESS & PRECAUTIONS AT SITE:

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, the contractor 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.

While carrying out any civil work including road/ pit digging, plinth/ fence making, road restoration etc contractor shall adhere to below mentioned guidelines.

14.1 No construction material/ debris shall be stored on metalled road.

14.2 Wind breakers of appropriate height on all sides of ear marked area using CGI sheets shall be raised to ensure that no construction material dust fly outside ear marked area.

14.3 The construction material i.e. coarse sand, stone aggregates, excavated earth, cement and any other material to and from the site shall be transported under wet and covered condition to ensure their non-slippage en-route to avoid air contamination.

14.4 The contractor shall provide mask and helmet to every worker working on the construction site and involved in loading/unloading and carriage of construction material and construction debris to prevent inhalation of dust particles.

14.5 Over loading of vehicles shall be strictly prohibited.

14.6 The construction material at site shall be stored under wet and covered condition.

14.7 The dumping sites for temporarily storing the excavated earth shall be properly levelled, watered and rehabilitated by plantation to avoid flying of dust.

14.8 The worker at the site shall be sensitized to adopt / observe the dust controlled measures in true spirit.

14.9 If any C&D waste is generated at site the same will be transported to the C&D waste site only and the record for the same will be maintained by the agency.

14.10 Wet jet in grinding and stone cutting is being permitted at site.

14.11 The necessary record for dust control is being maintained by the department on day to day basis and being monitored regularly.
14.12 Bidder shall ensure that no tree shall be harmed and no tree roots shall be destroyed/cut while performing the task under contract.

14.13 Bidder shall comply the provisions of The Delhi Preservation of Trees Act 1994.

14.14 Guidelines regarding inspection & maintenance of PITS/DUGS while doing work at site in BYPL Area. The contractor shall ensure strict compliance of the following directions:

i. The sites of all manholes, pits, holes, tanks or any other opening in the ground of any kinds shall be regularly inspected and maintained.

ii. Schedule and protocols of inspections and maintenance shall be drawn up and notified to BYPL.

iii. These sites shall be cordoned off to render them inaccessible to the public.

iv. The existence of these sites shall be clearly & visibly marked by the display of signboards/ signages.

v. If they are required to be covered, it shall be ensured that the covers are in place.

vi. If required, as per law, prior permission from authorities shall be secured before the commencement of work.

vii. Bidder shall follow all law of the land and prevailing borders issued by various Govt departments like Dept of Power / DERC /NGT/ Dept of forest /Dept of environment/DPCB/Court Orders etc.

14.15 The Execution vendors shall be responsible for all the preventive and protective environmental steps as per guidelines. Any violations from the above guidelines have been viewed very seriously by the authorities. Concerned agency is liable for the penalties / other action by the authorities, The Agency shall indemnify BYPL from all liabilities on this account.

15 COMMISSIONING & ACCEPTANCE TEST:

After completion of the work, the Contractor shall conduct trial run/ operation in the presence of Engineer In charge. During such trial run the system shall be operated under the supervision of the Contractor. If any rectification/modification required during this period the Contractor shall do all necessary measures.

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

16 WORK COMPLETION CERTIFICATION, HANDING OVER:

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

The contractor shall be solely responsible for any shortage or damage of materials issued to them handling of and / or in storage and erection at site and cost of the same will be recovered from the contractor as certified by Engineer In-Charge. Contractor must submit a periodical material reconciliation statement in the approval format with every Running Bill raise by him or end of every month whichever is earlier. The contractor shall maintain an accurate and exhaustive record detailing out the list of all

items received by him for the purpose of erection and keep such record open for the inspection of the company.

17 PENALTY AND LIQUIDATED DAMAGES

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

17.2 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 as per the clause defined in SCC.

18 SAFETY CODE:

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

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

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

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

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

19. STATUTORY OBLIGATIONS:

The Contractor shall take all steps as may be necessary to comply with the various applicable laws/rules including the provisions of contract labour (Regulation & Abolition Act) 1970 as amended, minimum wages Act, 1984, Workman Compensation Act, ESI Act, PF Act, Bonus Act and all other applicable laws and rules framed there under including any statutory approval required from the Central/State Govt. Ministry of Labour. Broadly, the compliance shall be as detailed below, but not limited to:

a) An Electrical license issued by Govt.of Delhi.
b) PF Code No. and all employees to have PF A/c No. under PF every Act, 1952.
c) All employees to have a temporary or permanent ESI Card as per ESI Act.
d) ESI Registration No.
e) PAN No.
f) Work Contract Tax Registration Number/ GSTN Registration. g) Labour License under Contract Labour Act (R & A) Act 1970

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

The Contractor must follow:

a) Third party Insurance Policy before start of work.
b) To follow Minimum Wages Act prevailing in the state.
c) Salary / Wages to be distributed in presence of representative of Company's representative not later than 7th of each month.
d) To maintain Wage- cum - Attendance Register.
e) To maintain First Aid Box at Site.
f) Latest P.F. and E.S.I. challans pertaining to the period in which work was undertaken along with a certificate mentioning that P.F. and E.S.I. applicable to all the employees has been deducted and deposited with the Authorities within the time limits specified under the respective Acts.
g) Workman Compensation Policy. {If applicable}
h) Labour license before start of work. {If applicable}

20. WORKMAN COMPENSATION:

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

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

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

21. STAFF AND WORKMAN:

It shall be responsibility of contractor

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

b) To obtain workman insurance cover against deployment of workers etc.

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

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

The records shall be in the prescribed formats only.

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

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

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

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

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

22. HUMAN RESOURCE ISSUES:

22.1 The CONTRACTOR would execute these works through their own resources.

22.2 The CONTRACTOR shall bear all expenses/cost to be incurred towards salary, allowances, perks, traveling allowances, advances, insurance, safety measures, security, transportation and all other misc. expenses etc. of their employees/ workmen during the tenure of AMC. Also, the CONTRACTOR shall be sole responsible for making payment for Out-patient department, Hospitalization, Compensation thereof in case of any accident, injury or death.

22.3 ID CARD: No contractor will issue any ID cards to their staff on their own .All ID Cards for the workforce will be issued by BYPL Security ID Card Cell only. Contractors should maintain the records of Identity Cards of their employees and whenever any employee quits / is removed then his/her Identity card should be collected & submitted to BYPL Security ID Card Cell. Penalty will be imposed on the vendor in case of violation of the above rule.Contractors shall submit the detail list of the employees that they are going to be hire to BYPL Security before start of the contract.

22.4 The CONTRACTOR to deploy their manpower immediately for carrying out the work as specified above.

22.5 The CONTRACTOR should ensure that there are no disputes regarding service, payment etc of the persons engaged by him, anytime during the currency of the contract. At no point of time during the currency of contract, the CONTRACTOR's employees shall insist upon the COMPANY for employment, wages, and allowances or any other related matter, payment etc.

22.6 The CONTRACTOR shall not deploy the manpower below the age of 18 years.

22.7 The CONTRACTOR shall not deploy the female manpower between 7 PM to 6 AM.

22.8 The CONTRACTOR shall be directly responsible for any / all disputes arising between him and his persons and keep the COMPANY indemnified against all losses, damages and claims arising thereof. The CONTRACTOR shall resolve any dispute of their manpower. All the legal dues of their manpower is to be paid on due date or within 8 days on the termination of manpower.

22.9 All safety wears required for the CONTRACTOR's manpower during the execution of work such as safety shoes, safety helmets, hand gloves, safety belt, goggles etc. must be provided by the CONTRACTOR at his own cost and he shall ensure that his employees regularly use such safety gears while executing COMPANY's work.

22.10 The CONTRACTOR shall be responsible for discipline of his manpower and shall adhere to the disciplinary procedure set by the COMPANY at site. The COMPANY shall be at liberty to object to the presence of any representative or employees of the CONTRACTOR at the site, if in the opinion of the COMPANY such manpower has done any act of misconduct or negligence or otherwise undesirable, then the CONTRACTOR shall remove such a person objected to and provide a competent replacement immediately.

22.11 The CONTRACTOR shall ensure that he has complied with the following:
- has paid minimum wages to his manpower as per the rate notified from time to time by the Government of National Capital Territory of Delhi.
- Contractor shall disburse the salary of his staff through ECS only.

22.12 Deduct and deposited ESI and PF contribution. Copies of the same shall be submitted.
22.13 The COMPANY reserves the right to demand the CONTRACTOR's services on holidays as well as beyond the normal working hours.The Engineer In-charge shall communicate in writing for any work required to be done during Holidays.

22.14 The CONTRACTOR will ensure that none of their person is engaged in any unlawful activities subversive of the COMPANY's interest failing which suitable action may be taken against the CONTRACTOR as per the terms and conditions of this tender.

22.15 The CONTRACTOR shall be liable for payment of all taxes and duties as applicable, to the State/ Central Govt. or any local authority.

22.16 The CONTRACTOR's employees shall not be treated as COMPANY's employees / persons for any purpose whatsoever & facilities/ benefits applicable to the COMPANY's employees shall not be applicable to CONTRACTOR's employees. If due to any reasons whatsoever the COMPANY is made liable to meet any obligation under any of the laws & enactment etc, for any reason whatsoever the same shall be recovered from the CONTRACTOR or from any of the bills payable to him or failing which it shall be recovered as per law.

22.17 The CONTRACTOR shall be responsible and shall comply with the provision of all the STATUTORY ACTS APPLICABLE. Special attention of the CONTRACTOR is drawn towards the compliance of provision of the following statutes: (along with the latest amendments/additions):

22.17.1 The Child Labour (Prohibition and Regulation) Act, 1986.
22.17.2 The Contract Labour (Regulation and Abolition) Act, 1970.
22.17.3 The Employee's Pension Scheme, 1995.
22.17.4 The Employee's Provident Funds and miscellaneous provisions Act, 1952. 22.17.5 The Employees State Insurance Act, 1948.
22.17.6 The Industrial Disputes Act, 1947.
22.17.7 The Maternity Benefit Act 1961.
22.17.8 The Minimum Wages Act, 1948.
22.17.9 The Payment of Bonus Act, 1965.
22.17.10 The Payment of Gratuity Act, 1972.
22.17.11 The payment of Wages Act, 1936.
22.17.12 The Delhi Shops & Establishment Act, 1954.
22.17.13 The Workmen's Compensation Act. 1923.
22.17.14 The Employer's Liability Act, 1938.

The Contractor shall furnish the above specified compliances as per the format attached as Annexure I.

Contractor shall adhere to the Vendor Code of Conduct as specified in the NIT.

23. INSURANCE:

23 a) THIRD PARTY INSURANCE:

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

23 b) ACCIDENTAL INSURANCE POLICY FOR LIFE COVER:

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

23 C) INSURANCE FOR MAN, MATERIAL & MACHINERY DEPLOYED AT SITE:

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

24. SECURITY

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

25. ENVIRONMENTAL, HEALTH & SAFETY PLAN:

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

a) Comply with all of the elements of the EHS Plan and any regulations applicable to the work

b) Comply with the procedures provided in the interests of Environment, Health and Safety

c) Ensure that all of their employees designated to work are properly trained and competent

d) Ensure that all plant and equipment they bring on to site has been inspected and serviced in accordance with legal requirement and manufacturer's or suppliers' instructions

e) Make arrangements to ensure that all employees designated to work on or visit the site present themselves for site induction prior to commencement of work

f) Provide details of any hazardous substances to be brought onsite

g) Ensure that a responsible person accompanies any of their visitors to site

All contractors staff is 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.

26. TEST CERTIFICATE & QUALITY ASSURANCE:

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

27. SUB-CONTRACTING / SUBLETTING:

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

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

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

28. INDEMNITY:

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

a) any breach non-observance or non-performance by contractor or its employees or agents of any of the provisions of this Work Order.
b) any act or omission of contractor or its employees or agents.
c) any negligence or breach of duty on the part of contractor, its employees or agents including any wrongful use by it or them of any property or goods belonging to or by COMPANY.
d) The vendor shall submit an Indemnity Bond against any damages / loss of free issued materials.

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

29. EVENTS OF DEFAULTS:

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

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

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

30. RISK & COST:

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

BSES Yamuna Power Limited

31. ARBITRATION:

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

32. SECRECY CLAUSE:

The technical information, drawing and other related documents forming part of work order and the information obtained during the course of investigation under this work order shall be the Company's executive property and shall not be used for any other purpose except for the execution of the work order. The technical information drawing, records and other document shall not be copied, transferred, or divulged and/ or disclosed to third party in full/part, not misused in any form whatsoever except to the extent for the execution of this work order.

These technical information, drawing and other related documents shall be returned to the Company with all approved copies and duplicates including drawing/plans as are prepared by the Contractor during the executions of this work order, if any, immediately after they have been used for agreed purpose.
In the event of any breach of this provision, the contractor shall indemnify the Company against any loss, cost or damage or claim by any party in respect of such breach.

33. TERMINATION DUE TO NON PERFORMANCE:

"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.

34. TERMINATION BY EOMPLOYER CONVENIENCE:

The owner at any time terminate the contract for any reason, by giving the contractor a notice of termination. Upon receipt of the notice of termination, the contractor shall either within 14 days of receipt of such notice, or on the date specified in the notice of termination, carry out the following : Cease all further work, except for such work as the owner may specify in the notice of termination for the sole purpose of protecting that part of the facilities already executed, or any work required to leave the site in a clean and safe condition.

• Terminate all subcontracts, except as mentioned below.

• Remove all Contractor's equipment from the site, repatriate the contractor's and its sub-contractor's personnel from the site, remove from the site any wreckage, rubbish and debris of any kind, and leave the whole of the site in a clean and safe condition.

• Deliver to the owner the parts of the facilities executed by the contractor up to date of termination.

• To the extent legally possible, assign to the owner all right , tile and benefit of the contractor to the facilities and to the plant and equipment as at the date of termination, and as may be
required by the owner, in any subcontracts concluded between the contractor and its sub-contractors.

• Deliver to the owner all non-proprietary drawings, specifications and other documents prepared by the contractor or its sub-contractors as at date of termination in connection with the facilities. In the event of termination of the contract by the owner, under this clause, the owner shall pay to the contractor the following amounts after setting off the owner's claim if any under the contract:

a) The contract price, properly attributable to the parts of the facilities executed by the contractor as of the date of termination.
b) The costs reasonably incurred by the contractor in the removal of the contractor's equipment from the site and in the repatriation of the contractor's and its sub contractors personnel.
c) Pre- approved and reasonable cost of satisfying all other obligations, commitments and claims that the contractor may in good faith have undertaken with third parties in connection with the contract and that are not covered above.

35. QUALITY:

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

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

The contractor shall submit SQP indicating Customer Holding Point for design, manufacture, inspection, testing, packing, forwarding, transportation including shop painting and final painting for Purchaser's review and approval.

The contractor shall submit Field Quality Assurance and Filed Quality Control Plan (FQP) indicating Customer Hold Point for unloading, receiving, storage at site, transportation, handling at site, erection, testing, pre-commissioning & commissioning for Purchaser's review and approval as per applicable provisions of Technical Specifications.

The Contractor shall submit a Field Erection Procedure for the scope of work under the Contract Agreement. The same shall be subject to the approval of the Purchaser and the work shall be carried out in accordance with such approved procedures.

36. CONSTRUCTION WATER & POWER:

Construction Water and power shall be arranged by Contractor at his own cost.

37. PROGESS REPORTS OF WORK EXECUTION:

During the various stages of manufacturing and erection of the critical equipments in the pursuance of the Contract, the Contractor shall at its own cost submit periodic progress reports as may be reasonably required by the Purchaser with such materials as charts, networks, photographs, test certificates, etc. Such progress reports shall be in the form and size as may be required by the Purchaser and shall be submitted in adequate number of copies to be notified by the Purchaser

The quantitative progress report of the works by reference to the project schedule in sufficient detail should permit the Purchaser to assess performance, plan witness dates and evaluate forecasts, including reports on key Sub-contracts (as applicable). Within 7 days of the submission of each such report and at such other times as the Purchaser may reasonably request, the Contractor and the Purchaser shall meet to discuss progress.. Weekly progress reports shall include the following sections:

a) Executive summary

b) Description of the work and services performed and goods and materials delivered and erected during the preceding week.

c) Necessary photographs of work done in the manufacturer's shop and erection site which shall be taken when and where indicated by the Purchaser. Photographs shall be approximately 100 x 125 mm in size including a margin of 5 mm side for fixing. Adequate numbers of photographs shall be submitted indicating various stages of manufacture and erection of critical items. Each photograph shall contain the date, the name of the Contractor and the title of the view taken.

d) Updated project schedule showing progress to the end of the week (as percentages completed of the Contractor's activities broken down into significant elements of the works), and the current schedule of activities and the targets for the next week.

e) Identification of areas with foreseeable problems which in the opinion of the contractor may affect the project schedule.

f) Such other information and supporting documentation as the Purchaser may require satisfying himself about the timely manufacture, delivery and erection of equipment as per contract.

The Purchaser shall advise the Contractor about the number of copies of progress reports and, where relevant, photographs he has to submit each week together with the names and addresses of persons to whom they are to be sent. Purchaser will also advise the contractor regarding the format of the Monthly Progress report.

38. FREE ISSUES OF MATERIAL AND /OR EQUIPMENT:

The Purchaser issued Free Issue Material/Equipment to Vendor in order that Vendor may fulfill its obligations under the Agreement, shall remain the property of Purchaser and shall be clearly labelled as such by Vendor until delivery of the completed Goods in accordance with the terms of the Agreement. Risk of loss in respect of all such Free Issue Items shall pass to Vendor upon receipt of such items by Vendor and remain with Vendor until delivery of the completed Goods to Purchaser in accordance with the terms of the Agreement. Vendor shall maintain all such Free Issue Items in good condition and shall use them solely in connection with the requirements of the Agreement. Disposal of surplus items shall be in accordance with written instructions from Purchaser. The vendor shall submit an Indemnity Bond to this effect, as per the format.

39. PROTECTION OF PROPERTY:

The Contractor shall be responsible for any damage resulting from his operation. He shall also be responsible for protection of all persons including members of public; and employees of the PURCHASER & the PURCHASER; employees of the Contractors & Subcontractors; and all public and private property including structures, buildings, other plants and equipment and utilities either above or below the ground.

The Contractor shall ensure provision of necessary safety equipment such as barriers, sign boards, warning lights and alarms, etc to provide adequate protection to persons and property. The Contractor shall be responsible to give reasonable notice to the PURCHASER & the PURCHASER of public or private property and utilities when such property and utilities are likely to get damaged or injured during the performance of his works and shall make all necessary arrangements with such PURCHASER, related to removal and/or replacement or protection of such property and utilities.

40. VARIATIONS / AMENDEMENTS:

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

41. ACCEPTANCE

Acceptance of this work order implies and includes acceptance of all terms and conditions enumerated in this work order in the technical specification and drawings made available to you consisting of general conditions, detailed scope of work, detailed technical specification & detailed equipment, drawing. Complete scope of work and the Contractor's and Company's contractual obligation are strictly limited to the terms set out in the work order. No amendments to the concluded work order shall be binding unless agreed to in writing for such amendment by both the parties.
However, during the course of the execution of the work order, if at any time the Company's representative observe and form an opinion that the work under the work order is not being performed in accordance with the terms of this work order, the company reserves its right to cancel this work order forthwith without assigning any reason and the Company will recover all damages including losses occurred due to loss of time from the Contractor.
We request you to please sign the duplicate copy of this work order as a token of your acceptance and return to us.

BSES Yamuna Power Limited

Annexure - I

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

a) An Electrical license. (If applicable)
b) PF Code No. and all employees to have PF A/c No. under PF every Act, 1952.
c) All employees to have a temporary or permanent ESI Card as per ESI Act.
d) ESI Registration No. e) PAN No.
f) Work Contract Tax/VAT Registration Number.
g) Labor License under Contract Labor Act (R & A) Act 1970(All Engineer-in-charge responsible for execution of the job should obtain a copy of Labor License as per guidelines of HR department before start of the work by the contractor.)

The Contractor must follow:

a) Third party Insurance Policy before start of work.

b) To follow Minimum Wages A ct prevailing in the state.

c) Salary/ Wages to be distributed in presence of Company's representative not later than 7th of each month.

d) To maintain Wage- cum - Attendance Register.

e) To maintain First Aid Box at Site.

f) Latest P.F. and E.S.I. challans pertaining to the period in which work was undertaken along with a certificate mentioning that P.F. and E.S.I. applicable to all the employees has been deducted and deposited with the Authorities within the time limits specified under the respective Acts.

g) Workman Compensation Policy. (If applicable)

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

i) Group personnel accident insurance shall have coverage of Rs. 10 Lacs (Table C-Death + Permanent Total Disability + Partial permanent Disability due to external accidents).

BSES Yamuna Power Limited

CIVIL CONDITIONS OF CONTRACT (CCC)

BSES Yamuna Power Limited

Table of Contents

BSES Yamuna Power Limited

CIVIL CONDITIONS OF CONTRACT

The general Condition of the contract shall form a part of the specifications, contract documents.

1. PRIORITY OF CONTRACT DOCUMENTS:

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

1. The Contract Agreement
2. The Letter of Acceptance/ Intent
3. Agreed Minutes of the Contract Negotiation Meetings.
4. Agreed Minutes of the contract Technical Meetings.
5. Instruction to Bidders (ITB)
6. Special Condition of Contract (SCC)
7. General Condition of Contract (GCC)
8. Erection Conditions of Contract (ECC)
9. Civil Conditions of Contract
10. The Priced Bill of Quantities
11. The Particular Technical Specifications
12. The General Technical Specifications
13. The Submitted Tender, including all Appendices and/or Addenda, the latest taking precedence.

All the materials, literature, data and information of any sort given by the contractor along with its bid proposal subject to the approval of the purchaser.

2. DEFINITIONS AND INTERPRETATION:

Definitions TO BE FOLLOWED UNDER THE CONTRACT shall have following meanings:

The following terms & expressions as used in this Tender shall have the meaning defined and interpreted here under: Company: The terms "Company" shall mean BSES YAMUNA Power Ltd, a company incorporated under the Companies Act 1956 and having its office at Shaktikiran Building, Karkardooma, Delhi -110032, which expression shall include its authorized representatives, agents, successors and assigns.

2.1 Package: Package shall comprise of all the work, as defined in the scope of work as well as technical specifications, for the GIS grid substation, Cable In-feed as well as outgoing feeder.
2.2 Contractor: The terms "Contractor" shall mean the successful Tenderer / vendor to whom the contract has been awarded.

2.3 Purchaser: The terms "Purchaser" shall mean BSES YAMUNA Power Ltd who purchase the grid from the successful contractor.

2.4 Owner: The terms "Owner" shall mean BSES YAMUNA Power Ltd who own the grid.

2.5 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.

2.6 Tender Specification: The terms "Tender Specification" shall mean the Indian Standard specification of the work and description of work as detailed in Tender document/Tender enclosed and all such particulars mentioned directly/referred to or implied as such in the Tender.

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

2.8 Engineer In Charge: "Engineer In-charge" means the Company's authorized representative for the purpose of carrying out the work.

2.9 Applicable Law: "Applicable Laws" means the constitution of India and any act, rule, regulations, directive, notification, code, order or instruction having its force of law enacted or issued by any competent legislature or Governmental Agency (including those related to taxes, duties, assessments, expropriation and compulsory acquisition) as may be in effect from time to time the implications thereof shall be deemed a Change in Law or Change in Permits.

2.10 Other Clearances: Means any consent, approval, permit or other authorisation which is required to be granted by authorities (local, government or any other) essential to start/complete the work.

2.11 Defect Liability Period: Shall mean the period during which the contractor shall remain liable for repair or replacement of any defective part of the work performed under the contract, free of cost.

3. EXAMINATION OF SITE AND LOCAL CONDITIONS:

The contractor is deemed to have visited the site of the work and ascertained therefore all site conditions and information pertaining to his work. Before submitting the bid, all bidders will at their expenses make or obtain any additional informations, investigations, explorations, test and studies and obtain any additional information and data which pertains to the physical conditions at or contiguous to the site or otherwise which may affect cost, progress, performance of the work and which the bidder deems necessary to determine its Bid for performing the work in accordance with the time and other terms and conditions of the tender/contract documents.

The company shall not accept any claim whatsoever arising out of the difficult site/terrain/local conditions, if any.

4. LANGUAGE AND MEASUREMENT:

The Tender issued to the contractor by the company and all correspondence and documents relating to the Tender placed on the Contractor shall be written in English language. Metric System shall be followed for all dimension, units etc., the mode of measurement shall be as per IS 1200.

5. SCOPE OF WORK:

The scope of work under this contract shall include the turnkey execution on End to End Basis , including but not limited to design, manufacturing, inspection & testing, dispatches, loading , unloading ,storage at site, erection & installation, testing of the installation, associated civil work ,commissioning ,handing over to the purchaser including comprehensive marine cum storage cum erection Insurance (MSE) on "Single Point Responsibility Basis" for GIS Grid Substation.

Brief Scope of Work related to Erection and Installation work including testing and commissioning and final handover for the above packages shall be as per the NIT conditions with the following salient details.

5.1 Survey, design, engineering, manufacture, shop testing, inspection, packing, dispatch, loading, unloading and storage at site including comprehensive SCE (Storage cum Erection) insurance, assembly, erection, civil structural, architectural work, complete pre-commissioning checks, testing & commissioning at site, also includes all statutory clearances & certification from Electrical Inspector, Municipal corporation department, Fire officer, Horticulture department , various local bodies like RWA and handing over to the Owner after satisfactory commissioning of complete Packages as defined above for **Grid Substation** on Turnkey Basis.

Schedule of work shall be as mentioned in the Bill of quantity attached herewith.

- After completion of E/T/C work of the scheme, contractor has to obtain the Electrical Inspectorate's Clearance from the Electrical Inspector of BYPL.
- Contractor shall arrange any permission like Road cutting clearance etc. from the Delhi Civic authorities. All Statutory charges and direct fees shall be borne by BYPL.
- All the Labour, plant appliance, ladder, scaffoldings, materials, tool, tackles etc are included 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. Detailed Organization chart , along with the qualification of the manpower to be deployed shall submitted along with Bid.
- The Contractor shall also make his own arrangement for the accommodation/conveyance requirements for its staff at site.

- Contractor shall arrange storage for storing the materials, tools, tackles etc. Contractor shall be responsible for all the unloading of the material, marking, staking and storage at site. The insurance for all the storage material shall be included in the policy taken by Contractor. Contractor shall submit the copy of insurance policy to BYPL. In case of any mis-happening/damage to the storage material contractor shall be responsible to lodge the claim. Under no circumstances no delay in execution shall be allowed and contractor shall immediately arrange for the replacement without waiting for the settlement.

- All the incoming and outgoing materials, equipment, tools, tackles and any other items related to said work shall be entered into the register kept for this purpose and shall be in the custody of Contractor, however company does not hold any responsibility for any loss or damage of Contractor's material etc.

- All loading/unloading, of materials at work-site shall be contractors responsibility. Involvement of Crane/Hydra/Tractor/Trailer for this type of work shall be in contractors scope. Adequate weather protection shall be provided by the contractor to keep the materials safe from sun & rain by providing covered storage space as well as using tarpaulins.

6. FIRM CONTRACT PRICES:

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.

7. QUANTITY VARIATION AND EXTRA ITEM/WORK:

7.1. The Contractor shall carry out and complete the works in every respect in accordance with this Contract and In accordance with the directions and to the satisfaction of the Engineer in charge.

7.2. The Engineer In Charge may, at his discretion, from time to time, issue further drawings and/ or written instructions, details, directions and explanations which are herein after referred to as "EIC's Instructions" in regard to:

a) The variation or modification of the design, quality, specification or quantity of works or the omission or substitution of any work.

b) The timing or sequencing of work.

c) Any discrepancy between the drawing and / or the Bill of Quantities and / or Specifications.

d) The removal from the site of any materials/ equipment/ resources brought thereon by the Contractor and the substitution of the same thereof.

e) The Execution of additional works of any kind necessary of the completion of the work.

f) The removal and /or re-execution of any works executed by the Contractor.

g) The substitution from the site of the works of any person employed there upon.

h) The amending and making good of any defects under clause "Defects Liability".

i) The opening up for inspection of any work covered up.

j) Changes in lines, levels, positions and dimensions of any part of the Work.

7.3. The Contractor shall forthwith comply with and duly execute any work comprised in such EIC's instructions provided always that verbal instructions, directions and explanations given to the Contractor or his supervisor upon the works by the Engineer In Charge shall if involving a variation be confirmed in writing by the Contractor within seven days and the Engineer in charge's written approval is obtained.

7.4. If compliance with the Engineer In Charge's Instructions as aforesaid involves work beyond that contemplated by the Contract, then unless the same were issued owing to some breach of this Contract by the Contractor, the EIC shall pay to the Contractor the cost of the said work as an extra to be valued and as hereinafter provided.

7.5. No such variation shall in any way vitiate or invalidate the Contract but the value, if any, of all such variations shall be taken into account in ascertaining the amount of the final certification.

7.6. No such variations shall be carried out by the Contractor without instructions, in writing from the Engineer in charge. Provided that no instructions in writing shall be required for increase or decrease in the quantity of any work where such increase or decrease is not the result of an instruction given under this clause, but is the result of the quantities exceeding or being less than those stated in the Bill of Quantities. If the Engineer in charge shall consider it desirable to give any instructions verbally, the Contractor shall comply with such an instruction and any confirmation in writing of such verbal instruction given by the Engineer in charge whether before or after the carrying out of such work, shall be deemed to be an instruction in writing within the meaning of this clause. Provided further that if the Contractor shall within 7 days confirm in writing to the Engineer in charge and such confirmation shall not be contradicted in writing within 30 days by the Engineer in charge, it shall be deemed to be an instruction in writing by the Engineer in charge.

7.7. All extra or additional work done on the instructions of the Engineer In Charge shall be valued at the rates and prices set out in the Contract. If the Contract does not contain any rates or prices applicable to the extra or additional work, then suitable rates or prices shall be agreed upon between Company and the Contractor as per the following, in the order of preference:

(i) The rate shall be derived from any one of the quoted rates for similar items of work in the tender.

(ii) In case similar items are not available in the tender, then rates shall be worked out as per the following:

a) The direct cost of labour including indirect charges thereon. The labour components shall be computed wherever possible from the related BIS Codes and the quantity of

materials to be based on consumption factor as per standard norms or as accepted by the EIC.

b) The material cost inclusive of taxes, levies, fees, duties etc. as delivered to the site. Proof of cost in form of an invoice to be submitted along with the extra work claim along with other working documents.

c) The Plant & Equipment cost inclusive of hire charges of plant & equipment and operational charges as per standard norms or as accepted by the EIC.

d) In addition the Contractor shall be entitled to payment towards overheads and profit.

7.8. In cases where the items of works are not accepted as complete, or not fully in accordance with the Specification, the Engineer in Charge shall make payments of such items at such reduced rates, as he may consider reasonable in approval of Interim Bills and the Final Bill.

7.9. In all cases the Contractor shall furnish detailed Rate Analysis along with necessary details as and when required by the Engineer in Charge. The Engineer in Charge on establishing the validity of such claims shall certify the amount payable for such work and rates so determined shall be final and binding on the Contractor.

7.10. The quantities of the various kinds of work to be done and materials to be furnished under this Contract as listed in the Bill of Quantities are estimated and approximate only and shall be subject to re-measurement upon completion. The Contractor shall make no claim for anticipated profits, for loss of profits or for damages because no work is ordered under certain items or because of a difference between the quantities of the various kinds of work to be done or materials actually delivered and the estimated quantities set forth in the Bill of Quantities.

7.11. The rate/prices quoted by the Contractor in the Bills of Quantities shall be firm irrespective of any variation in the quantities of individual items of work and / or in the Total Contract Sum.

8. TAX & DUTIES:

Prices are inclusive of all taxes, duties, GST shall be to contractor's account including any duties which may be levied by the Govt. during currency of this order.(except service tax). However, IT as per applicable rate will be deducted from your bills as Tax Deduction at Source (TDS). The total order value shall remain FIRM within stipulated delivery period and shall not be adjusted on account of any price increase/variations in labour & materials. However Statutory Taxes, duties and Levies imposed by Competent Authorities by way of fresh notification(s) within the stipulated delivery period shall be borne by BYPL on submission of necessary documents claiming such variation. Service tax as applicable shall be paid on submission of Service Tax Registration and self declaration on your letter head stating that you have deposited/or will deposit the Tax as per the applicable service tax laws.

STATUARY VARIATION IN TAXES:

The total order value shall remain FIRM. However in case of any Statutory variation in GST, or Taxes, duties and Levies imposed by Competent Authorities by way of fresh notification(s) shall be borne by BYPL on submission of the documentary evidence.

Any variation in taxes shall be applicable only to the direct/price breakup as mentioned in the contract.

9. CHANGE OF LAW:

"Change in Law" means:

a) Any enactment or issue of any new Applicable Law,
b) Any amendment, alteration, modification, or repeal of any existing Applicable Law or any new or modified directive or order thereunder,
c) Any change or variation in taxes payable in connection with and under this Agreement in each case with respect to a), b), and c) above coming into effect after the date of this Agreement.

10. ACCOMMODATION & CONVEYANCE FOR THE STAFF:

The Contractor shall also make his own arrangement for the accommodation/conveyance requirements for its staff at site.

11. STORAGE AT SITE:

Company will be provided at site the adequate open space for contractor's site store for storing the materials, tools, tackles etc.

All the Contractor's storage will be within the site premises. All the incoming and outgoing materials, equipment, tools, tackles and any other items related to said work shall be entered

into the register kept for this purpose and shall be in the custody of Contractor, however company does not hold any responsibility for any loss or damage of Contractor's material etc. All loading/unloading, of materials at work-site shall be your responsibility. Involvement of Crane/Hydra/Tractor/Trailer for this type of work shall be in your scope.

Adequate weather protection shall be provided by the contractor to keep the materials safe from sun & rain by providing covered storage space as well as using tarpaulins. Water and Electricity Power shall be arranged by the Contractor at his own. 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 including in the above mentioned Tender value. The unit rates mentioned in annexure is inclusive of barricading and watch & ward during execution and no separate charges shall be paid for the same.

12. SECURITY, WATCH & WARD:

The contractor, at his own cost , shall arrange for the security and watch and ward of the materials, men and machineries at site. Round the clock security alongwith the CCTV shall be provided for the materials stored at the site.

13. DEFECT LIABILITY PERIOD:

Work executed shall be guaranteed against any defect or failure which may arise due to faulty materials, design or workmanship for a period of 24 months from the date of final handing over of the entire package as defined in SCC.

If during the Defect Liability Period any work are found to be defective, shall be immediately rectified or repaired, upto BYPL satisfaction, by the contractor at his own cost within 10 days from the date of receipt of intimation from BYPL.

Under no circumstances any extra claim in terms of time and cost shall be entertained for such repair/rectification.

14. PERFORMANCE GUARANTEE:

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

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

14.03 Contractor shall submit the workmanship / equipment performance bank guarantee equivalent to the 10% of the contract value at the time of claiming the last payment as per TERMS OF PAYMENT (Erection, Testing & Commissioning)), with the validity of the bank guarantee till Defect Liability Period i.e. 24 months from the date of Handing over of entire package plus 3 months.

15. COMPLETION PERIOD:

You are required to mobilize your manpower and Tools & Tackles and furnish a list of equipments to be used for erection and commence the execution activity as per instructions of Engineer In-charge. The detailed schedule and milestone completion dates would be as per the contract schedules given from time to time by Engineer In-charge at site.

The time schedule for carrying out this work and period for mobilization shall be as under:

15.1 The Contractor's team should be mobilized at site for commencement of work immediately on receipt of the order.

15.2 The entire work under this order as indicated in the scope of work shall be carried out and completed within 300 days for entire package as defined inn SCC. Total completion schedule for Engineering, manufacturing, inspection & testing, packing and

forwarding and Transportation till site and Erection Testing & Commissioning of all the identified package shall be as under.

15.3 A detailed L2 Schedule shall be submitted by the supplier within 15 days of LOI. The contractor shall plan parallel working (round the clock working) for completion of work as per schedule and mobilise manpower accordingly.

15.4 Progress Review Meeting between the Contractor and the Engineer In charge shall be held at site at least once in a week. Also a weekly progress report giving the details of the manpower engaged at site and the details of the major job completion shall be submitted to Engineer In-charge.

15.5 The above time schedule must be strictly adhered to and improved upon wherever possible. In the event we find that your work is not progressing in quality or time frame as per above agreed schedule and to our satisfaction, we reserve the right to withdraw the work in whole or in part without further notice and liability of the Company.

15.6 The completion of the work shall have to be certified by Engineer In charge.

15.7 In order to maintain the time schedule, if necessary the Contractor shall carry out the work on all Sunday & Holiday except National Holiday with prior written permission from Engineer-in-Charge.

16. TEST CERTIFICATE & FIELD QUALITY ASSURANCE:

The Contractor shall procure all equipment from genuine sources as approved by the Company & as per Company specifications. Cement shall be of grade 43 ordinary port land cement conforming to IS 8112/53 grade O.P.C. conforming to IS 12269, aggregate for cement concrete shall confirm to IS 383, reinforcement for cold twisted bars shall confirm to IS 1786, the bricks for brick work shall correspond to IS 1077, Structural steel shall confirm to relevant IS code, water to be used shall comply with requirement of IS 456. Contractor shall provide all requisite facilities for field tests and laboratory tests shall be carried out in the laboratory having ISO 9001- 2000 Certified Testing Lab for which no extra payment shall be made. The Contractor shall maintain mandatory Test Register with Engineer-in-Charge as provide in latest Indian Standard Specifications.

The contractor shall submit SQP indicating Customer Holding Point for design, manufacture, inspection, testing, packing, forwarding, transportation including shop painting and final painting for Purchaser's review and approval.

The contractor shall submit Field Quality Assurance and Filed Quality Control Plan (FQP) indicating Customer Hold Point for unloading, receiving, storage at site, transportation, handling at site, erection, testing, pre-commissioning & commissioning for Purchaser's review and approval as per applicable provisions of Technical Specifications.

The Contractor shall submit a Field Erection Procedure for the scope of work under the Contract Agreement. The same shall be subject to the approval of the Purchaser and the work shall be carried out in accordance with such approved procedures.

17. SUB-CONTRACTING / SUBLETTING:

CONTRACTOR shall not assign or transfer the whole or any part of this Work Order or any other benefits accruing there from nor shall it subcontract / sublet the whole or any part of the Works without the prior written consent of COMPANY. In the event the contractor assigns this work order, contractor's assignees shall be bound by the terms and conditions of this work order and shall , if deemed necessary by COMPANY at the time of such assignment, undertake in writing to be so bound by this Work Order. Notwithstanding the subletting / subcontracting of any portion of the works, contractor shall remain wholly responsible for the carrying out, completion and satisfactory execution of Works in all respects in accordance with this Work Order, specification, approved drawings and data sheets.

18. CLEANLINESS & PRECAUTIONS AT SITE TO PREVENT DUST POLLUTION:

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, the contractor 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.

While carrying out any civil work including road/ pit digging, plinth/ fence making, road restoration etc contractor shall adhere to below mentioned guidelines.

18.1 No construction material/ debris shall be stored on metalled road.

18.2 Wind breakers of appropriate height on all sides of ear marked area using CGI sheets shall be raised to ensure that no construction material dust fly outside ear marked area.

18.3 The construction material i.e. coarse sand, stone aggregates, excavated earth, cement and any other material to and from the site shall be transported under wet and covered condition to ensure their non-slippage en-route to avoid air contamination.

18.4 The contractor shall provide mask and helmet to every worker working on the construction site and involved in loading/unloading and carriage of construction material and construction debris to prevent inhalation of dust particles.

18.5 Over loading of vehicles shall be strictly prohibited.

18.6 The construction material at site shall be stored under wet and covered condition.

18.7 The dumping sites for temporarily storing the excavated earth shall be properly levelled, watered and rehabilitated by plantation to avoid flying of dust.

18.8 The worker at the site shall be sensitized to adopt / observe the dust controlled measures in true spirit.

18.9 If any C&D waste is generated at site the same will be transported to the C&D waste site only and the record for the same will be maintained by the agency.

18.10 Wet jet in grinding and stone cutting is being permitted at site.

18.11 The necessary record for dust control is being maintained by the department on day to day basis and being monitored regularly.

The Execution vendors shall be responsible for all the preventive and protective environmental steps as per guidelines. Any violations from the above guidelines have been viewed very seriously by the authorities. Concerned agency is liable for the penalties / other action by the authorities, The Agency shall indemnify BYPL from all liabilities on this account.

19. INDEMNITY:

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

a) any breach non-observance or non-performance by contractor or its employees or agents of any of the provisions of this Work Order.

b) any act or omission of contractor or its employees or agents.

c) any negligence or breach of duty on the part of contractor, its employees or agents including any wrongful use by it or them of any property or goods belonging to or by COMPANY.

d) The vendor shall submit an Indemnity Bond against any damages / loss of free issued materials.

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.

20. EVENTS OF DEFAULTS:

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

a) Failing to complete execution of work within the terms specified in this work order.

b) Failing to complete works in accordance with the approved schedule of works.

c) Failing to meet requirements of specifications, drawings, and designs as approved by COMPANY.

d) Failing to comply with any reasonable instructions or orders issued by COMPANY in connection with the works.

e) Failing to comply with any of the terms or conditions of this work order. In the event COMPANY terminates this work order, in whole or in part, on the occurrence of any event of default, COMPANY reserves the right to engage any other subcontractor or agency to complete

the work or any part thereof, and in addition to any other right COMPANY may have under this work order or in law including without limitation the right to penalize for delay under clause 15.0 of this work order, the contractor shall be liable to COMPANY for any additional costs that may be incurred by COMPANY for the execution of the Work.

21. RISK & COST:

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

22. ENVIRONMENTAL, HEALTH & SAFETY PLAN:

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

a) Comply with all of the elements of the EHS Plan and any regulations applicable to the work.

b) Comply with the procedures provided in the interests of Environment, Health and Safety.

c) Ensure that all of their employees designated to work are properly trained and competent.

d) Ensure that all plant and equipment they bring on to site has been inspected and serviced in accordance with legal requirement and manufacturer's or suppliers' instructions.

e) Make arrangements to ensure that all employees designated to work on or visit the site present themselves for site induction prior to commencement of work.

f) Provide details of any hazardous substances to be brought onsite.

g) Ensure that a responsible person accompanies any of their visitors to site.

All contractors' staff are accountable for the following:

1. Use the correct tools and equipment for the job and use safety equipment and protective clothing supplied, e.g. helmets, goggles, ear protection, etc. as instructed.

2. Keep tools in good condition.

3. Report to the Supervisor any unsafe or unhealthy condition or any defects in plant or equipment.

4. Develop a concern for safety for themselves and for others.

5. Prohibit horseplay.

6. Not to operate any item of plant unless they have been specifically trained and are authorized to do so.

23. GENERAL CONDITIONS:

a) No idle labour charges will be admissible in the event of any suspension of work by the Company or stoppage caused in the work due to any reason resulting in contractors' labour or equipments being rendered idle due to any cause at any time.

b) The LOI followed by Work Order shall supersede all other correspondence and conditions of contract if furnished earlier in the event of any ambiguity.

c) ID CARD: No contractor will issue any ID cards to their staff on their own. All ID Cards for the workforce will be issued by BYPL Security ID Card Cell only.

Contractors should maintain the records of Identity Cards of their employees and whenever any employee quits / is removed then his/her Identity card should be collected & submitted to BYPL Security ID Card Cell.

Penalty will be imposed on the vendor in case of violation of the above rule.

Contractors shall submit the detail list of the employees that they are going to be hire to BYPL Security before start of the contract.

d) SITE OFFICE AND SITE FACILITIES:
The Contractor shall also make his own arrangement for the accommodation/conveyance requirements for its staff. He shall be provided at site the adequate open space for construction of site store for storing the materials, tools, tackles etc. All the Contractor's storage will be within the site premises in a manner affording convenient access for identification and inspection at all times. The storage of arrangements shall be subject to IS: 4082. All the incoming and outgoing materials, equipment, tools, tackles and any other items related to said work shall be entered into the register kept for this purpose and shall be in the safe custody of Contractor, however company does not hold any responsibility for any loss or damage caused to Contractor's material etc.

e) The Contractor shall strictly control the labour so that the site is not polluted, made dirty or littered with debris, wastes or the likes.

f) Any person, labour found creating mess or litter or pollution shall be removed from the site immediately at the Contractors cost and shall also be subject to penalty at the discretion of the EIC.

g) WATER & POWER:

Water and Electricity Power shall be arranged by the Contractor at his own.

It shall be the responsibility of the Contractor to make arrangements at his own expense for supply of water for construction and other uses. The Contractor shall also install pumps, construct temporary storage tanks and distribute the water to various points in works Site as required. The Contractor at his own expense shall make arrangement for operating and maintaining pumps & distribution lines, connections, which are installed by him for water.

h) WATCHING & LIGHTING:
The Contractor shall in connection with the works provide and maintain at his own cost all lights, barricading arrangements, guards, fencing and watching when and where necessary for the protection of works, or for the safety and convenience of the public or others. The care, housekeeping and safety of the materials and works within the works site shall be sole responsibility of the Contractor.

i) EXTENSION OF TIME LIMIT & TIME OVER RUN:
If delay is not attributable to the Contractor, the extension of time may be considered at the discretion of the Company without prejudice to the right of the Company for recovery of liquidated damages. This is also subject to the Contractor having taken sufficient precautions to mitigate the delay and submitted to the Company a full-detailed particular of any extension of time to which he may consider himself entitled within 10 days after such work has been commenced or such circumstances have arisen. The extension of time may be granted and without any financial increment in the contract price to the Company.

j) RELEASE OF INFORMATION AND CONFIDENTIALITY:
The Contractor shall not communicate or use in advertising, publicity, sales release or in any medium photograph or reproduction of the works under this contract, or description of the site, dimensions, quantity or any other information concerning the works unless prior written permission is obtained by Company. The Contractor shall keep all the information obtained directly or indirectly through appointment of this contract confidential and shall not reveal the same to any other party without the prior written permission of the Company. The technical information, drawing and other related documents forming part of order and the information obtained during the course of execution under this order shall be the Company's exclusive property and shall not be used for any other purpose except for the execution of the 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 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 Contactor during the executions of this order, if any, immediately after they have been used for agreed purpose.

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

k) SITE REPRESENTATIVE, SITE SUPERVISION AND ADVANCE INTIMATION:
l) The Contractor shall have to appoint and authorize a Site In Charge/ Project Manager (PM) along with its project team, who shall be available always at site till the completion of the contract as certified by Engineer In Charge (EIC).

m) The Contractor shall be responsible for supervising the works by employing competent and experienced engineers and support teams to inspect the work and check the quality of work to ensure that the work is carried out in accordance with the drawings, specifications and instructions of the EIC. Such inspection and supervision shall not relieve the Contractor from any of his obligations towards use of material, workmanship, sequence of working and completion of project as per the stipulated period.

n) On receipt of the LOI or Work Order whichever is earlier the Contractor shall furnish to the Company, for approval, the proposed site setup with list of Engineers, Supervisors and other staff to be deployed by him with their dates of joining.

o) The Contractor's Project Manager shall obtain the written approval and instructions from the EIC prior to commencement of any works at site. The PM shall give written advance intimation for approval of all activities including deployment of resources, procurement of materials, concrete pours etc. to EIC.

24. WORK COMPLETION CERTIFICATION:

The work carried out by the Contactor under this order has to be certified as being satisfactorily completed by the Engineer In charge at work site. In case of modification/ rectification /correction to be carried out, Contractor shall carry out the said modifications/ corrections. The Contractor shall remain in close contact with Engineer In charge at site to report the general findings of the field work during the initial as well as later stage of the work at site, If required, there shall also be joint meetings at site/company office at Karkardooma, New Delhi to discuss the field findings and for revision of the method for site work if required. Work Completion Certificate shall be issued by the Engineer In charge with in 10 days of satisfactory work completion subject to handing over of clear site i/c removal of Labor accommodation, stores, storage arrangements for water, plants, tackles, scaffoldings, ladders, leveling at site. The Contractor shall give undertaking that all standing dues to Labor have been paid and all the statutory obligations have been met with. Completion certificate to be submitted with the final bill issued by Engineer-in-Charge.

25. PENALTY AND LIQUIDATED DAMAGES:

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

25.2 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 as per the clause defined in SCC.

26. SAFETY REGULATIONS:

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

26.2. The Contractor shall indemnify the Company from any consequence arising due to contractor's failure in respect to safety compliance.

26.3. First Aid facilities at easily accessible place shall be provided by the Contractor at his own cost as per provisions of Labor act or as advised by the Company wherever works are carried out.

26.4. All critical injuries shall be reported promptly to the Company. The report shall cover type, nature, cause, physician's report and actions for prevention of those types again.

26.5. To ensure effective enforcement of the rules and regulations relating to safety precautions, arrangements made by the Contractor shall be open to inspection by the Company.

26.6. The cost so incurred by the Contractor in providing for safety standards and requirements as above shall be deemed to be included in the rates quoted for various items under the scope of Contract and no extra amounts shall be payable to the contractor on this account.

26.7. The Contractor shall furnish to the Company within seven days from issue of LOI or Work Order whichever is earlier, for approval of Company, the proposed safety programme on how it intends to implement the safety procedures and precautions to ensure that the site is accident free.

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

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

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

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

27. WORKMEN COMPENSATION:

The Contactor shall take insurance policy under the Workman Compensation Act to cover such workers, who are not covered under ESI and PF by the Contractor however engaged to undertake the jobs covered under this order and a copy of this insurance policy will be given to Engineer-In-Charge. This insurance policy shall be kept valid at all times. In case there are no worker involve other than those who are covered under ESI and PF by the Contractor, the Contractor shall certify for the same. The Contactor shall keep the Company indemnified at all times, against all claims of compensation under the provisions 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 Contactor/sub-Contactor/sub-agent in carrying out the job involved under this order and against costs and expenses, if any, incurred by the Company in connection therewith and without prejudice to make any recovery. The Company shall be entitled to deduct any money due to or to become due to the Contractor, money paid or payable by way of compensation as aforesaid or cost or expenses in connection with any claims thereto and the Contactor shall abide by the decision of the Company as to the sum payable by the Contactor under the provisions of this clause.

28. BOCW ACT:

BOCW Act applies to every establishment which employs, or had employed on any day of the preceding twelve months, ten or more building workers in any building or other construction work.The Tenderer, for carrying out any construction work, must get themselves registered with the Registering Officer under Section 7 of the Building and Other Construction Workers Act, 1996
and rules made thereto by the concerned State Govt .and submit certificate of Registration, issued from the Registering Officer of the concerned State Govt. (Labour Dept.). As per this Act, the tenderer shall be levied a cess @1% of cost of construction work, which would be deducted from each bill. Cost of material, when supplied under a separate schedule item, shall be outside the purview of cess The Tender shall also comply with all provisions of the said Act applicable to him.

29. STATUTORY OBLIGATIONS:

The Contractor shall take all steps as may be necessary to comply with the various applicable laws/rules including the provisions of contract Labor (Regulation & Abolition Act) 1970 as amended, Minimum wages Act, 1984, Workman Compensation Act, ESI Act, PF Act, Bonus Act and all other applicable laws and rules framed there under including any statutory approval required from the Central/State Governments, Ministry of Labor. Broadly, the compliance shall be as detailed in ANNEXURE I enclosed.

Before issue of order it would be mandatory for the Contractor to furnish the Company the permanent PF code no, ESI registration, registration under W.C.T Act.

30. HUMAN RESOURCE ISSUES:

30.1 The CONTRACTOR would execute these works through their own resources.

30.2 The CONTRACTOR shall bear all expenses/cost to be incurred towards salary, allowances, perks, traveling allowances, advances, insurance, safety measures, security, transportation and all other misc. expenses etc. of their employees/ workmen during the tenure of AMC. Also, the CONTRACTOR shall be sole responsible for making payment for Out-patient department, Hospitalization, Compensation thereof in case of any accident, injury or death.

30.3 ID CARD: No contractor will issue any ID cards to their staff on their own .All ID Cards for the workforce will be issued by BYPL Security ID Card Cell only. Contractors should maintain the records of Identity Cards of their employees and whenever any employee quits / is removed then his/her Identity card should be collected & submitted to BYPL Security ID Card Cell. Penalty will be imposed on the vendor in case of violation of the above rule. Contractors shall submit the detail list of the employees that they are going to be hire to BYPL Security before start of the contract.

30.4 The CONTRACTOR to deploy their manpower immediately for carrying out the work as specified above.

30.5 The CONTRACTOR should ensure that there are no disputes regarding service, payment etc of the persons engaged by him, anytime during the currency of the contract. At no point of time during the currency of contract, the CONTRACTOR's employees shall insist upon the COMPANY for employment, wages, and allowances or any other related matter, payment etc.

30.6 The CONTRACTOR shall not deploy the manpower below the age of 18 years.

30.7 The CONTRACTOR shall not deploy the female manpower between 7 PM to 6 AM.

30.8 The CONTRACTOR shall be directly responsible for any / all disputes arising between him and his persons and keep the COMPANY indemnified against all losses, damages and claims arising thereof. The CONTRACTOR shall resolve any dispute of their manpower. All the legal dues of their manpower is to be paid on due date or within 8 days on the termination of manpower.

30.9 All safety wears required for the CONTRACTOR's manpower during the execution of work such as safety shoes, safety helmets, hand gloves, safety belt, goggles etc. must be provided by the CONTRACTOR at his own cost and he shall ensure that his employees regularly use such safety gears while executing COMPANY's work.

30.10 The CONTRACTOR shall be responsible for discipline of his manpower and shall adhere to the disciplinary procedure set by the COMPANY at site. The COMPANY shall be at liberty to object to the presence of any representative or employees of the CONTRACTOR at the site, if in the opinion of the COMPANY such manpower has done any act of misconduct or negligence or otherwise undesirable, then the CONTRACTOR shall remove such a person objected to and provide a competent replacement immediately.

30.11 The CONTRACTOR shall ensure that he has complied with the following:
- has paid minimum wages to his manpower as per the rate notified from time to time by the Government of National Capital Territory of Delhi.
- Contractor shall disburse the salary of his staff through ECS only.

30.12 Deduct and deposited ESI and PF contribution. Copies of the same shall be submitted.

30.13 The COMPANY reserves the right to demand the CONTRACTOR's services on holidays as well as beyond the normal working hours.The Engineer In-charge shall communicate in writing for any work required to be done during Holidays.

30.14 The CONTRACTOR will ensure that none of their person is engaged in any unlawful activities subversive of the COMPANY's interest failing which suitable action may be taken against the CONTRACTOR as per the terms and conditions of this tender.

30.15 The CONTRACTOR shall be liable for payment of all taxes and duties as applicable, to the State/ Central Govt. or any local authority.

30.16 The CONTRACTOR's employees shall not be treated as COMPANY's employees / persons for any purpose whatsoever & facilities/ benefits applicable to the COMPANY's employees shall not be applicable to CONTRACTOR's employees. If due to any reasons whatsoever the COMPANY is made liable to meet any obligation under any of the laws & enactment etc, for any reason whatsoever the same shall be recovered from the CONTRACTOR or from any of the bills payable to him or failing which it shall be recovered as per law.

30.17 The CONTRACTOR shall be responsible and shall comply with the provision of all the STATUTORY ACTS APPLICABLE. Special attention of the CONTRACTOR is drawn towards the compliance of provision of the following statutes: (along with the latest amendments/additions):

30.17.1 The Child Labour (Prohibition and Regulation) Act, 1986.
30.17.2 The Contract Labour (Regulation and Abolition) Act, 1970.
30.17.3 The Employee's Pension Scheme, 1995.
30.17.4 The Employee's Provident Funds and miscellaneous provisions Act, 1952. 30.17.5 The Employees State Insurance Act, 1948.
30.17.6 The Industrial Disputes Act, 1947.
30.17.7 The Maternity Benefit Act 1961.
30.17.8 The Minimum Wages Act, 1948.
30.17.9 The Payment of Bonus Act, 1965.
30.17.10 The Payment of Gratuity Act, 1972.
30.17.11 The payment of Wages Act, 1936.
30.17.12 The Delhi Shops & Establishment Act, 1954.
30.17.13 The Workmen's Compensation Act. 1923.
30.17.14 The Employer's Liability Act, 1938.

31. STAFF AND WORKMAN:

(I) It shall be responsibility of contractor

(a) To obtain Contract Labor License from the concerned authorities and maintain proper liaison with them. Necessary Forms for obtaining Labor License would be issued by the company. However you will bear all expenses for obtaining Labor 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 Labor Act. The records shall be in the prescribed formats only.

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

32. INSURANCE:

The Contractor at its own cost shall also arrange, secure and maintain the following insurance covers

33. THIRD PARTY INSURANCE:

Before commencing the execution of the work the Contractor shall insure against any damage or loss or injury which may occur to any property or to any person or any

employee or representative of any outside Agency/Company engaged or not engaged for the work of the

Company, by or arising out the execution of the work or temporary work or in carrying out of this work order.

34. INSURANCE OF MAN MATERIAL & MACHINERY DEPLOYED AT SITE:

Contractor shall be responsible for the insurance of all the Man , Material and Machinery deployed at site.

35. GROUP PERSONAL ACCIDENTAL INSURANCE POLICY FOR LIFE COVER:

Before commencing the execution of the work the CONTRACTOR shall take Accidental insurance policy for the staff engaged by him for this work to insure against any loss of life which may occur during the contract for the work of the COMPANY. The policy shall have coverage of Rs. 10 Lacs (Table C- Death + Permanent Total Disability + Partial permanent Disability due to external accidents). The premium amount for such policy shall be borne by the contractor. The contractor shall furnish copy of policy when demanded by BYPL.

The Contractor shall be responsible for on the spot same day claim settlement with the victim's legal heirs without waiting for settlement by insurance claim without any liability on BYPL.

36. PROGRESS REPORTS OF WORK EXECUTION:

During the various stages of manufacturing and erection of the critical equipments in the pursuance of the Contract, the Contractor shall at its own cost submit periodic progress reports as may be reasonably required by the Purchaser with such materials as charts, networks, photographs, test certificates, etc. Such progress reports shall be in the form and size as may be required by the Purchaser and shall be submitted in adequate number of copies to be notified by the Purchaser

The quantitative progress report of the works by reference to the project schedule in sufficient detail should permit the Purchaser to assess performance, plan witness dates and evaluate forecasts, including reports on key Sub-contracts (as applicable). Within 7 days of the submission of each such report and at such other times as the Purchaser may reasonably request, the Contractor and the Purchaser shall meet to discuss progress.. Weekly progress reports shall include the following sections:

a) Executive summary

b) Description of the work and services performed and goods and materials delivered and erected during the preceding week.

c) Necessary photographs of work done in the manufacturer's shop and erection site which shall be taken when and where indicated by the Purchaser. Photographs shall be approximately 100 x 127 mm in size including a margin of 5 mm side for fixing. Adequate numbers of photographs shall be submitted indicating various stages of manufacture and erection of critical items. Each photograph shall contain the date, the name of the Contractor and the title of the view taken.

d) Updated project schedule showing progress to the end of the week (as percentages completed of the Contractor's activities broken down into significant elements of the works), and the current schedule of activities and the targets for the next week.

e) Identification of areas with foreseeable problems which in the opinion of the contractor may affect the project schedule.

f) Such other information and supporting documentation as the Purchaser may require satisfying himself about the timely manufacture, delivery and erection of equipment as per contract.

The Purchaser shall advise the Contractor about the number of copies of progress reports and, where relevant, photographs he has to submit each week together with the names and addresses of persons to whom they are to be sent. Purchaser will also advise the contractor regarding the format of the Monthly Progress report.

37. ARBITRATION:

To the best of their ability, the parties hereto shall endeavor to resolve amicably between themselves all disputes arising in connection with this work order. If the same remain unresolved within thirty (30) days of the matter being raised by either party, either party may refer the dispute for 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 final and binding upon the parties. The arbitration proceeding shall be conducted in accordance with this provisions of the Indian Arbitration & Conciliation Act, 1996 and the venue of such arbitration shall be city of New Delhi only.

38. FORCE MAJEURE:

38.1 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 partys 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

38.2 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.

38.3 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.

38.4 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 majure 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 Majure with best estimates as to likely continuation and what measures or contingency planning it is taking to mitigate and or terminate the Event Of Force Majure.

38.5 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.

38.6 Terminations for certain events of force Majure: 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.

39. SECRECY CLAUSE:

The technical information, drawing and other related documents forming part of order and the information obtained during the course of execution under this order shall be the Company's exclusive property and shall not be used for any other purpose except for the execution of the 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 order. These 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 Contactor during the executions of this order, if any, immediately after they have been used for agreed purpose. In the event of any breach of this provision, the contractor shall indemnify the Company against any loss, cost or damage or claim by any party in respect of such breach.

40. PROTECTION OF PROPERTY:

The Contractor shall be responsible for any damage resulting from his operation. He shall also be responsible for protection of all persons including members of public; and employees of the PURCHASER & the PURCHASER; employees of the Contractors & Subcontractors; and all public and private property including structures, buildings, other plants and equipment and utilities either above or below the ground.

The Contractor shall ensure provision of necessary safety equipment such as barriers, sign boards, warning lights and alarms, etc to provide adequate protection to persons and property. The Contractor shall be responsible to give reasonable notice to the PURCHASER & the PURCHASER of public or private property and utilities when such property and utilities are likely to get damaged or injured during the performance of his works and shall make all necessary arrangements with such PURCHASER, related to removal and/or replacement or protection of such property and utilities.

41. VARIATIONS / AMENDMENTS:

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

42. FREE ISSUES OF MATERIAL AND/OR EQUIPMENT:

The Purchaser issued Free Issue Material/Equipment to Vendor in order that Vendor may fulfill its obligations under the Agreement, shall remain the property of Purchaser and shall be clearly labelled as such by Vendor until delivery of the completed Goods in accordance with the terms of the Agreement. Risk of loss in respect of all such Free Issue Items shall pass to Vendor upon receipt of such items by Vendor and remain with Vendor until delivery of the completed Goods to Purchaser in accordance with the terms of the Agreement. Vendor shall maintain all such Free Issue Items in good condition and shall use them solely in connection with the requirements of the Agreement. Disposal of surplus items shall be in accordance with written instructions from Purchaser. The vendor shall submit an Indemnity Bond to this effect, as per the format.

43. TERMINATION DUE TO NON PERFORMANCE:

"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.

44. TERMINATION BY EMPLOYER CONVENIENCE:

The owner at any time terminate the contract for any reason, by giving the contractor a notice of termination. Upon receipt of the notice of termination, the contractor shall either within 14 days of receipt of such notice, or on the date specified in the notice of termination, carry out the following : Cease all further work, except for such work as the owner may specify in the notice of termination for the sole purpose of protecting that part of the facilities already executed, or any work required to leave the site in a clean and safe condition.

• Terminate all subcontracts, except as mentioned below.

• Remove all Contractor's equipment from the site, repatriate the contractor's and its sub-contractor's personnel from the site, remove from the site any wreckage, rubbish and debris of any kind, and leave the whole of the site in a clean and safe condition.

• Deliver to the owner the parts of the facilities executed by the contractor up to date of termination.

• To the extent legally possible, assign to the owner all right , tile and benefit of the contractor to the facilities and to the plant and equipment as at the date of termination, and as may be required by the owner, in any subcontracts concluded between the contractor and its sub-contractors.

• Deliver to the owner all non-proprietary drawings, specifications and other documents prepared by the contractor or its sub-contractors as at date of termination in connection with the facilities. In the event of termination of the contract by the owner, under this clause, the owner shall pay to the contractor the following amounts after setting off the owner's claim if any under the contract:

a) The contract price, properly attributable to the parts of the facilities executed by the contractor as of the date of termination.
b) The costs reasonably incurred by the contractor in the removal of the contractor's equipment from the site and in the repatriation of the contractor's and its sub contractors personnel.
c) Pre- approved and reasonable cost of satisfying all other obligations, commitments and claims that the contractor may in good faith have undertaken with third parties in connection with the contract and that are not covered above.

45. ACCEPTANCE:

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

However, during the course of the execution of the work order, if at any time the Company's representative observe and form an opinion that the work under the work order is not being performed in accordance with the terms of this work order, the company reserves its right to cancel this work order forthwith without assigning any reason and the Company will recover all damages including losses occurred due to loss of time from the Contractor.
We request you to please sign the duplicate copy of this work order as a token of your acceptance and return to us.

BSES Yamuna Power Limited

Annexure - I

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

a) An Electrical license. (If applicable)
b) PF Code No. and all employees to have PF A/c No. under PF every Act, 1952.
c) All employees to have a temporary or permanent ESI Card as per ESI Act.
d) ESI Registration No. e) PAN No.
f) Work Contract Tax/VAT Registration Number.
g) Labor License under Contract Labor Act (R & A) Act 1970(All Engineer-in-charge responsible for execution of the job should obtain a copy of Labor License as per guidelines of HR department before start of the work by the contractor.)

The Contractor must follow:

a) Third party Insurance Policy before start of work.

b) To follow Minimum Wages A ct prevailing in the state.

c) Salary/ Wages to be distributed in presence of Company's representative not later than 7th of each month.

d) To maintain Wage- cum - Attendance Register.

e) To maintain First Aid Box at Site.

f) Latest P.F. and E.S.I. challans pertaining to the period in which work was undertaken along with a certificate mentioning that P.F. and E.S.I. applicable to all the employees has been deducted and deposited with the Authorities within the time limits specified under the respective Acts.

g) Workman Compensation Policy. (If applicable)

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

i) Group personnel accident insurance shall have coverage of Rs. 10 Lacs (Table C-Death + Permanent Total Disability + Partial permanent Disability due to external accidents).

BSES Yamuna Power Limited

Annexure – II

ON THE LETTER HEAD OF THE CIVIL CONTRACTOR

QUARTERLY COMPLIANCE CERTIFICATE

I,_____(Name of Proprietor/Partner/Director with DIN number) of _____ (Firm/Company Name) duly certify that the Firm/Company has duly complied with all the applicable Central & State Acts, Rules, Regulations, Orders, Guidelines and any statutory modification or re-enactment thereof for the time being in force ("the Applicable Laws) for the quarter ended _____ including but not limited to:

Sr. No.	Particulars*
1	The Companies Act, 2013 and rules thereof;
2	Workmen's Compensation Act, 1923 and rules thereof;
3	Contract Labour (Regulation and Abolition) Act, 1970
4	Delhi Contract Labour (Regulation and Abolition) Rules, 1972
5	Employees' Compensation Act, 1923 and rules thereof;
6	The Delhi Shops and Establishments Act, 1954 and rules thereof;
7	The Employees' Provident Funds And Miscellaneous Provisions Act, 1952 and rules thereof;
8	Equal Remuneration Act, 1976 and rules thereof;
9	Minimum Wages Act, 1948 and rules thereof;
10	Maternity Benefits Act, 1961 and rules thereof;
11	Building and Other Construction Workers (Regulation of Employment And Conditions of Service) Act, 1996 and Delhi Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Rules, 2002
12	Employees' State Insurance Act, 1948 and rules thereof;
13	The Payment of Gratuity Act, 1972 and rules thereof;
14	Equal Remuneration Act, 1976 and rules thereof;
15	The Payment of Bonus Act, 1965 and rules thereof;
16	Delhi Labour Welfare Fund Act and rules thereof; *strikeout whichever is not applicable

Further, it is certified that a system has been devised to ensure compliance with the provisions of all applicable laws & that system is adequate & operating effectively.

DECLARATION:
This is to declare that I, the undersigned am responsible to ensure that all the compliances of the Applicable Laws, has been done within the timeframe as given under the respective Acts.
Signature:
Name:
Employee ID:
Designation:
Department:
Date:
Place:New Delhi

BSES Yamuna Power Limited

CONTRACT HEALTH AND SAFETY PLAN

1 OBJECTIVE

The objective of the Contractor Health and Safety plan is to lay down clear guidelines for all Vendors / contractors and manpower agencies (including their associates, staff and agents) which would facilitate them to observe all statutory and regulatory rules and regulations, comply with applicable standards of Central Electricity Authority (Measures relating to safety and electric supply) Regulations, 2010 & (safety requirements for construction, operation and maintenance of electrical plants and electric lines) Regulations,2011, BYPL EHS policy, Safety Manual Guidelines, and SOPs and thus, ensure creation of safe working environment for all stakeholders of our network.

2 SCOPE

It is applicable to all contracts, work orders of any kind and cost will be subjected to the provisions of this document.

Small Contracts: Contracts which satisfy all the criteria listed under the head "Small Contracts".

Major Contracts: Contracts which satisfy any two or more criteria listed under the head "Major Contracts"

Criteria	Small Contracts	Major Contracts
Value of Contract	< Rs. 20,000,00/- (less than Rs. Twenty Lac)	>= Rs. 20,000,00/- (Equal or more than Rs. Twenty Lac)
Period	Period less than 1 year	Any period
Working on energized electrical equipment	No	Yes
Working on height (above 1.8 Mtrs from ground)	No	Yes
Work involving construction activity	No	Yes
Working with hazardous goods or chemicals	No	Yes
Work involving danger to general public	No	Yes

Exclusions: Exceptions for major and small contract are – in house software development, supply of material or equipment but no direct or indirect installation of the same material, administration contracts (courier, water supply, printing, security, transport, etc.). The facility management (housekeeping) contract will always be treated as a small contract.

3 GENERAL SAFETY CONDITIONS

For small contracts, the contractor shall assign the duties of Safety Representative to the Work Supervisor. Work Supervisor will deliver all duties and responsibilities of Safety Supervisor as detailed in this document.

For Major contracts, the contractor will appoint Safety supervisor, engineer / manager for the works in BYPL. The Contractor shall make all necessary arrangements for getting their workforce safety trained and competency checked from the safety team of BYPL before deployment in the field.

Safety Representative of Contractor will formally become the nodal point for safety concerns for BYPL. Contractor shall not frequently transfer or terminate the services of any of the safety representatives appointed for BYPL work site**.** Contractor will be required to provide all applicable infrastructure and power to ensure smooth working of the safety representative to maintain a sound safety management system. In the major contracts safety representative will not be assigned any other activity at site apart from the works related to safety management.

The Safety Representative of the Contractor shall be required to meet and follow the instructions of the Engineer In-charge and EHS team of BYPL. He shall be responsible for providing the MIS and/or any other relevant information, as and when desired, within the stipulated time frame as per the requirements of BYPL. Any non-conformance to safety will lead to the negative marking or issue of safety violation challan/ tokens which shall affect the monthly evaluation and performance of Contractor.
All contracts where Contractor has to depute vehicle for their staff and equipment to move from one location to other, the Contractor shall ensure that vehicle complies all required statutory clearances and requirement as per The Motor Vehicle Act, 1988 and are in good & safe state of working.

The Contractor shall display the name of the Safety representative at all its sites including zonal and divisional office.

4 QUALIFICATION AND EXPERIENCE OF THE SAFETY PERSONAL

Qualification and experience required for the safety and site personnel are as following:

Safety Supervisor: It is mandatory that educational qualification of safety supervisor be ITI (electrician trade) / Diploma (Any branch of engineering) and he has a working experience on electrical system / network of at least 5 yrs for ITI and 3 years for Diploma holder. Having formal experience of the safety systems will be an added advantage

Safety Engineer: It is mandatory that educational qualification of safety engineer be at least diploma (electrical) and he has working experience on electrical system of at least 3 yrs. Having the formal experience of the safety systems will be an added advantage.

Safety Manager: The educational qualification of safety manager should be graduate engineer with working experience on electrical system / network of at least 3 yrs. OR
Diploma in Industrial Safety with working experience of 05 years including at least 02 years on electrical network.

Site Skilled Personnel: For all responsibility related to site activities and operations, the BA shall employ only qualified and skilled persons and shall comply the provisions of section 19 & 29 of Central Electricity Authority (Measures relating to safety and electric supply) Regulations, 2010. Persons holding valid approvals only by any Government approved agency or a competency assessment panel or a team set up by TPDDL shall be allowed to perform the High Risk / High Hazard activities (refer page 1). The skill / qualification required for the electrician and electrical supervisor are given in annexure 5. The contracts related to maintenance of Distribution Network, Distribution Projects, EHV Projects, maintenance of Sub-Transmission Network, MMG & EAG, maintenance and operation of street lights, shall preferably have at least 20 per cent of ITI qualified electricians in the first year of the contract. This figure shall preferably be incremented by 15 per cent every subsequent year.

5 Requirements from the Safety Representative(s)

Safety training of 4hrs/employee/month and one day of safety induction training to all new employees.

- Safety Talk / tool box talk before start of shift to all his workmen
- Ensuring the availability & proper usage of the safety equipment (PPE)
- Periodic inspection of PPE to ensure their serviceability
- Ensuring the adherence to standard operating procedures of BYPL
- Safety inspections / audits as per the process of BYPL
- Working in close coordination EHS department of BYPL
- Reporting of unsafe acts, unsafe conditions, near miss, incident or accident to Engineer In-Charge and EHS department of BYPL immediately after its occurrence.

Ensuring compliance with safety and other laws as may be applicable and providing for safety assurance.

6 Safety Induction Training

The Contractor shall not deploy any person at work place / site without Safety Induction Training. It is desired that Safety representative of the Contractor to impart the general safety training to each employee of duration 4 hrs per month. The training will be organized at Contractor level and the record to be sent to engineer in-charge and EHS department of BYPL every month.

7 List of Personal Protective Equipment (PPE) and Maintenance schedule

Contractor shall commence the project or any work only when the required PPE are made available to the team of employees involved in the work. Each PPE of Contractor shall be checked / inspected by the safety representative / supervisor at zone before the work start or as prescribed in the list. Safety representative shall regularly check the healthiness of each PPE allocated to lineman. Suitable record shall be maintained at zone. Defective PPE shall be immediately replaced or within 24 hours by the Contractor. In no case linemen or any other official of Contractor may be allowed to work with defective PPE. It is preferred that Contractor ensures minimum stock of each PPE for immediate replacement with defective one.

The PPE shall be IS / BS / CE marked and exactly as per the standard or specification mentioned in the *annexure 1*. Working without PPE / non-standard PPE shall be treated as safety violation and penalty as stated in section 12 of this document. If BYPL finds that Contractor has not provided the adequate / appropriate PPE to their staff, BYPL may provide the PPE to Contractor at the risk and actual cost of the PPE. Amount as decided by the management shall be charged to Contractor and same shall be first recovered from the current bill of Contractor or any future payment to be made to Contractor. In the event of any balance amount still left for recovery, the same shall be adjusted against retention amount or by invoking bank guarantee submitted by Contractor.

8 Integrated Management System & Audits

The Contractor shall work in the framework of Integrated Management System (IMS) and shall maintain documentation as prescribed in the IMS Manual of BYPL.
All contractors during their currency of contract shall strive to continuously improve and demonstrate strict compliance to ISO 9001, ISO 14001 & OHSAS 18001 standards of BYPL.
To verify compliance and to continually improve the management system, all contractors shall be subjected to both internal & external audits.

8.1 HIRA

The safety representative will be required to conduct the HIRA (Hazard Identification and Risk Assessment) of the process and work undertaken at least once in a year or every time if a new process / activity / machine is introduced or whenever an accident take place. The risk identified to be addressed suitably with –

Engineering Control
Administrative Control, and
Personal Protective Equipment.

The safety representative of Contractor shall inform and educate for the identified risk and hazard control methods to employees, supervisor and engineer as well as the engineer in-charge and EHS department of BYPL.

8.2 Working at Height

The Contractor shall ensure that all works carried out at a height of 2 Meter or more shall only be started after obtaining a permit to work at height, which shall be issued as per the procedure of BYPL by authorized personnel.
The contractor shall ensure that all control measures mentioned and agreed through above work permit or as deemed necessary by BYPL are enforced and complied all the time during activities carried out at height.

9 Safety Performance and Safety MIS

The Contractor shall maintain good practice of safety all through the contract duration. Safety shall always be of paramount importance during the contract period. Safety performance will be monitored throughout the period and no relaxation will be given for bad performance. Contractor with good track record and excellent performance will be rewarded suitably. The Contractor has to provide monthly "Performance Report – Safety" to engineer in-charge and EHS department of BYPL this shall be part of monthly bill along with training details. Performa of the report is enclosed as *annexure 2 to 5*.

10 Pre – Employment Medical Check-up and Fitness of employees engaged for the critical works

The contractor shall arrange a medical examination of all his employees including his sub-contractor employees like lineman, ALM, supervisor, Fitter, welders, gas cutters, drivers, workers supposed to work at height (and any other trade specified deemed necessary by BYPL at the time of deployment then annually) before employing, after illness or injury, if it appears that the illness or injury might have affected his fitness and, thereafter, once in every year as per the provisions of applicable laws or as prescribed by BYPL with proper record.

The Contractor shall submit the health fitness certificate for all those workers involved in climbing the pole or working at height for following diseases:

- Epilepsy
- Colour blindness
- Deafness

- Vertigo & height phobia

Every year Contractor will give an undertaking stating that all the employees are fit to work and have not developed aforesaid diseases.

Records of medical examination as described above shall be maintained at the contractor premises and shall be promptly produced as and when demanded by BYPL.
No person about whom the Contractor knows or has reason to believe that he is a deaf or he has a defective vision or he has a tendency to giddiness shall be required or allowed to work in any O&M operation or other construction work which is likely to involve a risk of any accident either to the worker himself or to any other person.

11 Suspension of Work

BYPL shall have the right at its sole discretion to suspend the work till compliance of safety norms, if in its opinion the work is being carried out in such a way that it may cause accidents and endanger the safety of the persons and / or property, and / or equipments.
In such cases, the contractor shall be informed in writing about the nature of hazards and possible injury /accident and he shall comply to remove all shortcomings promptly. Decision of BYPL shall be conclusive and binding on the Contractor in such aspects.
The contractor shall not be entitled to damages / compensation for suspending of work due to safety reasons and the period of such stoppage of work will not be taken as an extension of time for completion of the facilities as per the work order and will not be the ground for wavier of levy of liquidated damages.
The contractor shall follow and comply with all safety Rules of BYPL, relevant provisions of applicable laws pertaining to the safety of workmen, employees plant and equipment as may be prescribed from time to time without any demur, protest or contest or reservation. In case of any inconformity between statutory requirement and safety rules of the BYPL referred above, the latter shall be binding on the contractor unless the statutory provisions are more stringent.

12 Penalty matrix for safety violations

Consequence Of Safety Violation Observed (Not related to incident / accident)		**Violation**					
Sl No	**Safety Violations**	**1st**	**2nd**	**3rd**	**4th**	**Subsequent violations**	**Action required**
1	Working without PPE	**A**	**A**	**B**	**B**	Will attract same penalty as applicable in 4th violation	Take risk reduction measure
2	Working without proper tools and tackles	**A**	**B**	**B**	**C**		
3	Working without creation of proper safety zone	**B**	**B**	**C**	**D**		
4	Improper supervision at worksite	**B**	**C**	**D**	**E**		
5	Working without PTW process	**C**	**D**	**E**			Intolerable
Legand	**Action to be taken**	**Responsibility**		**Penalty Amount in Rs**		The number violations are to be calculated cummulative on the	

A	Warning Letter	Engineer incharge	NIL	contract period or on the annual basis (which ever is less).
B	Levy of penalty	Engineer incharge	INR 2,000	
C	Memo to Contactor and levy of penalty	Circle Head	INR 4,000	
D	Momo to contractor and leavy of penalty	Head of Department	INR 10,000	
E	Memo to Contactor, levy of penalty and termination of contract	Head of Department	INR 100,000	

Fig 12(1) – Penalty Matrix for safety violation

The above figure (12 (1)) is the matrix of safety violation and the penal action to be taken against the contractor. Once the contractor reaches the "BLACK" (color – "5") category, i.e. highest level of safety violation, "Termination" notice to contractor will be issued from the office of the Head of Department (equivalent to AVP/ VP) and further, *if required,* continuation / extension of contract will only be initiated by Functional Head of the department (equivalent to VP/Sr VP level) and approved by CEO. Till the extension, the contract will remain suspended.

Safety violations resulting in incident / accident will be treated as per gravity of the injury / fatality and its impact as well as type i.e. minor or Major. Consequences of incident / accident are shown in the matrix (figure 12(2) for major and 12(3) for small) below. In case of any accident, findings and recommendations of Accident Enquiry Committee will be final and binding and will supersede the arbitration clause of GCC.

BSES Yamuna Power Limited

Consequence of an Incident/Accident (in case of MAJOR contract)		Incident/Accident				
Sl No	**Safety Violations**	**1st**	**2nd**	**3rd**	**4th**	**Action required**
1	Slight injury (First Aid Case)	**F** (STRENTHENING OF PROCESS)				
2	Moinor injury (No or Hospitilization less then 48 Hrs)	**F**	**G**	**G**	**H**	Take risk reduction measure
3	Major injury (Bone injury or burn or Hospitalization more than 48 hrs)	**G**	**G**	**H**	**I**	
4	Single Fatality	**J**	**K**			
5	Multiple fatalities (Two or more fatalities during one event)	**K**				Intolorable

Legand	**Action to be taken**	**Responsibility**	**Penalty Amount in Rs**	
F	Issue memo and levy of penalty	Engineer incharge	INR 5,000	The number violations are to be calculated cumnulative on the contract period or on the anual basis (which ever is less).
G	Issue memo and levy of penalty	Engineer incharge	INR 20,000	
H	Issue memo and levy of penalty	Circle Head	INR 50,000	
I	Issue memo and levy of penalty	Head of Department	INR 200,000	
J	Issue memo and levy of penalty	Head of Department	INR 500,000	
K	Issue memo, levy of penalty, termination of contract and black listing of contractor	Function Head	INR 1,000,000	

Fig 12(2) – Penalty Matrix for Incident/Accident in Major Contracts

Consequence of an Incident/Accident (in case of SMALL contract)		Incident/Accident				
Sl No	**Safety Violations**	**1st**	**2nd**	**3rd**	**4th**	**Action required**
1	Slight injury (First Aid Case)	**L** (STRENTHENING OF PROCESS)				
2	Moinor injury (No or Hospitilization less then 48 Hrs)	**L**	**M**	**M**	**N**	Take risk reduction measure
3	Major injury (Bone injury or burn or Hospitalization more than 48 hrs)	**M**	**M**	**N**	**O**	
4	Single Fatality	**P**	**Q**			
5	Multiple fatalities (Two or more fatalities during one event)	**Q**				Intolorable

Legand	**Action to be taken**	**Responsibility**	**Penalty Amount in Rs**	
L	Issue memo and levy of penalty	Engineer incharge	INR 5,000	The number violations are to be calculated cumnulative on the contract period or on the anual basis
M	Issue memo and levy of penalty	Engineer incharge	INR 10,000	
N	Issue memo and levy of penalty	Circle Head	INR 25,000	
O	Issue memo and levy of penalty	Head of Department	INR 100,000	

P	Issue memo and levy of penalty	Head of Department	INR 200,000	(whichever is less).
Q	Issue memo, levy of penalty, termination of contract and black listing of contractor	Function Head	INR 5,00,000	

Fig 12(3) – Penalty Matrix for Incident/Accident in small Contracts

In case of single or multiple fatalities described under legends J&K of fig 12(2) and P&Q of fig 12(3), the concerned contractor may be debarred from extension of contract or participate in new contract. In such event the approval of functional Head will be necessary for extension or award of new contract to concerned contractor.

ANNEXURE-I

Specification for Personal Protective Equipment

Safety Shoes – With Composite/Fiber toes (CE approved / IS 15298) – Mandatory for all personnel working at BYPL O&M. The safety shoes shall meet the following features:

1. Electric Shock Resistant Sole
2. Impact Resistant
3. Scrap/Heat Resistant
4. Slip Resistant
5. Oil and Acid Resistant

Lead MAKE: BATA/LIBERTY/Honeywell

Safety Helmets: (IS 2925 - 1984 or DGMS) with chin strap – Mandatory for all personnel working at BYPL O&M. The specification of safety helmet shall be as given below:

HDPE Yellow With 4 Point Fast Trac Ratchet Suspension

Shell Material	UV stabilise HDPE, Non vented
Suspension	• With 4 Point Fas Trac Ratchet Suspension sewn headband • Textile straps made from polyester Suspension • point fixing: good positioning, ...stability, better air circulation due to ...limited contact areas with the head • Easy clean sweatband
Size	52-62 cm
Accessory slot	Standard 30 mm with removable HDPE dead plugs suitable to leak proof fitting
Approvals	ANSI/ IEC Z89.1 Class E (electrical)
Additional	Low temperature -10°C (acc. to GB2811), High temperature +50°C

Colours	Yellow
weight	360 g

Lead MAKE: 3M / KARAM/Honeywell

Full Body positioning Harness: (CE approved / IS 3521 / EN 361 / EN 355) – Shall be used while work is in progress at height more than 1.8 meter or where from a person may fall and get injured. The specification of the Full body harness shall be as given below:

Anchorage	Adjustable two chest attachment D-rings and A dorsal attachment D-ring
Adaptability	Adjustable shoulder and thigh straps
Convenience	Shoulder and thigh straps differentiated by a dual colour scheme.
Ergonomics	Idealy. Positioned sit strap for extended comfort.
Size	Standard
weight	1200GMS
ENERGY ABSORBING FORKED LANYARDS :	
Spec.	44mm wide polyamide webbing.
Length	1.5 Meter

Lead MAKE: KARAM /LIFEGEAR

Safety Spectacles

Shall be used to protect workers eyes from foreign materials and flying particles. Mandatory for all personnel working at BYPL O&M. Safety goggles shall meet the following feature

1. Poly carbonate/ Acetate lens for special applications requiring superior chemical resistance.
2. Industrial version of tough and popular first responder goggles.
3. SoftFlex low profile frosted frame for increased comfort.
4. Comfortable headband with length adjustment.
5. Indirect venting for comfortable, long lasting wear can be worn with safety helmets and over prescription spactacles.
6. Sightgard + premium anti-fog coating (EN 166 "N") with good anti- scratch properties.

Technical Specification:

Weight	95g.
Lens thickness	1.0mm
Overall width	173mm
Overall length	90mm
Bridge	47.6mm
Lens base	5.5 curve
Lens size	86.1mm verticle, 174mm diagonal
Headband	Adjustable length at max.440mm(long enough to fit together with helmets)
Material & colours	
Lens	Acetate clear, coating, Sightgard + anti-fog according to EN 166 "N" & anti scratch.
Body	PVC smoke
Headband holder	Nylone
Headband	Adustable grey elastic fixed on frame side parts
Marking / Approvals	
Standard number	EN 166
Frame marking	MSA EN 166 34-FT CE
Lens marking	2C-1.2 MSA 1 FT N CE
Filter class	2C (Ultra violet radiation with enhanced colour recognition)
Scale number	1.2: luminous trasmittance-89%
Optical class	1 (best class, for permanent wear)
Mechanical resistance	F (low energy impact 45m/s) T (at extreme temperature -5 to $+55^0$ C)
Resistance to	N(distorted vision due to lens fogging)
UV filter	99.9%
Ordering information	10145578-FlexiChem Sightgard + clear , 6x

Lead MAKE: MSA / UVEX/ 3M

Electrical Insulating Hand Gloves – Shall be used to prevent electric shock based upon the hazards/risks involved in a particular activity. Safety goggles shall meet the following feature

Breakthrough manufacturing process delivers exception dry grip.
Soft and flexible for enhanced tactility, high dexterity and wearer comfort.
Ergonomic design featuring tapered fingers to reduce hand fatigue.
Relaxed wrist for easy on/off.

Length	360mm
Class	2
Thickness	3.6mm
Proof test voltage	20000
Maximum use voltage	11000
Tensile strength	>16mpa[Mega Pascal]
Puncture resistance	>18N/mm [Newton per mili meter]
Elongation at break	>600% [Stretching length]
Tension set	<15%

It should be resist to oil, acid, ultra violet rays and very low temperature.

Each pair of glove should be marked with class, category, month & year of manufacturing, CE logo, batch no. and certified laboratory no.
EN certified to electrical and thermal hazards,
EN certified to thermal & electrical hazards to confirm EN 60-903,
EN certified to mechanical hazard to EN-388

Lead MAKE: Honeywell / ANSELL

CERTIFICATES REQUIRED:

1. Manufacturer Certificate
2. Test Certificate
3. Authorization of Dealership/Distributionship

Reflective Safety Jacket – Class -2 Safety Vest mandatory for all personnel working at BYPL O&M. Shall be used by the worker during the work.

Warning Tapes – HDPE or LDPE Made of 50 micron thick, non adhesive, width 75mm –Safety Logo embossed at every foot with white and red strips on both sides in Tubular form – Shall be used for barricading area around excavated pit to warn the personnel not to enter in such areas.

Road barricading cone with barricading tape – Shall be used by the worker during the operation / maintenance work.

Arc Protection Suit - shall be used by the worker for all HT/ EHV related works.

BSES Yamuna Power Limited

Annexure #2

BSES YAMUNA POWER LIMITED
(Name of Site)

Safety Appreciation / Violation Memo

DIVISION/Area: ---------- Date & Time: ----------

Name of Contractor: ---------- Activity: ----------

Name of Division Head: ----------

Appreciation/Penalty Memo#:

S.N	Safety Violation Details	Class (A/B/C/D/E)	No. of Violations	Penalty per Violation (Rs)	Penalty Amount (Rs)	Remarks
1						
2						
3						
4						
5						

Safety Appreciation/Violation Note:

Recommended By: Name: ---------- Designation: ----------

Sign/Date: ----------

Approved By (Division Head): Name: ---------- Designation: ----------
Sign/Date: ----------

BSES Yamuna Power Limited

Annexure #3

BSES YAMUNA POWER LIMITED
(Name of Site)

Monthly Status of PPE's / Tool Kit

Location/Area: ----------

Date & Time: ----------

Name of Contractor: ----------

No. AMC Employee:
Lineman:
ALM:

Status of PPE's

S.N	Name of PPEs / Tool	No. Of PPEs	Condition	Remarks
1	Safety Helmet			
2	Safety Goggle			
3	Electrical Insulating Hand gloves			
4	Full Body Harness			
5	Safety Shoes			
6	Reflective Jacket			

Signature / Date …….

BSES Yamuna Power Limited

Annexure #4

BSES YAMUNA POWER LIMITED
(Name of Site)

Monthly Status - Accident / Incident

Location/Area: ---------- Date & Time: ----------

Name of Contractor: ----------

Table – 1: Summary of Accident /Incident / Near Miss / Dangerous Occurences / First Aid:

S.N	Type of Accident /Incident / Near Miss / Dangerous Occurences / First Aid	Person Injured	Brief Discription
1			
2			
3			
4			
5			

Table – 2: Learning from Incidents:

S.N	Brief Discription	Root Cause	Recommendation
1			
2			
3			
4			
5			

Table – 3: Summary of Person Injured:

BSES Yamuna Power Limited

S.N	Name of Employee	Emp. ID / Designation	Type of Injury	Duration of Medical Rest	
				From	To
1					
2					
3					
4					
5					

Table -4 : Safety Inspections / Violation

S. No.	Date	Location	Discrepancies	Compliance
1				
2				
3				
4				
5				

Table - 5 : Health & Safety Complaints & Sugesstions :

S. No.	Date	Location	Complaints / Sugestion
1			
2			
3			
4			
5			

Measures to avoid recourrences for all above mentioned discrepancies (Attach relevant documents if required)

_____

_____

_____

_____

Signature / Date …….

BSES Yamuna Power Limited

Annexure #5

BSES YAMUNA POWER LIMITED
(Name of Site)

Format - PPE's Receipt by workers

Division:

Name of Contractor:

S. NO.	**NAME**	**DESI.**	Safety Helmet	Electrical Insulating Hand gloves	Full Body Harness	Safety Shoes	Safety Goggle	Reflective Jacket	SIGNATURE

Signature of Contractor / Date…….

BSES Yamuna Power Limited

APPENDIX II

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

FORMAT OF ADVANCE BANK GUARANTEE

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 Suppliers", 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 of the services on the terms and conditions as more particularly detailed therein.

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

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

5. NOW THEREFORE, in consideration inter alia of the 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.

6. The decision of the Owner as to whether the Supplier has fulfilled its obligation or not towards set-off of Advance Payment extended by the Owner to the Supplier shall be final and binding on the Bank and the Supplier. 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.

7. 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.

8. 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.

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

10. 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

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.

11. This Guarantee 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.

12. 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 obligations of the Suppliers under the Contract.

13. NOTWITHSTANDING anything herein above contained, the liability of the BANK under this Guarantee shall be restricted to _____*(insert an amount equal to 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.

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

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

16. 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.

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

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

FORMAT OF PERFORMANCE BANK GUARANTEE

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.

BSES Yamuna Power Limited

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

BENEFICIARY'S BANK DETAIL WITH IFSC CODE:

1. Name of the Bank:	Axis Bank Limited
2. Branch Name & Full Address:	C-58, Basement & Ground Floor, Preet Vihar, Main Vikas Marg, New Delhi 110092
3. Branch Code:	055
4. Bank Account No:	911020005246567
5. IFSC Code:	UTIB0000055
6. Swift Code:	AXISINBB055

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

FORMAT OF WARRANTY / DEFECT LIABILITY PERIOD –SERVICE

Performance requirements of the works completed is as per detailed specifications and standards specified and to be adhered to strictly. In-case of deficiency, the same is to be rectified / redone to meet the specifications by the contractor within stipulated schedule or any extension thereof. The Contractor shall be liable to rectify all defects except those arising out of normal wear and tear, in the works done by the Contractor under this contract, or from any act or omission of the contractors for a period of 24 months will depend on individual contract period package to package from the date of Handing over the works to the Employer / Owner.

Vendors Name & Signature

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

PRICE BID FORMATS (SUPPLY & SERVICES)

BSES Yamuna Power Limited

GRAND SUMMARY OF THE QUOTED PACKAGE(S)

ALL PRICES IN INR (₹)

Package Name/Description	Supply Prices-Landed (A)	Erection, Testing and commissioning prices - Landed (B)	Civil - Landed (C)
TURNKEY PACKAGE FOR CONVERSION OF 33 KV SYSTEM AT GT ROAD GRID FROM OUTDOOR AIS TO INDOOR GIS WITH DOUBLE BUS BAR SYSTEM, AUGMENTATION OF 1 NO 33/11 kV POWER TRANSFORMER FROM 16 TO 31.5 MVA AND INSTALLATION OF 3 NOS 11KV SWITCHBOARD ALONG WITH ASSOCIATED CIVIL WORKS			
Grand Total [A+B+C]			
Grand Total (In words)			

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

Date: Bidders Name:

Place: Bidders Address:

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

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

Note:

1) All prices for the packages quoted are inclusive of taxes and duties, GST and freight etc. Bidder shall include & indicate any others taxes under the applicable law(s) for supply and services to be performed in the purchaser's country.

2) Bidder shall include & indicate any others taxes under the applicable law(s) for supply and services to be performed in the purchaser's country.

3) The bidder shall, at its own, handle all imported equipment's and handle all formalities for custom clearances, port charges, etc if any

4) All prices for the packages quoted are against the scope of work under the contract shall be executed strictly as per the NIT conditions and the technical specification.

5) Quoted prices shall be as per the Bill of quantities (BOQ) as attached. However Any items/material/machinery, not specifically mentioned In BOQ as well as in the technical specifications but required for successful completeness, Erection, Testing and Commissioning of the package awarded shall be deemed to be in the scope of the bidder.

6) Insurance as per the clause defined in SCC and other contract conditions, is included in the quoted prices. However Bidder shall indicate the value of the insurance taken, separately.

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

BSES Yamuna Power Limited

PRICE FORMAT – SUPPLY (A) (Kindly refer detailed package wise SCOPE OF SUPPLY attached as Volume II for Indicative Description of Goods/BOM, BOQ)

S. No.	DESCRIPTION OF GOODS	HSN CODE (8 Digit Mandatory)	UoM	QTY **(A)**	UNIT BASIC PRICE (₹) **(B)**	UNIT GST & CESS AS APPLICABLE (CGST & SGST/UTGST or IGST) (₹) **(C)**		UNIT LANDED COST (₹) **(D = B+C)**	TOTAL LANDED COST (₹) **(E = DXA)**
						%	AMT		
	33 kV GIS with Double Bus Bar Arrangement as per SLD Attached								
1	Incomer Feeder Panel with Line PT		Nos	4					
2	Transformer Feeder Panel		Nos	3					
3	Bus Coupler		Nos	1					
4	Bus PT		Nos	2					
5	31.5 MVA, 33 kV/11 kV Power Transformer		Nos	1					
	11 kV Switchboard								
6	Incoming panel (with Line PT)		Nos	3					
7	Adaptor Panel for Bus Coupling Through Cables		Nos	2					
8	Bus Coupler Panel		Nos	2					
9	Bus Riser Cum Bus PT Panel		Nos	2					
10	Bus PT Panel		Nos	1					
11	Capacitor Panel		Nos	3					
12	Outgoing Panel		Nos	24					
13	Station Transformer Panel		Nos	2					
14	Earthing Truck for Bus bar Side Earthing		Nos	2					
15	Earthing Truck for Cable Side Earthing		Nos	2					
	End Termination Kits								
16	GIS termination kit for 33kV, 3C X 400sqmm cable		Nos	16					
17	End Termination kit for 33kV, 3C X 400 sqmm Cable		Nos	6					
18	End termination kit for 11kV, 1c x 1000sqmm cable		Set	72					
19	End Termination kit for 11kV, 3C x 300 sqmm cable		Nos	12					
20	End termination kit for 11kV, 3C x 300 sqmm cable		Nos	4					
21	End Termination kit for 0.415 kV 4C X 300 sqmm cable		Nos	8					

BSES Yamuna Power Limited

S. No.	DESCRIPTION OF GOODS	HSN CODE (8 Digit Mandatory)	UoM	QTY **(A)**	UNIT BASIC PRICE (₹) **(B)**	UNIT GST & CESS AS APPLICABLE (CGST & SGST/UTGST or IGST) (₹) **(C)** %	AMT	UNIT LANDED COST (₹) **(D = B+C)**	TOTAL LANDED COST (₹) **(E = DXA)**
	Cable and Associated Items								
22	33 kV 3CX400 XLPE insulated, stranded aluminum conductor, PVC outer sheath Power cable		Lot	1					
23	11 kV 1CX1000 sqmm XLPE insulated, stranded Aluminium conductor, PVC outer sheath cable		Lot	1					
24	11 kV 3CX300 sqmm XLPE insulated, stranded aluminum conductor, PVC outer sheath Power cable		Lot	1					
25	11 kV 3CX300 sqmm XLPE insulated, stranded aluminum conductor, PVC outer sheath Power cable		Lot	1					
26	0.415 kV 2R X 4C X 300 sqmm XLPE Insulated stranded conductor, PVC outer Sheath Power Cable		Lot	1					
27	LT Power Cable		Lot	1					
28	Control Cables with proper ferruling and tagging along with glands and lugs		Lot	1					
29	Cable Tray including bends etc with 50% spare capacity in each		Lot	1					
30	Cable Tray Support Structure		Lot	1					
31	Cable Sealing System		Lot	1					
32	Fire Resistant Coating		Lot	1					
33	Cable Support Structure along with Clamping Arrangement		Lot	1					
	Auxiliary Equipment								
34	AC Distribution Board		Nos	1					
35	Oil Type 400 kVA Station Transformer		Nos	1					
36	DC Distribution Board		Nos	1					
37	Illumination and lighting system		Lot	1					
38	Power Distribution Board		Lot	1					
39	SMPS Battery Charger		Nos	1					
40	50 V Li Ion Battery Bank (2X300 AH)		Nos	1					

BSES Yamuna Power Limited

S. No.	DESCRIPTION OF GOODS	HSN CODE (8 Digit Mandatory)	UoM	QTY **(A)**	UNIT BASIC PRICE (₹) **(B)**	UNIT GST & CESS AS APPLICABLE (CGST & SGST/UTGST or IGST) (₹) **(C)**		UNIT LANDED COST (₹) **(D = B+C)**	TOTAL LANDED COST (₹) **(E = DXA)**
						%	AMT		
	Earthing System								
41	Earthing		Lot	1					
42	Earth Resistivity Test		Nos	1					
43	Lightning Protection		Lot	1					
44	Angle Channel Arrangement		Lot	1					
45	Line Interface Unit (LIU)		Lot	1					
46	Patch Cord		Lot	1					
47	11 kV Auto Switched Capacitor Bank		Nos	3					
48	Fire Protection System		Lot	1					
49	Conduits		Lot	1					
50	Insulated Floor Coating		Lot	1					
51	SF6 Gas Handling Kit		Nos	1					
52	SCADA Works		Lot	1					
53	Painting of Feeder names (SCADA code, Asset Code, etc)		Lot	1					
54	Licensed programming software		Nos	1					
55	Communication Cord		Lot	1					
	Ladders and Trolleys								
56	A-Type ladder (3 feet height)		Nos	1					
57	Stepped trolley cum platform		Nos	2					
58	Stepped trolley cum platform		Nos	2					
59	9 Meter SMC Expandable Ladder		Nos	1					
60	Recommended & Mandatory Spares		Lot	1					
61	Accessories		Lot	1					
62	SLD of Grid		Nos	1					
63	Video surveillance system		Nos	1					
64	Emergency Exit Floor Marking		Lot	1					
65	Air Conditioning		Nos	2					
	Testing Equipment								
66	High voltage Test Set (0-80 kV DC)		Nos	1					
67	Insulation Resistance Kit		Nos	1					
68	Earthing Rod for Discharging Purpose		Nos	1					
69	Live Line Detector		Nos	1					

BSES Yamuna Power Limited

S. No.	DESCRIPTION OF GOODS	HSN CODE (8 Digit Mandatory)	UoM	QTY **(A)**	UNIT BASIC PRICE (₹) **(B)**	UNIT GST & CESS AS APPLICABLE (CGST & SGST/UTGST or IGST) (₹) **(C)** %	AMT	UNIT LANDED COST (₹) **(D = B+C)**	TOTAL LANDED COST (₹) **(E = DXA)**
70	Bosch Professional Tool Kit		Nos	1					
71	Bosch Cordless Motorized Torque Wrench		Nos	1					
72	Earth Resistance Tester		Nos	1					
73	Portable Flash Light		Nos	1					
GRAND TOTAL LANDED COST (₹)									
In words									
Note: All quantities mentioned above are estimated quantities. Actual quantities may vary as per actual site requirement. All the lot items are required to be quantities for ordering and billing purpose.									

BSES Yamuna Power Limited

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

S. No.	DESCRIPTION OF SERVICES	SAC CODE (8 Digit Mandatory)	UoM	QTY **(A)**	UNIT BASIC PRICE (₹) **(B)**	UNIT GST & CESS AS APPLICABLE (CGST & SGST/UTGST or IGST) (₹) **(C)** %	AMT	UNIT LANDED COST (₹) **(D = B+C)**	TOTAL LANDED COST (₹) **(E = DXA)**
	Erection, Testing and Commissioning of all items specified in "Scope of Supply"								
A	**33 kV GIS with Double Bus Bar Arrangement as per SLD Attached**								
1	Incomer Feeder Panel with Line PT		Nos	4					
2	Transformer Feeder Panel		Nos	3					
3	Bus Coupler		Nos	1					
4	Bus PT		Nos	2					
5	31.5 MVA, 33 kV/11 kV Power Transformer		Nos	1					
B	**11 kV Switchboard**								
6	Incoming panel (with Line PT)		Nos	3					
7	Adaptor Panel for Bus Coupling Through Cables		Nos	2					
8	Bus Coupler Panel		Nos	2					
9	Bus Riser Cum Bus PT Panel		Nos	2					
10	Bus PT Panel		Nos	1					
11	Capacitor Panel		Nos	3					
12	Outgoing Panel		Nos	24					
13	Station Transformer Panel		Nos	2					
14	Earthing Truck for Bus bar Side Earthing		Nos	2					
15	Earthing Truck for Cable Side Earthing		Nos	2					
C	**End Termination Kits**								
16	GIS termination kit for 33kV, 3C X 400sqmm cable		Nos	16					
17	End Termination kit for 33kV, 3C X 400 sqmm Cable		Nos	6					
18	End termination kit for 11kV, 1c x 1000sqmm cable		Set	72					
19	End Termination kit for 11kV, 3C x 300 sqmm cable		Nos	12					

BSES Yamuna Power Limited

S. No.	DESCRIPTION OF SERVICES	SAC CODE (8 Digit Mandatory)	UoM	QTY **(A)**	UNIT BASIC PRICE (₹) **(B)**	UNIT GST & CESS AS APPLICABLE (CGST & SGST/UTGST or IGST) (₹) **(C)** %	AMT	UNIT LANDED COST (₹) **(D = B+C)**	TOTAL LANDED COST (₹) **(E = DXA)**
20	End termination kit for 11kV, 3C x 300 sqmm cable		Nos	4					
21	End Termination kit for 0.415 kV 4C X 300 sqmm cable		Nos	8					
D	**Cable and Associated Items**								
22	33 kV 3CX400 XLPE insulated, stranded aluminum conductor, PVC outer sheath Power cable		Lot	1					
23	11 kV 1CX1000 sqmm XLPE insulated, stranded Aluminium conductor, PVC outer sheath cable		Lot	1					
24	11 kV 3CX300 sqmm XLPE insulated, stranded aluminum conductor, PVC outer sheath Power cable		Lot	1					
25	11 kV 3CX300 sqmm XLPE insulated, stranded aluminum conductor, PVC outer sheath Power cable		Lot	1					
26	0.415 kV 2R X 4C X 300 sqmm XLPE Insulated stranded conductor, PVC outer Sheath Power Cable		Lot	1					
27	LT Power Cable		Lot	1					
28	Control Cables with proper ferruling and tagging along with glands and lugs		Lot	1					
29	Cable Tray including bends etc with 50% spare capacity in each		Lot	1					
30	Cable Tray Support Structure		Lot	1					
31	Cable Sealing System		Lot	1					
32	Fire Resistant Coating		Lot	1					
33	Cable Support Structure along with Clamping Arrangement		Lot	1					
E	**Auxiliary Equipment**								
34	AC Distribution Board		Nos	1					
35	Oil Type 400 kVA Station Transformer		Nos	1					
36	DC Distribution Board		Nos	1					

BSES Yamuna Power Limited

S. No.	DESCRIPTION OF SERVICES	SAC CODE (8 Digit Mandatory)	UoM	QTY **(A)**	UNIT BASIC PRICE (₹) **(B)**	UNIT GST & CESS AS APPLICABLE (CGST & SGST/UTGST or IGST) (₹) **(C)** %	AMT	UNIT LANDED COST (₹) **(D = B+C)**	TOTAL LANDED COST (₹) **(E = DXA)**
37	Illumination and lighting system		Lot	1					
38	Power Distribution Board		Lot	1					
39	SMPS Battery Charger		Nos	1					
40	50 V Li Ion Battery Bank (2X300 AH)		Nos	1					
F	**Earthing System**								
41	Earthing		Lot	1					
42	Earth Resistivity Test		Nos	1					
43	Lightning Protection		Lot	1					
44	Angle Channel Arrangement		Lot	1					
45	Line Interface Unit (LIU)		Lot	1					
46	Patch Cord		Lot	1					
47	11 kV Auto Switched Capacitor Bank		Nos	3					
48	Fire Protection System		Lot	1					
49	Conduits		Lot	1					
50	Insulated Floor Coating		Lot	1					
51	SF6 Gas Handling Kit		Nos	1					
52	SCADA Works		Lot	1					
53	Painting of Feeder names (SCADA code, Asset Code, etc)		Lot	1					
54	Licensed programming software		Nos	1					
55	Communication Cord		Lot	1					
G	**Ladders and Trolleys**								
56	A-Type ladder (3 feet height)		Nos	1					
57	Stepped trolley cum platform		Nos	2					
58	Stepped trolley cum platform		Nos	2					
59	9 Meter SMC Expandable Ladder		Nos	1					
60	SLD of Grid		Nos	1					
61	Video surveillance system		Nos	1					
62	Emergency Exit Floor Marking		Lot	1					
63	Air Conditioning		Nos	2					
64	Retrofitting Work of Line Differential Relay at remote end		Lot	1					

BSES Yamuna Power Limited

S. No.	DESCRIPTION OF SERVICES	SAC CODE (8 Digit Mandatory)	UoM	QTY **(A)**	UNIT BASIC PRICE (₹) **(B)**	UNIT GST & CESS AS APPLICABLE (CGST & SGST/UTGST or IGST) (₹) **(C)** %	AMT	UNIT LANDED COST (₹) **(D = B+C)**	TOTAL LANDED COST (₹) **(E = DXA)**
65	Dismantling of Equipment placed in Existing Building and Outdoor Yard		Lot	1					
66	Dismantling of Power Cables		Lot	1					
67	Dismantling of Control Cables		Lot	1					
68	Shifting of Station Transformer and its associated items		Nos	1					
69	Dismantling of Guard Room and BM Room		Nos	2					
70	Training on O&M of 33 KV GIS		Days	2					
71	Training on application, programming, testing and commissioning of Numerical Relays		Days	2					
72	Training on commissioning, operations and maintenance of 11KV Switchgear		Days	2					
73	Training on commissioning, operations and maintenance of NIFPS		Days	2					
74	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

PRICE FORMAT – CIVIL (C) (Kindly refer detailed package wise SCOPE OF WORK attached as Volume II for Indicative Description of Services/BOM, BOQ)

S. No.	DESCRIPTION OF SERVICES	SAC CODE (8 Digit Mandatory)	UoM	QTY **(A)**	UNIT BASIC PRICE (₹) **(B)**	UNIT GST & CESS AS APPLICABLE (CGST & SGST/UTGST or IGST) (₹) **(C)** %	AMT	UNIT LANDED COST (₹) **(D = B+C)**	TOTAL LANDED COST (₹) **(E = DXA)**
	Civil Works (It includes supply of all material required for civil works)								
1	Engineering		Lot	1					
2	Site survey, Soil testing, design and engineering		Lot	1					
3	Substation Building		Nos	1					
4	Cable cellar		Nos	1					
5	33kV GIS Room		Nos	1					
6	Guard Room		Nos	1					
7	Motorized Shutter		Nos	1					
8	Fire protection system		Lot	1					
9	Illumination and lighting system		Lot	1					
10	Exhaust and Ventilation system		Lot	1					
11	Conduits		Lot	1					
12	Power Distribution Board		Lot	1					
13	New Trench including repair of Existing Trench		Lot	1					
14	Motorized De-Watering system		Lot	1					
15	Equipment Foundation Works		Lot	1					
16	Levelling		Lot	1					
17	Soak Pit		Nos	1					
18	Sump Pit		Nos	1					
19	Motorized Dewatering/De-oiling System		Lot	1					
20	Fire Walls		Nos	3					
21	Fencing		Lot	1					
22	RCC Type Road having thickness – 6 Inches		Lot	1					
23	Yard Development		Lot	1					
24	Rain Water Harvesting		Lot	1					
25	Finishing Work		Lot	1					
26	Repair and Renovation of existing building		Lot	1					
27	Rework of Existing Toilet Room		Nos	1					
28	Digging and Refilling of Ground		Lot	1					

BSES Yamuna Power Limited

S. No.	DESCRIPTION OF SERVICES	SAC CODE (8 Digit Mandatory)	UoM	QTY **(A)**	UNIT BASIC PRICE (₹) **(B)**	UNIT GST & CESS AS APPLICABLE (CGST & SGST/UTGST or IGST) (₹) **(C)** %	AMT	UNIT LANDED COST (₹) **(D = B+C)**	TOTAL LANDED COST (₹) **(E = DXA)**
29	Powder Coated MS Almirah		Nos	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 – II: SCOPE OF TURNKEY EXECUTION & TECHNICAL SPECIFICATIONS

SCOPE OF TURNKEY EXECUTION

FOR

AIS TO GIS CONVERSION WITH CAPACITY AUGMENTATION

AT

GT ROAD SUBSTATION

Revision			0
Date			31.05.2022
Pages			Page 1 of 19
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 GT Road Grid 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. GT Road Grid S/S is situated near Jhilmil Metro, Delhi 110095.

b. Longitude and Latitude of GT Grid S/S is 28°40'34.5"N 77°18'33.9"E

3 BIDDER'S SCOPE

a. Bidder's Scope includes design, engineering, manufacture, shop testing, inspection, packing, dispatch, supply, loading, unloading, storage at site, civil works, 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

DocUUID : 89db2c6f-f09a-4fa0-86a8-6e69d0c135ee

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

3.1.3 SYSTEM PARAMETERS

3.1.3.1	Nominal Voltage kV	33	11
3.1.3.2	Rated voltage kV	36	12
3.1.3.3	Power Frequency (kV rms) with stand voltage	70	28
3.1.3.4	Basic Insulation Level KVp	170	75
3.1.3.5	Rated Frequency Hz	50±5%	50±5%
3.1.3.6	System Neutral Earthing	Solidly Grounded	Solidly Grounded

3.2 SCOPE OF SUPPLY

S. No	Items	UOM	Qty	Remarks
3.2.1	33 kV GIS with Double Bus Bar Arrangement as per SLD Attached			a) Dummy panel wherever applicable is included in scope to avoid fouling with beams, columns or any other structure b) Line Differential Protection Relay for both Local and Remote End are included in scope of supply
3.2.1.1	Incomer Feeder Panel with Line PT	Nos	4	
3.2.1.2	Transformer Feeder Panel	Nos	3	
3.2.1.3	Bus Coupler	Nos	1	
3.2.1.4	Bus PT	Nos	2	
3.2.2	31.5 MVA, 33 kV/11 kV Power Transformer	Nos	1	
3.2.3	11 kV Switchboard			
3.2.3.1	Incoming panel (with Line PT)	Nos	3	In case it is possible to limit the switchboard depth to 1500mm, separate Adaptor panel has to

				be provided with each incomer panel for incomer cable termination
3.2.3.2	Adaptor Panel for Bus Coupling Through Cables	Nos	2	
3.2.3.3	Bus Coupler Panel	Nos	2	
3.2.3.4	Bus Riser Cum Bus PT Panel	Nos	2	
3.2.3.5	Bus PT Panel	Nos	1	
3.2.3.6	Capacitor Panel	Nos	3	
3.2.3.7	Outgoing Panel	Nos	24	
3.2.3.8	Station Transformer Panel	Nos	2	
3.2.3.9	Earthing Truck for Bus bar Side Earthing	Nos	2	
3.2.3.10	Earthing Truck for Cable Side Earthing	Nos	2	
3.2.4	End Termination Kits			
3.2.4.1	GIS termination kit for 33kV, 3C X 400sqmm cable	Nos	16	a) 8 Kits shall be used at 33kV GIS Line Feeder b) 6 Kits shall be used at 33kV GIS Transformer Feeder c) 2 Kits shall be in spare
3.2.4.2	End Termination kit for 33kV, 3C X 400 sqmm Cable	Nos	6	For connecting cable to the bushing of power Transformers
3.2.4.3	End termination kit for 11kV, 1c x 1000sqmm cable	Set	72	a) For Terminating 11 kV Cables at 11 kv incomer end b) For Terminating 11 kV Cables at Transformer end c) For interconnection 11 Kv Switchgears
3.2.4.4	End Termination kit for 11kV, 3C x 300 sqmm cable	Nos	12	For Terminating 11 kV Cables at 11 kV Capacitor Bank end and 11 kV Capacitor Panel end
3.2.4.5	End termination kit for 11kV, 3C x 300 sqmm cable	Nos	4	For Terminating 11 kV Cables at 11 kV Station Transformer Panel and Station Transformer
3.2.4.6	End Termination kit for 0.415 kV 4C X 300 sqmm cable	Nos	8	For Terminating 0.415 kV Cables at ACDB and Station Transformer
3.2.5	Cable and Associated Items			
3.2.5.1	33 kV 3CX400 XLPE insulated, stranded aluminum conductor, PVC outer sheath Power cable	Lot	1	For connecting all power transformer with 33 kV Trafo panel
3.2.5.2	11 kV 1CX1000 sqmm XLPE insulated, stranded Aluminium conductor, PVC outer sheath cable	Lot	1	All Power transformer to 11 kV incoming Panel
3.2.5.3	11 kV 3CX300 sqmm XLPE insulated, stranded aluminum conductor, PVC outer sheath Power cable	Lot	1	For 11 kV Capacitor Bank

3.2.5.4	11 kV 3CX300 sqmm XLPE insulated, stranded aluminum conductor, PVC outer sheath Power cable	Lot	1	For Station transformer
3.2.5.5	0.415 kV 2R X 4C X 300 sqmm XLPE Insulated stranded conductor, PVC outer Sheath Power Cable	Lot	1	For Station Transformer
3.2.5.6	LT Power Cable	Lot	1	For items specified in “Scope of Supply” and Cables Related to Shifting of Station Transformer
3.2.5.7	Control Cables with proper ferruling and tagging along with glands and lugs	Lot	1	For Items specified in “Scope of Supply” and Cables Related to Shifting of Station Transformer
3.2.5.8	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
3.2.5.9	Cable Tray Support Structure	Lot	1	
3.2.5.10	Cable Sealing System	Lot	1	For all cables entering and exiting the Proposed Substation Building
3.2.5.11	Fire Resistant Coating	Lot	1	a) On all cable specified in “Scope of Supply” b) Fire rating-2 hours
3.2.5.12	Cable Support Structure along with Clamping Arrangement	Lot	1	a) For all Power Cable Terminations b) For Control Cable Termination wherever Required
3.2.6	Auxiliary Equipment			
3.2.6.1	AC Distribution Board	Nos	1	Type-1 Type
3.2.6.2	Oil Type 400 kVA Station Transformer	Nos	1	
3.2.6.3	DC Distribution Board	Nos	1	Type-1 Type
3.2.6.4	Illumination and lighting system	Lot	1	a) For Items specified in "Scope of Supply" b) It Excludes Illumination and Lighting system for New building containing 33 kV GIS
3.2.6.5	Power Distribution Board	Lot	1	
3.2.6.6	SMPS Battery Charger	Nos	1	Type-1 Type
3.2.6.7	50 V Li Ion Battery Bank (2X300 AH)	Nos	1	Type-1 Type
3.2.7	Earthing System			
3.2.7.1	Earthing	Lot	1	Earthing of complete Grid Substation and items specified in “Scope of Supply”

3.2.7.2	Earth Resistivity Test	No	1	For Earthing Design
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	Line Interface Unit (LIU)	Lot	1	It also includes LIUs for remote end optical fibre cable
3.2.11	Patch Cord	Lot	1	It also includes Patch Cord for remote end Line Differential relay
3.2.12	11 kV Auto Switched Capacitor Bank	Nos	3	
3.2.13	Fire Protection System	Lot	1	For Items specified in "Scope of Supply"
3.2.14	Conduits	Lot	1	
3.2.15	Insulated Floor Coating	Lot	1	For Items specified in "Scope of Supply"
3.2.16	SF6 Gas Handling Kit	No	1	
3.2.17	SCADA Works	Lot	1	As per Specification
3.2.18	Painting of Feeder names (SCADA code, Asset Code, etc)	Lot	1	As per Engineer Incharge Guidance
3.2.19	Licensed programming software	No	1	
3.2.20	Communication Cord	Lot	1	
3.2.21	Ladders and Trolleys			
3.2.21.1	A-Type ladder (3 feet height)	No	1	For viewing and operating Relays
3.2.21.2	Stepped trolley cum platform	No	2	To Access Relays of Switchgears
3.2.21.3	Stepped trolley cum platform	No	2	To Access Cable terminations in Cable Cellar Room
3.2.21.4	9 Meter SMC Expandable Ladder	No	1	
3.2.22	Recommended & Mandatory Spares	Lot	1	For Items specified in "Scope of Supply"
3.2.23	Accessories	Lot	1	For Items specified in "Scope of Supply"
3.2.24	SLD of Grid	No	1	Covered in Acrylic Sheet
3.2.25	Video surveillance system	No	1	
3.2.26	Emergency Exit Floor Marking	Lot	1	For Items specified in "Scope of Supply"
3.2.27	Air Conditioning	No	2	For Battery and RTU
3.2.28	Testing Equipment			
3.2.28.1	High voltage Test Set (0-80 kV DC)	No	1	
3.2.28.2	Insulation Resistance Kit	No	1	
3.2.28.3	Earthing Rod for Discharging Purpose	No	1	
3.2.28.4	Live Line Detector	No	1	
3.2.28.5	Bosch Professional Tool Kit	No	1	a) Including all accessories suitable for Tightening and opening of bolts of 11 kV and 33 kV Switchgear b) Cordless tool shall have facility of working on 240 VAC

				also
3.2.28.6	Bosch Cordless Motorized Torque Wrench	No	1	
3.2.28.7	Earth Resistance Tester	No	1	
3.2.28.8	Portable Flash Light	No	1	
3.2.28.9	Civil Works	Lot	1	Refer scope of Work and Specification for Details

3.3 SCOPE OF WORK

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

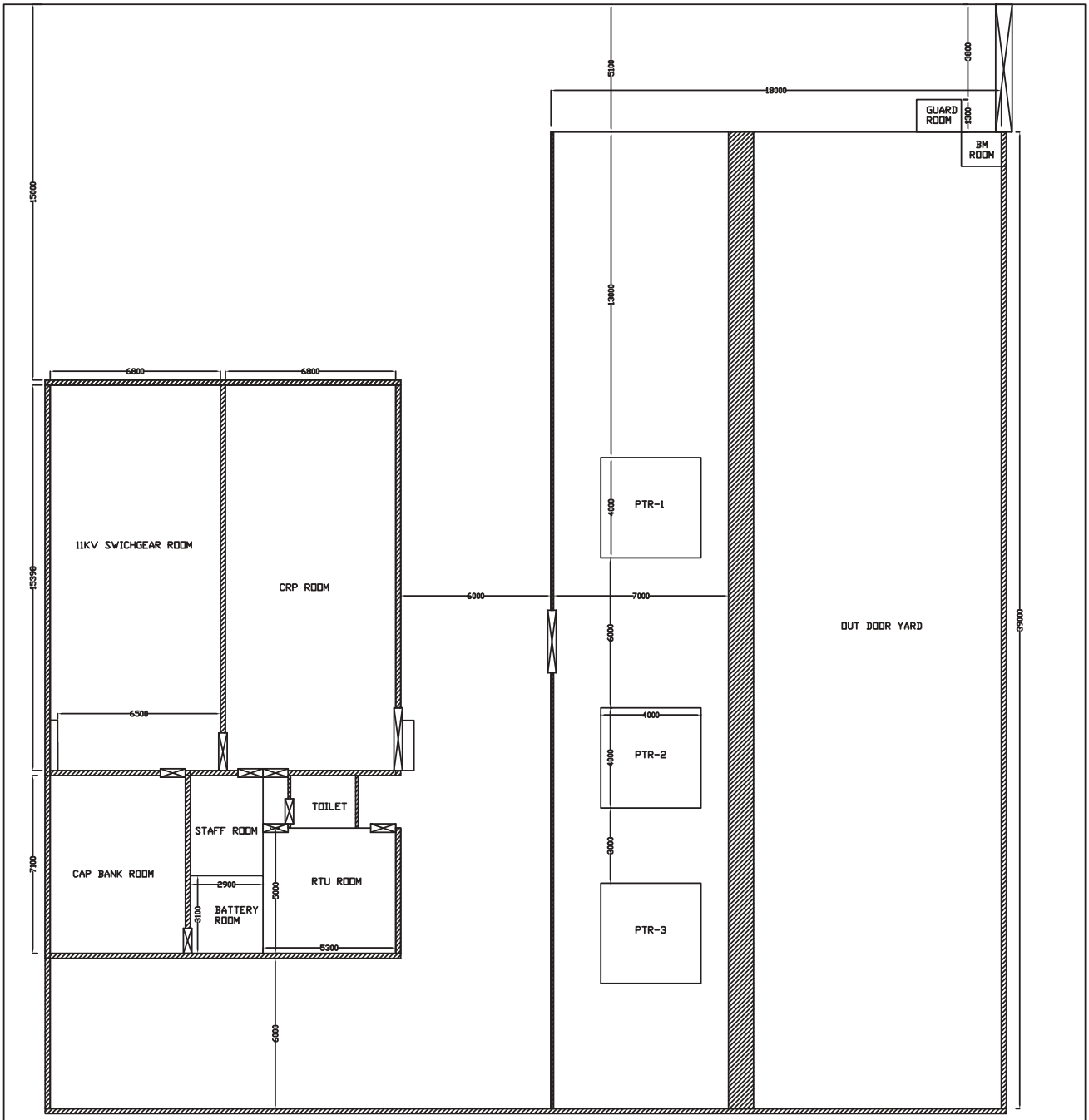
S. No	Items	Unit	Qty	Remarks
3.3.1	Erection, Testing and Commissioning of all items specified in "Scope of Supply"	Lot	1	
3.3.2	Retrofitting Work of Line Differential Relay at remote end	Lot	1	a) Installation, testing and commissioning including cut out works on remote end panels b) Control cable works
3.3.3	Dismantling of Equipment placed in Existing Building and Outdoor Yard	Lot	1	a) It includes dismantling of Cables associated to this equipment b) It includes dismantling of Foundations c) It Excludes Two Power Transformers
3.3.4	Dismantling of Power Cables	Lot	1	Reconnection of 11 kV Outgoing Power Cables shall be in BYPL scope.
3.3.5	Dismantling of Control Cables	Lot	1	a) All equipment to be dismantled b) For Existing Power Transformers
3.3.6	Shifting of Station Transformer and its associated items	No	1	a) It Includes Foundation work of Station Transformer b) Note that Cables, Cable trench work and cable tray work supply shall also be in bidder's scope
3.3.7	Dismantling of Guard Room and BM Room	No	2	
3.3.8	Training on O&M of 33 KV GIS	Days	2	One-day classroom training at BYPL Training Centre and one-

				day onsite training. Training shall be provided by Domain experts only
3.3.9	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
3.3.10	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
3.3.11	Training on commissioning, operations and maintenance of NIFPS	Days	2	One-day classroom training at BYPL Training Centre and one day onsite training. Training shall be provided by Domain experts only
3.3.12	Training on IEC 61850	Days	2	Two - Day Classroom Training
3.3.13	Civil Works			It includes supply of all material required for civil works
3.3.13.1	Engineering	Lot	1	
3.3.13.2	Site survey, Soil testing, design and engineering	Lot	1	Soil Testing Includes Soil Resistivity Test
3.3.13.3	Substation Building	No	1	a) Building shall be G+1 storey b) Although Foundation design shall be for G+2 storey c) First floor level and roof level shall match with existing building as far as possible d) Building Shall comply fire safety norms as per IS 1642, IS 1646.
3.3.13.4	Cable cellar	No	1	Location-Ground Floor
3.3.13.5	33kV GIS Room	No	1	Location-First Floor
3.3.13.6	Guard Room	No	1	
3.3.13.7	Motorized Shutter	No	1	For Entry and Exit of Switchgears
3.3.13.8	Fire protection system	Lot	1	For both old and new Building
3.3.13.9	Illumination and lighting system	Lot	1	For both old, new Building and Items specified in “Scope of Supply”
3.3.13.10	Exhaust and Ventilation system	Lot	1	For both old, new Building and Items specified in “Scope of Supply”
3.3.13.11	Conduits	Lot	1	For Lighting, Ceiling Fans, Power Sockets, Exhaust Fans, Fire Protection etc.

3.3.13.12	Power Distribution Board	Lot	1	For both old, new Building and Items specified in “Scope of Supply”
3.3.13.13	New Trench including repair of Existing Trench	Lot	1	a) Cable trench shall be of RCC type b) For Items specified in "Scope of Supply" and for all cables inside the grid substation including 11 kV Outgoing cables and 33 kV incoming cables c) It Includes Trench Cover d) Box Culvert shall be provided where ever required e) Two Separate Power Cable trenches to maintain N-1 Redundancy in cable trench design f) 50% spare capacity in each trench for future use
3.3.13.14	Motorized De-Watering system	Lot	1	For Trenches
3.3.13.15	Equipment Foundation Works	Lot	1	For items specified in “Scope of Supply”
3.3.13.16	Levelling	Lot	1	a) Complete Yard Area b) Substation Building
3.3.13.17	Soak Pit	No	1	
3.3.13.18	Sump Pit	No	1	a) Joining of soak pit of each transformer with sump Pit b) Capacity shall be 20000 Litres
3.3.13.19	Motorized Dewatering/De-oiling System	Lot	1	For Sump Pit
3.3.13.20	Fire Walls	Nos	3	
3.3.13.21	Fencing	Lot	1	a) For all outdoor equipment b) Pre-galvanized MS Fencing with powder coating c) Fencing shall be Anticut and anticlimb type
3.3.13.22	RCC Type Road having thickness – 6 Inches	Lot	1	a) For Approach of Items specified in scope of supply b) It includes Box culvert where ever required for cable trenches c) For Complete Outdoor yard Area
3.3.13.23	Yard Development	Lot	1	For Complete outdoor Yard Area
3.3.13.24	Rain Water Harvesting	No	1	

3.3.13.25	Finishing Work	Lot	1	For Existing Substation Building and New Building
3.3.13.26	Repair and Renovation of existing building	Lot	1	a) It Includes toilet, Battery Room, CRP Room, Switchgear Room, RTU Room, Capacitor Bank Room b) For Erection of all equipment included in "Scope of Supply"
3.3.13.27	Rework of Existing Toilet Room	No	1	a) This Includes changing of all washroom Fittings b) Installation of New tiles in complete Existing Toilet
3.3.13.28	Digging and Refilling of Ground	Lot	1	For Earthing Purpose
3.3.13.29	Powder Coated MS Almirah	No	2	

3.4 EXISTING AND PROPOSED REFERENCE LAYOUT

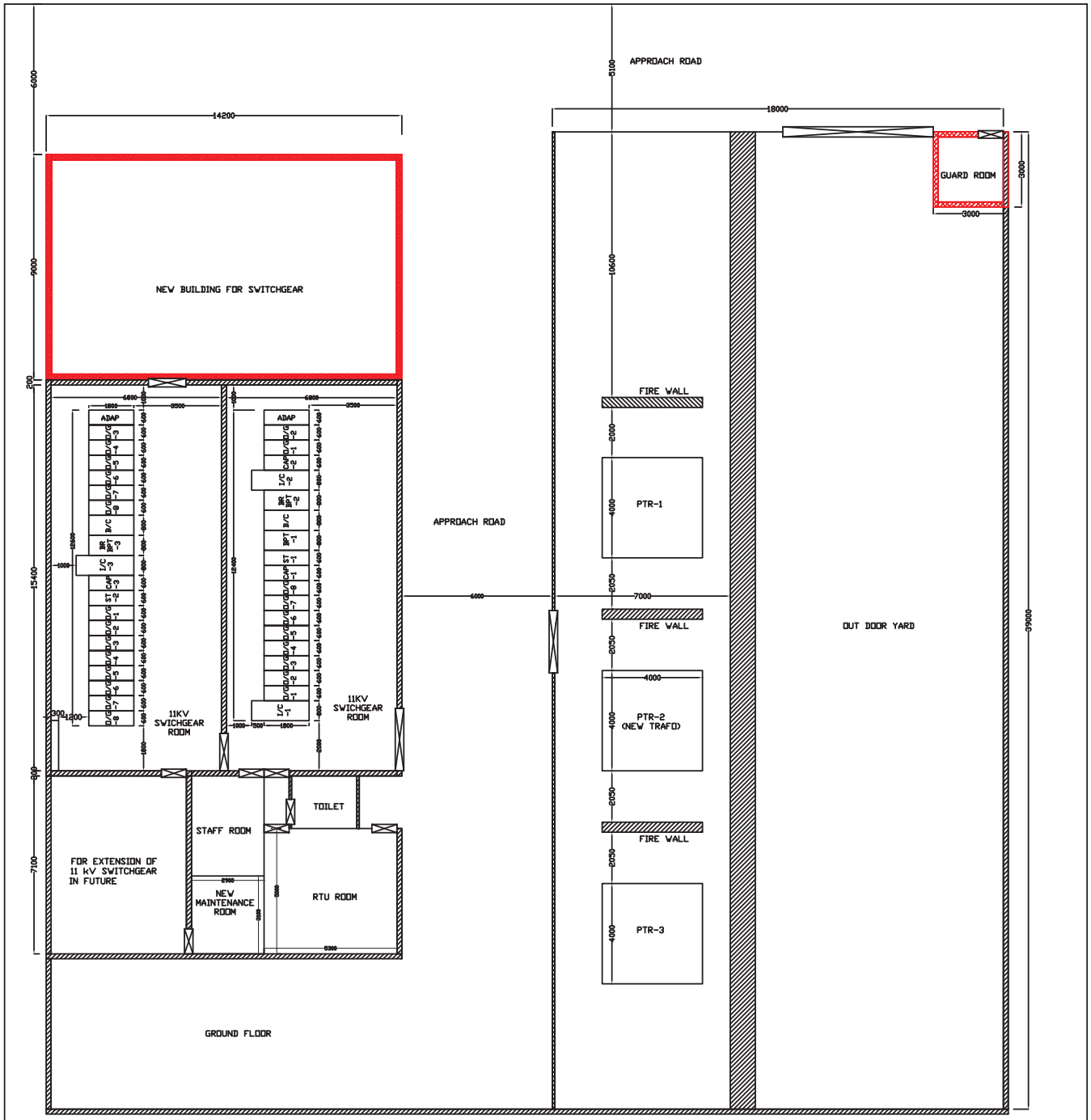


NOTE:-Layout is tentative in nature

DRAWN	A.H/SG
CHECKED	SG
APPD.	GS
DATE	27/05/22
SCALE	NTS

BSES Yamuna Power Limited

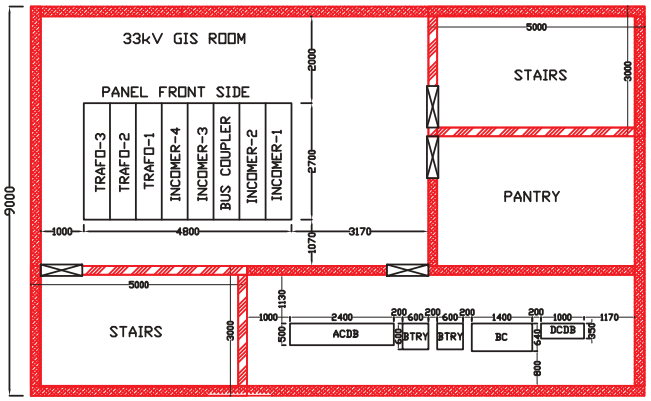
TITLE:- EXISTING LAYOUT OF GT ROAD GRID



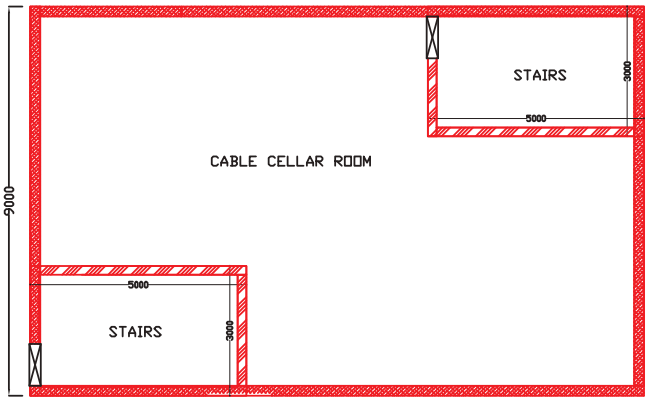
DRAWN	A.H/SG
CHECKED	SG
APPD.	GS
DATE	27/05/22
SCALE	NTS

BSES Yamuna Power Limited

TITLE:- PROPOSED LAYOUT OF GT ROAD GRID



FIRST FLOOR OF NEW BUILDING



GROUND FLOOR OF NEW BUILDING

DRAWN	A.H/SG
CHECKED	SG
APPD.	GS
DATE	27/05/22
SCALE	NTS

BSES Yamuna Power Limited

TITLE:-
PROPOSED LAYOUT OF GT ROAD GRID - NEW BUILDING FOR SWITCHGEAR

3.5 SCOPE DEMARCATION

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

3.5.18	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.
3.5.19	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
3.5.20	Temporary store at work premises	✘	✓	
3.5.21	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
3.5.22	Any damages done to the existing system, shall be repaired/ rectified/ replaced	✘	✓	
3.5.23	Clearance certificate	✘	✓	Clearance Certificate shall be taken from BYPL Departments (Quality, Safety, Protection, O&M, SCADA, EHV, Civil, etc) before Final Charging of the Systems. Any Site Observations/ Punch points, observed during execution, shall be attended.
3.5.24	External Agency Clearance	✘	✓	Statutory fee shall be borne by BYPL
3.5.25	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.
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	Required			

DocUUID : 89db2c6f-f09a-4fa0-86a8-6e69d0c135ee

S. No.	Description	Technical Bid	Drawing Approval	Pre-Dispatch	Pre-Closure
	specification				
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 mentioned in technical specification	Required	Required		
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	33 kV & 11 kV Power Cable	Universal/KEI/GEMSCAB/Polycab/Torrent/Sterlite/Gupta Power/KEC
4.1.2	33 kV AIS Cable Straight Through Joint & Termination kit	Raychem/3M
4.1.3	33kV GIS Termination kit	Raychem/3M
4.1.4	11 kV Cable Straight Through Joint & Termination kit	Raychem/3M/Yamuna Power Infrastructure
4.1.5	Control cable	Universal/KEI/GEMSCAB/Polycab/ Cords Cable

4.1.6	Power Transformer	ABB/Schneider/Siemens/Transformer & Rectifiers/ EMCO/ Bharat Bijlee/ BHEL/Toshiba/Voltamp/CGL
4.1.7	Station Transformer	ABB/Schneider/Siemens/Transformer & Rectifiers/ EMCO/ Bharat Bijlee/ BHEL/Toshiba/Voltamp/CGL
4.1.8	33 kV GIS	ABB/Siemens/Schneider
4.1.9	11 kV AIS	ABB/Siemens/Schneider/CGL
4.1.10	11 kV Auto Switched Capacitor bank	ABB/ EPCOS/Shreem
4.1.11	Numerical relays	Siemens (Siprotec series) and Schneider / Alstom (Micom Series)
4.1.12	Ethernet Switch	Ruggedcom, Hirschman
4.1.13	Cable sealing system	Roxtec, MCT Brattberg
4.1.14	Fire retardant coating for cables	3M/Demech/Stanvac
4.1.15	SF6 Gas Handling Kit	Dilo/Wika
4.1.16	Floor coating	3M/Demech/Stanvac
4.1.17	Earth Electrodes	JMV/Pragati
4.1.18	Earth Enhancing Material	JMV/Pragati/Marconite

DocUUID : 89db2c6f-f09a-4fa0-86a8-6e69d0c135ee

BSES

Technical Specification

For

33 kV Gas Insulated Switchgear

Specification no – BSES-TS-65-33GIS-R0

Rev		0
Page		1 of 47
Date		28 Apr 2022
Prepared by	Abhishek Harsh	
	Alok Mandal	
	Javed Ahmed	
Reviewed by	Srinivas Gopu	
	Abhinav Srivastava	
Approved by	Gaurav Sharma	
	Gopal Nariya	

INDEX

1.0 SCOPE

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

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

2.0 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

3.0 SERVICE CONDITIONS

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 50^0C Average 40^0 C
3.5	Minimum ambient air temperature	0^0C
3.6	Relative Humidity	100%
3.7	Rainfall	750mm concentrated in four months
3.8	Seismic Zone	IV

4.0 ELECTRICAL SYSTEM

4.1	Type	Switchgear shall be 33kV, 3 phase, 3 wire, 50Hz,
4.2	Earthing type	Solidly Earth
4.3	Fault Current	31.5 kA for 3 sec
4.4	Rating	As per Annexure –B (Technical Particulars) and Annexure-F (SLD)

5.0 PANEL CONSTRUCTION

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

		accessible for fitting of the power cable plugs and the test cable sockets. b. Cable compartment shall also include provisions for conventional VT plug in connections. Cable compartment should be IP4X compliant.
5.5	Low voltage compartment	a. It should contain the switch operating mechanisms and all secondary equipment including the protection and control system. All operating mechanisms shall be motorized. b. Manual operation switches and mechanical position indicators shall also be provided. Degree of protection for LV compartment should be IP4X.
5.6	Safety from Internal faults	a. The structure, including doors and panels, shall be capable of withstanding the internal pressures created by faults within the structure (equal to the maximum fault-current rating) without danger to the operating personnel. b. Type test reports regarding internal arc withstand performance shall be available with bids.
5.6.1	Passive Protection from internal faults	a. A passive safety section shall ensure that hot gases shall be guided via pressure relief disks from each compartment. b. The pressure relief duct ends shall be guided to open air or fitted with absorbers to cool the hot gases. c. Relief into a cable basement or cavity below a false floor is not acceptable. d. Hazards to persons or risk of fire shall be reliably prevented. An arcing fault in one compartment should not cause major damage to other compartments. e. Structure shall be provided with barriers to prevent the transfer of ionized gases between two adjacent compartments except bus chamber. f. Separate pressure relief vents shall be provided in bus bar, cable and circuit breaker compartments to release arc fault pressure quickly and safely. g. The orientation of pressure relief vents and gas exhaust ducts as necessary shall be coordinated with BUYER at the bid stage.
5.6.2	Internal arc classification	As per Annexure-B (Technical Particulars)

5.7	Workability	a. Switchgear shall be designed and constructed to facilitate inspection, cleaning, repair and maintenance and to ensure absolute safety during such work. b. Interlocks, busbar shutters and covers shall be provided to prevent incorrect or unsafe operation and to prevent access to live parts. c. It shall be possible to work safely within individual panels, such as equipping and commissioning of spare panels as well as connecting main, control and auxiliary cabling, while the remainder of the switchgear is energized.
5.8	Service continuity	a. Arc faults caused by external reasons shall be positively confined to the originating compartment and shall not spread to other parts of the switchgear. b. In case of any internal arc fault in a busbar, busbar disconnector or circuit breaker, of double bus system, repair works must be possible without shutting down complete substation and at least one busbar and the undisturbed bays must remain in operation. c. For Bus Coupler / sectionaliser - In case of any internal arc fault in a busbar, busbar disconnector or sectionaliser, repair work must be possible without shutting down the complete substation and at least one half of the substation must remain in operation. d. To achieve service continuity, gas tight buffers shall be used at suitable place. e. Documents indicating sequence of repair work steps and description of necessary restrictions during work shall be submitted with the technical bid. Each bay module should be equipped with suitable arrangement for easy dismantling and refitting during maintenance without disturbing other units.
5.9	Interchange-ability	a. Similar parts and components shall be interchangeable wherever practical. An interlock system shall be provided to prevent the interchange of modules with higher current rating with modules of lower current rating. b. Replacement of circuit breaker module shall be without interfering busbar operation and without gas work.

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

6.0 CIRCUIT BREAKER & THREE POSITION DISCONNECTOR

6.1	Circuit Breaker	
6.1.1	Interrupting medium	Vacuum in SF6 filled compartment
6.1.2	Breaker operation	Three separate identical single pole units operated through a common shaft
6.1.3	Operating Mechanism	Re-strike free, Trip free, with electrical anti-pumping feature
6.1.4	Type	Motor wound, spring charged, stored energy type with manual charging facility
6.1.5	Operation on supply failure	One O-C-O operation possible after failure of power supply to the spring charging motor
6.1.6	Shunt Release	For closing and tripping
6.1.7	Number of Trip coils	Two
6.1.8	Push buttons	a. Manual / mechanical ON/ OFF / Emergency trip push button b. Emergency Off push button should be provided with a protective flap. c. Mechanical ON shall have padlocking facility d. Labels giving clear instructions for manual operation should be provided wherever appropriate
6.1.9	Mechanical Indications	a. On-Off b. Operation counter c. Mechanism charge/discharge
6.1.10	Position detection	Through proximity sensors/Aux Switches
6.1.11	Breaker Control	On panel front only
6.1.12	Technical particulars	As per Annexure-B
6.2	Three position disconnector	
6.2.1	Functions	Three phase, three position suitable for- a. Connecting b. Disconnecting c. Earthing
6.2.2	Type	Motorized with provision for local and remote operation. Operation of earth switch should be through local only. Provision for Manual operation shall also be there.
6.2.3	Position detection	Through proximity sensors/Aux Switches
6.2.4	Mechanical indications	Earthing switch close/open.
6.2.5	Padlocking facility	For locking the earthing device in the open and close position.
6.2.6	Rating	Continuous and Short circuit rating should be same as specified for switchgear.

7.0 FUNCTIONAL REQUIREMENTS

7.1	Mechanical and electrical interlock	a. To prevent earthing of an incoming supply which has not been isolated b. To prevent switching on an incoming supply which is earthed c. To prevent earthing of feeder circuit when the circuit breaker is in the closed position d. To prevent switching on a circuit breaker when the feeder is earthed
7.2	Breaker Operation	
7.2.1	Closing from local	Only when local/remote selector switch is in local position
7.2.2	Closing from remote	Only when local/remote selector switch is in remote position
7.2.3	Tripping from local	Only when local/remote selector switch is in local position
7.2.4	Tripping from remote	Only when local/remote selector switch is in remote position
7.2.5	Tripping from protective relays	Irrespective of position of local/remote switch
7.2.6	Trip circuit supervision relay contact	For indication, alarm & to inhibit closing of breaker
7.2.7	Tripping or opening of breaker through relay but not routed through Lockout (Example- SCADA Opening, Under voltage, Overvoltage)	Wired to Contact multiplication Relay and then from CMR to tripping of breaker
7.2.8	Closing of breaker through relay	Wired to Contact multiplication Relay and then from CMR to closing of breaker
7.2.9	Emergency trip push button contact	Wired directly to trip coil (wired to Master trip relay if second trip coil provided)
7.2.10	Emergency trip push button contact	Wired to inhibit closing of breaker
7.2.11	Master trip relay contact (if given)	Wired to inhibit closing of breaker
7.3	DC control supply bus in all panels	Fed by two DC incoming sources in Bus coupler panel with auto changeover facility
7.4	PT supply bus in all panels	Fed normally by bus PT with automatic changeover facility to incomer line PT

8.0 BUSBARS

8.1	Material	Hard drawn electrolytic copper
8.2	Cross section	Uniform throughout length of switchgear

8.3	Phase busbars	The phase busbars shall be enclosed in individual or a combined gas filled compartment. Busbars shall be silver or tin-plated at joints. Provision shall be made at the bolted connections to enable accessibility for maintenance and extension where appropriate.
8.4	Marking	All busbars and cable connections shall be marked to indicate the phase colouring, which shall be red, yellow and blue unless otherwise specified or explicitly precluded by relevant national standards.
8.5	Earth busbar	An earth busbar, sized for the earth fault rating of the electrical system and switchgear, shall be provided along the full length of the switchgear structure. The earth busbar shall have provision for earth cable connections at each end.
8.6	Supports	All phase and earth busbars and connections shall be sized, braced and supported to withstand the dynamic, dielectric stresses and thermal affects resulting from the switchgear rated short circuit current over the full length of the switchgear and carry certification from a recognized testing authority.
8.7	Rating	As per Annexure – B (Technical particulars) and Annexure-F (Single line diagram).

9.0 EARTHING

9.1	Earthing of enclosure & non -current carrying parts	All metallic non-current carrying parts of the switchgear shall be bonded together and connected to the switchgear earth busbar. The frame of each functional unit and each device requiring earthing shall be connected directly to the earth busbar. For direct connection to the station earthing grid, earthing bolts of at least 10mm shall be provided at both ends of the main earth bar.
9.2	Busbar and Feeder Earthing	Through three position switch
9.3	Circuit breaker frame earthing	Integral earthing shall be provided on feeder/incoming circuit breakers for cable earthing, and on incoming or bus coupler circuit breakers for busbar earthing.
9.4	Earthing of withdrawable parts	Withdrawable parts shall be effectively earthed until they are completely withdrawn with all power and control connections disconnected.
9.5	Cable armour Earthing	Provision shall be made, adjacent to the cable termination, for connecting earthing cable armouring to the earth busbar.
9.6	Hinged doors	Earthed through flexible copper braid

9.7	Metallic cases of relays, instruments and other LT panel mounted equipment	Connected to the earth bus by independent copper wires of size not less than 2.5 sq. mm with green colour insulation. For this purpose LT compartment should have a clear designated earth bus to which earth connections from all components are to be connected.
9.8	CT and PT neutral	Earthed at one place at the terminal blocks through links.
9.9	Instructions	Clear instructions, preferably pictorial, shall be provided showing methods of earthing wherever appropriate.

10.0 SURGE SUPPRESSOR

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

11.0 CURRENT TRANSFORMER

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

12.0 VOLTAGE TRANSFORMERS

12.1	Type	Shall be cast resin type with insulation class of E or better.
12.2	Disconnection provision for Both Bus and Line PT	Motorised Disconnecting switch with provision for Manual operation.
12.3	Rating	As per Annexure – B (Technical particulars) and Annexure-F (SLD)

13.0 CABLE TERMINATION

13.1	Power Cable termination	
13.1.1	Cable entry	Front / rear entry only. Socket and plug assembly shall be provided for the field power cables. Facilities shall be provided for cable testing including current and voltage injection.

13.1.2	Bushing Extender	Bushing extender has to be provided for connecting rear cable directly on panel bushing in absence of front cable. This will enable easy energization of panel with rear cable in event the front cable is faulty. Needs to be removed for energizing the panel to bushing incomer panel in absence of front cable.
13.1.3	Cable size and nos. of runs	2 runs x 3C x 400sqmm XLPE insulated stranded aluminium cable
13.1.4	Cable supports	Cable supports shall be provided (where practicable) by bidder to avoid undue strain on the cable termination.
13.1.5	Gland plates	Termination of single core cables shall be through a non-magnetic metal panel or gland plate. Minimum air clearances shall be maintained over and above cable lugs and fixing bolts.
13.1.6	Armour Earthing	Provision should be made for bonding and earthing any armour and/or concentric earth conductors.
13.2	Control Cable termination	
13.2.1	Cable entry	Bottom and front entry
13.2.2	Gland plate	Undrilled 3mm CRCA

14.0 METERS

14.1	Mounting	Flush mounted
14.2	Multifunction Meter	
14.2.1	SCADA Interfacing	RS485 rear port suitable for integration on Modbus Protocol
14.2.2	Size	96x96 mm^2
14.2.3	Panels where to be provided	All panels except Bus PT Panel
14.2.4	Accuracy Class	1
14.2.5	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
14.2.6	Data Type	MFI
14.2.7	Compatibility with RTU	ABB 560
14.2.8	Programmability	CT secondary shall be programmable i.e for both 1 A and 5 A
14.2.9	Auxiliary Supply	a. 48 – 240VDC and AC i.e universal type. b. Although in Scheme, MFM must be wired up with DC only
14.3	Voltmeter	Digital type with programmable ratio
14.3.1	Size	96x96 mm^2

14.3.2	Panels where to be provided	Incomer and bus PT panel
14.3.3	Voltmeter switch	Inbuilt in meter
14.3.4	Accuracy Class	1.0
14.4	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

15.0 INDICATIONS & ALARMS

15.1	Indications	Flush mounted, High intensity, clustered LED type
15.1.1	Breaker ON	Red
15.1.2	Breaker Off	Green
15.1.3	Isolator On	Red
15.1.4	Isolator Off	Green
15.1.5	Earth switch On	Red
15.1.6	Earth switch Off	Green
15.1.7	Spring Charged	Blue
15.1.8	DC control supply fail	Amber
15.1.9	AC control supply fail	Amber
15.1.10	Auto trip	Amber
15.1.11	Heater circuit healthy	Yellow (Indication with integrated push button for checking)
15.1.12	Trip circuit healthy	White
15.1.13	PT supply as applicable	R,Y B
15.2	Alarm scheme with isolation switch	a. For DC fail, TC fail and CB auto trip b. For all signals wired to annunciator in 33kV panels

16.0 SELECTOR SWITCHES & PUSH BUTTONS

16.1	Selector switches	Flush mounted on LV compartment door, with shrouded terminals
16.1.1	TNC switch with pistol grip	Lockable, spring return to normal position for CB, Isolator and earth switch control
16.1.2	Local / SCADA selector switch	2 pole Lockable Switch
16.1.3	Rotary ON/OFF switches	For heater / illumination circuit
16.1.4	Rating	16 A

16.2	Push Button	Flush mounted on LV compartment door, with shrouded terminals
16.2.1	Emergency trip push button	Red color with stay put
16.2.2	Accept push buttons	Black color – Trip alarm / DC fail alarm
16.2.3	Reset push buttons	Yellow color – Trip alarm / DC fail alarm
16.2.4	Rating	10 A

17.0 INTERNAL WIRING

17.1	Grade and type	1100 V, PVC insulated, FRLS type stranded flexible copper wire.
17.2	Size	2.5 sq mm for CT circuit, 1.5 sq mm for PT & control circuits
17.3	Colour code	
17.3.1	CT & PT	R Ph – Red Y Ph – Yellow B Ph – Blue Neutral – Black
17.3.2	Others	DC– grey, AC-black, Earth – green
17.4	Ferrules	At both ends of wire
17.5	Ferrule type	Interlocked type (one additional red colour ferrule for all wires in trip circuit)
17.6	Lugs	Tinned copper, pre-insulated, ring type, fork type and pin type as applicable. CT circuits should use ring type lugs only.
17.7	Spare contacts	Spare contacts of relays and contactors etc. should be wired upto the terminal block.
17.8	Panel wiring	Panel wiring shall be on one side of the terminal block only. No more than two wires shall be connected to a terminal.
17.9	Inter-panel wiring	Inter-panel wiring for AC and DC supplies, voltage transformer circuits, annunciation circuits and other common services shall be provided on the same set of terminals in all the panels with proper segregation. Wires with ferrule to be terminated in the adjacent shipping section should be supplied with one end terminated and the other end bunched and coiled.
17.10	Wiring enclosure	Plastic channels for panel wiring, PVC sleeves for Inter panel wiring. Where wiring enters or passes through compartments containing high voltage apparatus, it shall be run in earthed continuous metallic conduit/trunking without gaps, holes or joints.

18.0 TERMINAL BLOCKS

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

19.0 PROTECTION AND CONTROL

19.1	Protection Relays – General Features	
19.1.1	Technology and Functionality	Numerical , microprocessor based with provision for multifunction protection, control, metering and monitoring
19.1.2	Mounting	Flush Mounting, IP5X
19.1.3	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.
19.1.4	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.
19.1.5	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
19.1.6	Communication module	Communication Card of Relay shall have galvanic Isolation from all other cards to prevent damage during power system transients/Faults

19.1.7	SCADA Interface port	LC Type Dual fibre optic port for interfacing with SCADA on IEC 61850 with PRP compatible. Through these ports relays shall be connected to Ethernet switches.
19.1.8	Indications Processing	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.
19.1.9	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.
19.1.10	GOOSE messaging	Relays shall communicate all status signals, commands and events on GOOSE messaging.
19.1.11	PC Interface port	Front port (preferably serial) for configuration/data download using PC. Licensed software and communication cord, required for programming of offered protection relays shall be provided with the switchgear.
19.1.12	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.
19.1.13	SCADA Interface	Relay shall communicate all measured & monitored parameters, analog signals, event record, fault record, DIs , DOs etc to SCADA
19.1.14	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.
19.1.15	Event and Fault records	Relay shall have the facility of recording of various parameters during event/fault with option to set the duration of record through settable pre fault and post fault time. Relay shall store records for last 10 events and 10 faults (minimum). It should be possible to download and access all records locally from PC and remotely from SCADA.
19.1.16	Self diagnosis	Relay shall be able to detect internal failures. A

		watchdog relay with changeover contact shall provide information about the failure.
19.1.17	Time synchronization	All relays shall be capable of being synchronized with the system clock using SCADA interface and PC.
19.1.18	Operation Indicators	LEDs with push button for resetting.
19.1.19	Test Facility	Inbuilt with necessary test plugs.
19.1.20	Auxiliary supply	50/220 VDC. Relays should be suitable for continuous operation at 15% overvoltage
19.2	Protection Relays for 33KV Incomer	
19.2.1	Relay 1	Line differential protection (Dual channel, Compatible for Single Mode Fibre having wavelength 1310 nm)
		Distance protection
		Power swing blocking
		Software based CT ratio correction
		Dual Channel ST port for communication with remote end relay through optical fibre. This port should be in addition to PC interface and SCADA interface ports.
	Selection of Relay 1	Selection of Relay-1 (primary protection) will depend on site requirements. In case of Line differential as primary protection, Relays at both ends shall be provided.
19.2.2	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
		Circuit Breaker failure protection
		Reverse blocking function
		Under Frequency, Over Frequency and Rate of Change of frequency
		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
19.2.3	DIs and DOs	a. Relay-1 should have DIs and DOs as per scheme requirement. Same shall be finalized during detailed engineering. 2 DIs and 2 DO shall be spare for future use. b. Relay-2 should have minimum of 32 DIs and 16 DOs exclusively for SCADA interfacing. DIs and DOs for tripping and interlocking shall be additional as per scheme requirement. If DIs and DOs for tripping and interlocking are integrated with DIs and DOs meant for SCADA (may be done to optimize DI/DO configuration), atleast 4 DIs and 4 DOs should be spare for future use.

19.2.4	Note	Combining functions of Relay-1 and Relay-2 in single relay is not acceptable.
19.2.5	SLD	Refer annexure – F1/F5
19.3	Protection Relays for 33KV Transformer Feeder Panel	
19.3.1	Relay 1	Biased differential protection
		REF protection
		Software based ratio and vector correction feature (without ICT)
		H2 and H5 harmonic restraint
19.3.2	Relay 2	Bay control unit having MIMIC with 3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		Trip Circuit Supervision
		Reverse blocking function
		Under Frequency, Over Frequency and Rate of Change of frequency
		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
19.3.3	DIs and DOs	a. Relay-1 should have DIs and DOs as per scheme requirement. Same shall be finalized during detailed engineering. 2 DIs and 2 DO shall be spare for future use. b. Relay-2 should have minimum of 32 DIs and 16 DOs exclusively for SCADA interfacing. DIs and DOs for tripping and interlocking shall be additional as per scheme requirement. If DIs and DOs for tripping and interlocking are integrated with DIs and DOs meant for SCADA (may be done to optimize DI/DO configuration), atleast 4 DIs and 4 DOs should be spare for future use.
19.3.4	Note	Combining functions of Relay-1 and Relay-2 in single relay is not acceptable.
19.3.5	SLD	Refer annexure – F2/F6
19.4	Protection Relays for 33KV Bus-coupler/Bus-sectionalizer Panel	
19.4.1	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
		Under Frequency, Over Frequency and Rate of Change of frequency
		PT supervision (fuse failure monitoring) for Bus PT-1

		Relay should have a total of 40 DIs and 20 DOs exclusively for SCADA interfacing. DIs and DOs for tripping and interlocking shall be additional as per scheme requirement. If DIs and DOs for tripping and interlocking are integrated with DIs and DOs meant for SCADA (may be done to optimize DI/DO configuration), atleast 4 DIs and 4 Dos should be spare for future use.
		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
19.4.2	Relay 2	PT supervision (fuse failure monitoring) for Bus PT-2
19.4.3	SLD	Refer annexure – F3/F4
19.4.4	Note	One Bus PT should be provided for each bus section
19.5	Protection Relays – SCADA Interfacing Philosophy for all panels	
19.5.1	Configuration and wiring of DIs in Protection Relays for routing status and alarm signals to SCADA through SCADA interface port	DI-1 – TC-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 – Spring Charged DI-7 – L/R switch in Remote DI-8 – L/R switch in Local DI-9 - DC fail DI-10 - AC Fail DI-11 – Gas pressure low in CB Compartment DI-12 –Gas pressure low in busbar compartment DI-13 – PT MCB trip (metering and protection, for incomer and bus coupler panel only) DI-14 – Isolator-1 Open DI-15 – Isolator-1 Close DI-16 – Earth Switch-1 Open DI-17 – Earth Switch-1 Close DI-18 – Isolator-2 Open DI-19 – Isolator -2 Close DI-20 – Earth switch -2 Open(bus coupler panel only) DI-21 – Earth switch -2 Close(bus coupler panel only) Sequence of DIs should be strictly as mentioned above.
19.5.2	Configuration and wiring of DOs in Protection relays for execution of SCADA commands through SCADA interface port	DOs should be wired for operation of CB and three position disconnectors. Sequence of DO assignment should be same in all panels.
19.5.3	Looping of protection relays	All relays in the switchboard have to be looped to form a common bus for interfacing with SCADA.

19.5.4	Spare DIs and DOs	Should be wired upto terminal block for future use.
19.6	Transformer Monitoring cum AVR Relay	
19.6.1	Features	As per annexure –A
19.6.2	Requirement	To be provided in 33KV Transformer feeder panel
19.7	Auxiliary Relays – General Features	
19.7.1	Relays for auxiliary, supervision, trip and timer relays	Static or electromechanical type.
19.7.2	Reset mechanism for auxiliary relays	Self reset contacts except for lock-out relays.
19.7.3	Reset mechanism for lockout relays	Hand reset type.
19.7.4	Operation indicators	With hand-reset operation indicators (flags) or LEDs with pushbuttons for resetting.
19.7.5	Auxiliary supply	50/220VDC. Relays should be suitable for continuous operation at 15% overvoltage
19.8	Auxiliary relays – Requirement	
19.8.1	Anti pumping (94), lockout (86) relays	For each breaker
19.8.2	PT selection relays	To be provided for selection between Bus PT and Line PT of respective sections.
19.8.3	Switchgear with two incomer & bus coupler	Lockout relay (86) contact of each incoming breakers to be wired in series in closing circuit of other incoming breakers & bus coupler.
19.8.4	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.
19.8.5	Auxiliary Relays, contact multiplication relays etc.	To effect interlocks and to exchange signals of status & control
19.8.6	Transformer trouble relays (For Transformer feeder panel only)	Auxiliary relays with indicating flags should be provided for the following trip and alarm commands – a. Buchholz trip b. OSR trip c. PRV trip d. SPR trip e. WTI Trip f. OTI Trip g. Buchholz Alarm h. Low oil level alarm i. OTI Alarm j. WTI Alarm.
19.9	MCBs	
19.9.1	Incoming auxiliary supplies	Shall be protected by MCB at the point of entry to the switchboard

19.9.2	Panel auxiliary supplies	a. All auxiliary supplies (DC, AC, PT supply etc.) shall be protected by MCB of appropriate rating. b. Separate MCBs shall be provided for control, indication and protection circuits of each breaker. For shunt trip circuits the protection shall be rated atleast 300 % of the load.

20.0 ETHERNET SWITCHES & FIBRE OPTICS

20.1	Ethernet Switch	
20.1.1	Numbers	Two at each site
20.1.2	FO Port	16 Nos
20.1.3	RJ 45 Port	4 Nos
20.1.4	Communication Protocol	IEC 61850
20.1.5	Network Protocol	PRP
20.1.6	Downlink Rate	100 MBPS
20.1.7	Uplink Rate	1 GBPS
20.1.8	Coating	Conformal
20.1.9	Power Supply Voltage	220 / 50 VDC as per site condition
20.1.10	Grade	Industrial
20.1.11	Certification required	KEMA,CE & FCC for IEC 61850 compliance
20.1.12	Operating Temperature	
20.1.13	Mounting	In Switchgear Panel
20.1.14	Blinking LED Indicators	On each RJ45 ports
20.1.15	Separate Maintenance/console Part	Required
20.1.16	Latency	Less than or equal to 10 ms
20.1.17	Fibre Optic Compatibility	Multimode, 1310 nm
20.1.18	Placement	Din Rail Arrangement inside Switchgear
20.2	Fibre Optics (Patch Cord) and Ethernet cable	
20.2.1	Connection	From Relays, Meters to Ethernet Switch
20.2.2	Mode of Fibre Optics	Multimode
20.2.3	Wavelength	1310 nm
20.2.4	Ethernet Cable Type	CAT VI
20.2.5	Associated Connectors and Accessories	Required

21.0 SPACE HEATERS, SOCKETS & ILLUMINATION LAMPS

21.1	Space Heaters	
21.1.1	Type	Thermostat controlled with switch for isolation

21.1.2	Location	In Breaker & HV cable compartment, mounted on an insulator. Heater position in cable compartment should be easily accessible after cable termination.
21.2	Illumination lamp with switch	For LV & cable chamber
21.3	Universal type (5/15 A) Socket with Switch	In LV chamber

22.0 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 as well as inside the panels shall be provided with individual name plates with equipment designation/description engraved. b. All front mounted equipment shall be also provided at the rear with individual name plates engraved with tag numbers corresponding to the one shown in the panel internal wiring to facilitate easy tracing of the wiring.
22.1.2	Feeder Nameplates	Large and bold name plate carrying feeder identification/ feeder number shall be provided on the top of each panel on front as well as rear side. On rear side, nameplate should be provided on frame.
22.1.3	Panel Rating Plate	Following details are to be provided on Panel rating plate: a. Manufacturers name or trade mark b. Switchgear designation c. Rated system voltage, phases, wires and frequency d. Rated fault current e. Busbar rating f. Insulation Gas Type and rated filling pressure for insulation g. Alarm pressure for insulation h. Minimum functional pressure for insulation i. Minimum functional pressure for operation j. Design pressure of gas filled compartment k. Year of manufacture l. Warranty Period m. Purchasers name n. Serial no o. Customer – BSES p. PO No. & Date – As per respective PO. q. CT rating details r. PT rating details
22.1.4	CB Rating Plate	a. Type / Model No. b. Month /Year of Manufacturing

		c. Current and voltage rating. d. Rated fault making and breaking current.
22.1.5	Material	Non-rusting metal or 3 ply lamicoid. Nameplates shall be black with white engraved lettering. Stickers are not allowed.
22.1.6	Fixing of rating plates and external nameplates	Shall be riveted to the panels at all four corners. Bolting/screwing is not acceptable.
22.1.7	Fixing of internal nameplates	Internal labels may make use of a durable proprietary labeling system unless specifically indicated otherwise.
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.

23.0 FINISH

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

24.0 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
24.4	Contact Multiplication Relays	Alstom/Schneider/Siemens/ABB
24.5	Contactors	ABB/Siemens/Schneider/ Telemechanique
24.6	MCBs	Siemens/Schneider/Legrand/ABB
24.7	Control switches	Switron/Kaycee
24.8	Test terminal blocks	IMP/Schneider/Alstom
24.9	Terminal blocks	Elmex/Connectwell
24.10	Indicating lamps	Siemens/Teknic/ Binay
24.11	Surge Suppressors	Oblum/Tyco/NKT/Nexans
24.12	Cable termination	Pfisterer/Sudkabel/ NKT/ Euromold

24.13	Multifunction Meter	Rishabh
24.14	Ethernet Switches	Ruggedcom/Hirschmann

25.0 INSPECTION AND TESTING

25.1	Type Tests	The product must be of type tested quality as per applicable Indian standards / IEC
25.2	Type test report validity period	Last five years from date of bid submission. Bidder with type test report more than 5 years old needs to re-conduct the tests without any commercial implication to BSES
25.3	Pressure relief device operation	Test certificate for panel to be submitted
25.4	Acceptance & Routine tests	To be done as per this specification and relevant standards. Charges for all these tests shall be deemed to be included in the equipment price. In addition to these tests, following tests have to be carried out as acceptance tests -
25.5	Primary injection test	To be carried out on panels selected for testing
25.6	Temperature rise test	One panel per Purchase order (PO with minimum 10 panels) without any commercial implication to BSES. In-house testing is acceptable.
25.7	Paint Thickness/ Peel off	To be carried out on panels selected for testing
25.8	Inspection	The purchaser/owner reserves the right to witness all the acceptance/routine tests during inspection.
25.9	Notice to purchaser for conducting type tests	At least three weeks in advance
25.10	Test reports before dispatch for approval	Six (6) copies of acceptance and routine test reports
25.11	Vendor quality plan	To be submitted for purchaser approval
25.12	Inspection points	To be mutually identified & agreed in quality plan

26.0 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

27.0 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 Bidder shall be responsible for all transit damage due to improper packing.

28.0 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.

29.0 DEVIATION

29.1	Deviation	Deviations from this Specification shall be provided in excel sheet 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.

30.0 ACCESSORIES & SPARES

30.1	Accessories	Should be supplied alongwith the switchgear in accordance with annexure-C
30.2	Spares	Should be supplied alongwith the switchgear in accordance with annexure- D

31.0 DRAWINGS & DATA SUBMISSION MATRIX

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

- All documents/drawings shall be provided in soft copy only in returnable Pen drives
- 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, 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	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
31.1	Contact Person Name, Email ID and Mobile Number	Required	Required		
31.2	Consolidated Deviation Sheet	Required	Required		
31.3	GTP	Required	Required		
31.4	Relevant Type Test as per IS/IEC (including internal arc withstand performance)	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		
31.8	Recommended Spares Apart from spares stated in Spec(for five years of operation)		Required		
31.9	**33 kV Switchgear drawing**				

31.9.1	General Arrangement	Required	Required		
31.9.2	Sectional Layout				
31.9.3	Door Layout		Required		
31.9.4	LV Box Internal Layout		Required		
31.9.5	Gas Pressure Diagram		Required		
31.9.6	SLD	Required	Required		
31.9.7	Gas SLD	Required	Required		
31.9.8	Schematic Circuit diagram and Scheme of Each type of Panel		Required		
31.9.9	Communication Architecture		Required		
31.9.10	Bus Bar Arrangement		Required		
31.9.11	QAP		Required		
31.9.12	Panel wise BOQ		Required		
31.9.13	Logic Operation Diagram		Required		
31.9.14	Plan		Required		
31.9.15	Synch Logic Diagram		Required		
31.9.16	Foundation Diagram		Required		
31.9.17	DI sheet		Required		
31.9.18	DO Sheet		Required		
31.9.19	TB Details		Required		
31.9.20	Make of all Component as per specification		Required		
31.10	Drawing of Substation Room		Required		
31.11	Ventilation detail requirement of GIS Room		Required		
31.12	Installation, erection and commissioning manual for switchgear		Required		
31.13	Inspection Reports			Required	
31.14	As manufacturing Drawings			Required	
31.15	Operation and Maintenance Manual			Required	
31.16	Trouble shooting manual			Required	
31.17	As built Drawings				Required
31.18	Test Report				Required

ANNEXURE – A – TRANSFORMER MONITORING CUM AVR RELAY

1	General features	
1.1	Technology and Functionality	Microprocessor based with provision for multifunction control and monitoring.
1.2	Mounting	Flush Mounting
1.3	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
1.4	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.
1.5	Programming and configuration	AVR shall utilize a user friendly setting and operating multi-lingual software in windows environment with menus and icons for fast access to the data required.
1.6	User Machine Interface	UMI with an alphanumeric key pad and graphical LCD display with backlight indicating measurement values and operating messages. Capability to access and change all settings and parameters.
1.7	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.
1.8	SCADA Interface port	LC Type Dual fibre optic port for interfacing with SCADA on IEC 61850 with PRP compatibility. Through these ports relays shall be connected to switches. Ethernet switches at switchgear end shall be suitably mounted in an auxiliary compartment in switchgear panel.
1.9	Self diagnosis	Shall be able to detect internal failures. A watchdog relay with changeover contact shall provide information about the failure.
1.10	Cable Termination	Termination of cable shall be at rear side.
1.11	Auxiliary supply	220VDC or 48VDC
2	Inputs and Outputs	
2.1	CT Input	1/5A selectable through programming
2.2	PT Input	110VAC
2.3	Binary Inputs	Sixteen programmable binary inputs should be provided
2.4	Analog Inputs (4-20mA)	One input to be provided
2.5	PT-100 direct input	Two inputs to be provided
2.6	Direct Resistance Input	For tap position indication (18 steps)

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

ANNEXURE – B – TECHNICAL PARTICULARS (DATA BY PURCHASER)

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

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

4.6	Rated voltage factor	1.2 continuous, 1.9 for 30 seconds
4.7	Class of insulation	Class E or better
4.8	Accuracy class	
4.8.1	Protection	3P
4.8.2	Metering	0.2
5.0	**SURGE ARRESTORS**	
5.1	Rated Voltage	30kV
5.2	Maximum continuous operating voltage (MCOV)	25kV
5.3	Discharge current	10kA
5.4	Discharge class	3

ANNEXURE – C – MANDATORY ACCESSORIES FOR EACH SWITCHBOARD SET

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

ANNEXURE – D – SPARES REQUIREMENT

S No.	Description	Qty
1	Numerical relay of each type	1
2	Auxiliary Relay of each type	5
3	Contactors of each type	5
4	Contact Multiplication Relay of each type	5
5	Line voltage transformer	3 (1 set)
6	Bus voltage transformer	3 (1 set)
7	GIS End Termination Kit	2
8	Ethernet Switch	1 No (Each Site)
9	Optical Fibre	20% of Supplied Items
10	CAT VI Ethernet cable for Communication	20% of Supplied Items
11	Current transformers suitable for incomer panel	3 (1 set)
12	Current transformers suitable for transformer panel	3 (1 set)
13	Current transformers suitable for bus coupler panel	3 (1 set)
14	Trip Coil	4
15	Closing Coil	4
16	CB Spring charging motor	2
17	Auxiliary switch	2 sets (2 Nos. each type)
18	Disconnector motor for isolator	1
19	Disconnector motor for earthswitch	1
20	Gas density switch	2
21	Bursting disc / pressure relief plate complete	2
22	Capacitive voltage indicator	6 (2 sets)
23	Mobile gas filling and evacuation device -DILO make	1
24	SF6 Gas cylinders	4
25	SCADA Spares	20% of Supplied Items
26	Other spares recommended by manufacturer may be added to this list	

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

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

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	UNITS	DATA SPECIFIED BY PURCHASER	DATA PROVIDED BY BIDDER
1.00	**SITE CONDITIONS**			
1.01	Altitude	meters	1 -50	
1.02	Maximum Ambient Temperature	°C	45	
1.03	Minimum Ambient Temperature	°C	0	
1.04	Design Ambient Temperature	°C	50	
1.05	Relative Humidity	%	100	
2.00	**PARAMETERS**			
2.01	Voltage	kV	33	
2.02	Phases	-	3	
2.03	Frequency	Hz	50	
2.04	Short Time Rating for 3 Sec	kA	31.5	
2.05	Voltage Class	kV	36	
2.06	Insulation level (PF rms / Impulse peak)	kVrms / kVpeak	70/170	
2.07	Internal arc test			
a	Rated current and duration	kA, sec		
b	Classification			
3.00	**ENCLOSURE TYPE**		IP65 / IP4X	
3.01	Rear Doors	-	Manufacturers Standard	
3.02	Indoor / Outdoor	-	Indoor	
3.03	Arc Resistant	-	YES	
3.04	Tamperproof Category		YES	
3.05	Dust resistant (gasketed)	-	YES	
4.00	**PANEL CONSTRUCTION**			
4.01	Gas pressure – busbar compartment		Bar / MPa	
a	Normal gas pressure		Bar / MPa	
b	Permitted range of Gas pressure for safe operation		Bar / MPa	
c	Alarm level		Bar / MPa	
d	Gas pressure for operation of PRD		Bar / MPa	
e	Withstand gas pressure of enclosure		Bar / MPa	
f	Number of aux.contacts /stages provided for the gas density meter			
4.02	Gas pressure – breaker		Bar / MPa	

S No.	DESCRIPTION	UNITS	DATA SPECIFIED BY PURCHASER	DATA PROVIDED BY BIDDER
	compartment			
a	Normal gas pressure		Bar / MPa	
b	Permitted range of Gas pressure for safe operation		Bar / MPa	
c	Alarm level		Bar / MPa	
d	Gas pressure for operation of PRD		Bar / MPa	
e	Withstand gas pressure of enclosure		Bar / MPa	
f	Number of aux. contacts /stages provided for the gas density meter			
4.03	Material and thickness of gas enclosure			
4.04	Total no. of Gas compartments per panel		No.	
4.05	Number of Gas Density meters provided per panel		No.	
4.06	Rating of Isolator (A)		Same as CB rating	
4.07	Rating of earthing switch (A)		Same as CB rating	
4.07	Guaranteed Gas leakage Rate		< 0.5 %	
4.08	Rodent damage protection		YES	
4.09	Ground and test device		YES	
4.10	Equipment Labeling		Anodized aluminium	
4.11	Lift truck		If required	
4.12	Testing facility			
a	For Cable		Required	
b	For CT		Required	
c	For PT		Required	
5.00	**BUS INFORMATION**			
5.01	Material		Copper	
5.02	Bus Joint Plating		Manufacturers Standard	
5.03	Rated Continuous Current	A rms	2000 A	
5.04	Short time Withstand Current	A rms	31.5kA for 3 Sec	
6.00	**BUS SUPPORTS AND INSULATION**			
6.01	Manufacturer's Standard & Type		Manufacturers Standard	
6.02	Material		Manufacturers Standard	
7.00	**POWER CABLE ACCOMMODATION**			

S No.	DESCRIPTION	UNITS	DATA SPECIFIED BY PURCHASER	DATA PROVIDED BY BIDDER
7.01	Power Cable entry		Bottom	
7.02	Terminal lug type		Socket & Plug for SF6	
7.03	Qty of power cables per phase per compartment	qty	As per specification and SLD	
7.04	Make of termination			
8.00	**CIRCUIT BREAKER INFORMATION**			
8.01	Manufacturer / Model No.			
8.02	Type (SF6/Vacuum)		Manufacturers Standard	
8.03	Rated Short-Circuit Current	kA	31.5 kA	
8.04	Short circuit-Current Withstand Time	sec	3	
8.05	Rated Maximum Voltage	kV rms	36	
8.06	Rated Voltage Range Factor, K		1.1	
8.07	Power Frequency Withstand Voltage	kV rms	70	
8.08	Lightning Impulse Withstand Voltage	kV crest	170	
8.09	Rated Continuous Current	A rms	As per single line drawing.	
8.10	Rated Transient Recovery Voltage Time to Peak (T2)	microsec	Manufacturers Standard	
8.11	Switching duty/capability			
a	Power Transformers (oil filled)	Capacity		
b	Cables	Length		
c	Over head lines	Length		
8.12	Rated Interrupting Time	ms	60	
8.13	Time for Opening Operation	cycles	3	
8.14	Time for Closing Operation	cycles	4	
8.15	Closing and latching capability (peak)	kA	Manufacturers Standard	
8.16	Control Power Voltage Range, Trip Coil	V dc	220/50	
8.17	Control Power Voltage Range, Closing Coil	V dc	220/50	
8.18	Auxiliary Contacts Total	qty	12	
8.19	Min. Auxiliary Contacts for Customer use	qty	6	
8.20	Auxiliary Contact voltage rating	V dc	220 / 50	
8.21	Auxiliary Contact current	Amps	10	

S No.	DESCRIPTION	UNITS	DATA SPECIFIED BY PURCHASER	DATA PROVIDED BY BIDDER
	rating			
8.22	Stored Energy System Minimum Voltage	V dc	187	
8.23	Stored Energy Spring Charging Motor Current	Amps	MS	
8.24	Stored Energy Spring Charging Motor Inrush	Amps	MS	
8.25	Stored Energy Time to Fully Recharge Spring:	seconds	MS	
8.26	Rated Operating duty cycle		O – 0.3Sec – CO - 3min -CO	
8.27	Rated out of phase switching capability to IEC 56			
8.28	Operating Power Consumption			
a	Trip Coil	Watt		
b	Closing Coil	Watt		
c	Operating Motor	Watt		
8.29	Number of trip coils	Nos.	2	
8.30	Quantity of Gas in CB			
a	Mass			
b	Volume at Normal Pressure	CuM		
8.31	Interrupting Gas Pressure Maximum / Normal / Minimum	Bar (Absolute)		
8.32	Number of Close / Open Operation possible without re-charging	No.		
8.33	Number of operations possible before interrupter maintenance required			
a	At rated S.C. current	Nos.		
b	At full load current	Nos.		
c	At no load	Nos.		
8.34	Method used to relieve internal overpressure due to short circuit (Bursting disc / relief valve / none. Etc.)			
8.35	Operating pressure of pressure relief device			
9.00	**PROTECTIVE RELAYS**			
9.01	Manufacturer		By Seller	
9.02	Model no. of each relay			
9.03	Relay functions		As per specification	

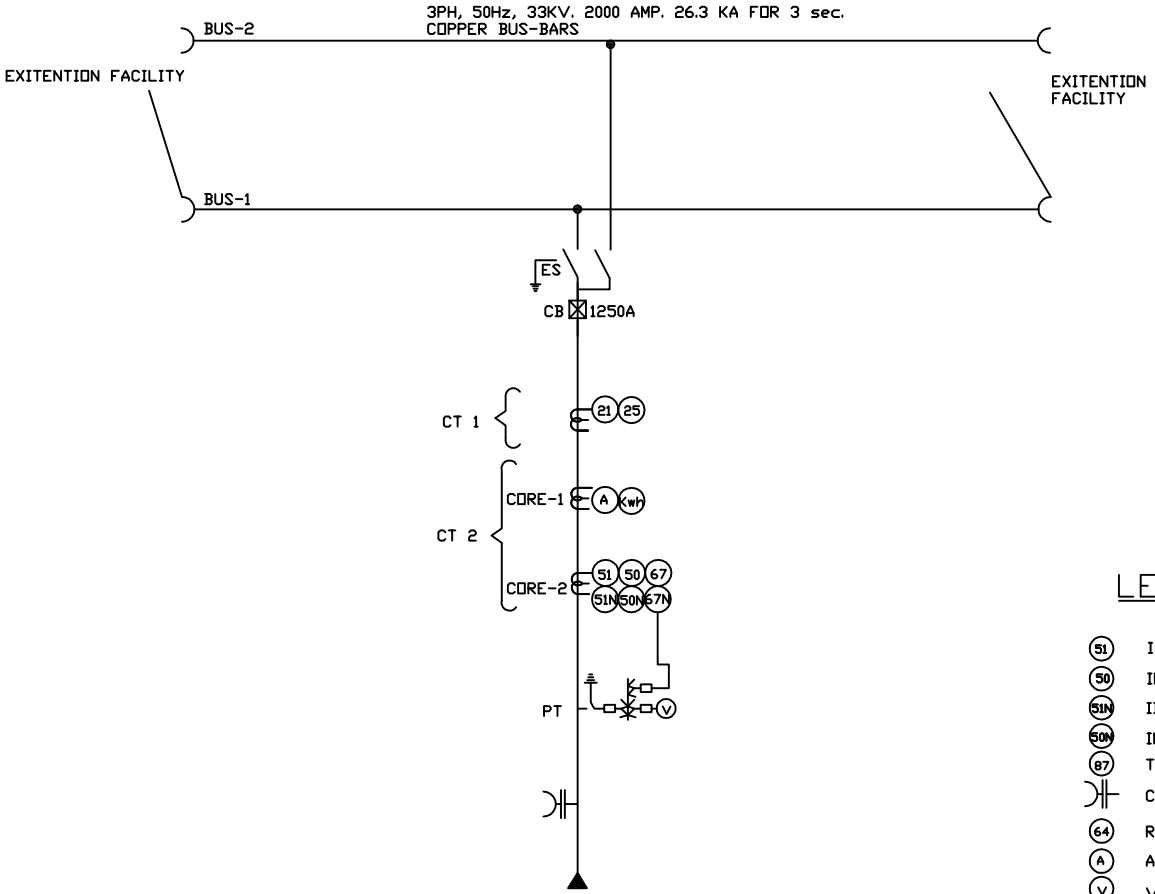
S No.	DESCRIPTION	UNITS	DATA SPECIFIED BY PURCHASER	DATA PROVIDED BY BIDDER
9.04	Relay Communication		IEC 61850	
10.00	**MULTI FUNCTION METER**			
10.01	Model		Rish Delta Energy	
10.02	Make		Rishabh	
10.03	SCADA Interfacing		RS485 rear port suitable for integration on Modbus Protocol	
10.04	Size	mm^2	96x96	
10.05	Panels where to be provided		All panels	
10.06	Accuracy Class		1	
10.07	Auxiliary Supply		48 – 240VDC and AC i.e universal type.	
11.00	**CONTROL WIRING**		See Specification	
11.01	Type		XLPE or PVC	
11.02	Control wire Size minimum:		1.5 mm	
11.03	Voltage Rating:	Vac	600/1000V	
11.04	FRLS type		Yes	
12.00	**CURRENT TRANSFORMERS**		As per SLD	
	(Details to be furnished for each type of CT)			
12.01	Manufacturer/Model Number:			
12.02	Accuracy Class		As per SLD	
12.03	Ratio		As per SLD	
12.04	Burden		As per SLD	
12.05	Knee point voltage		As per SLD	
12.06	Rct			
12.07	Excitation current		As per SLD	
13.00	**VOLTAGE TRANSFORMERS**			
13.01	Manufacturer			
13.02	Model Number			
13.03	Accuracy		As per SLD	
13.04	Secondary MCB		Required	
13.05	Burden		As per SLD	
13.06	Disconnecting switch for VT		Required	
14.00	**PANEL ACCESSORIES**			
14.01	Indications		LED type	
14.02	Control switches			
a	Make			
b	Type			
c	Rating			
14.03	L/R switch			

S No.	DESCRIPTION	UNITS	DATA SPECIFIED BY PURCHASER	DATA PROVIDED BY BIDDER
a	Make			
b	Type			
c	Rating			
14.04	CT & PT Terminal blocks			
a	Make			
b	Type		Disconnecting	
c	Size			
d	Rating			
14.05	Terminal blocks			
a	Make			
b	Type		Non-Disconnecting	
c	Size			
d	Rating			
15.00	**HEAT LOSS**			
15.01	Bus Losses	Watts		
15.02	Heat loss at rated breaker current –2000 A	W/bkr		
15.03	Heat loss of space heater per vertical section	W/vrtl		
16.00	**INSTALLATION INFORMATION**			
16.01	Mass of heaviest piece to be shipped as a unit	kg		
16.02	Largest section to be shipped a unit -Length:	mm		
16.03	Largest section to be shipped a unit -Width:	mm		
16.04	Largest section to be shipped a unit -Height:	mm		
16.05	Total Mass of assembly to be shipped	kg		
16.06	Total assembly (breaker line-up only) -Length	mm		
16.07	Total assembly (breaker line-up only) -Width	mm		
16.08	Total assembly (breaker line-up only) -Height	mm		
16.09	Transition section (breaker line-up only) -Mass	kg		
16.10	Transition section (breaker line-up only) -Length	mm		
16.11	Transition section (breaker line-up only) -Width	mm		
16.12	Transition section (breaker	mm		

S No.	DESCRIPTION	UNITS	DATA SPECIFIED BY PURCHASER	DATA PROVIDED BY BIDDER
	line-up only) -Height			
16.13	Total Number of shipping sections per line up:	qty		
17.00	**PANEL DIMENSIONS**			
17.01	Incomer (Width x Depth x Height)	mm		
17.02	Bus-coupler (Width x Depth x Height)	mm		
17.03	Outgoing (Width x Depth x Height)	mm		
17.04	Overall length of Complete board	mm		
18.00	**CONTROL AND AUXILIARY SUPPLY**			
18.01	Buyer Control power supply (Volts)		220 V / 50V , +15% & -15%V DC	
18.02	Buyer Control power current rating (A)		15 A	
18.03	Buyer control power supply short circuit level		30 kA	
18.04	Buyer AC power supply (Volts)		240 V + 10%	
18.05	Buyer AC power supply current rating (A)		20A	
18.06	Buyer AC power supply short circuit rating (kA)		50 kA	
19.00	**PAINTING / FINISHING**			
19.01	Manufacturer's Standard		Manufacturer's Paint Spec doc. No.	
19.02	Color		RAL7032	
20.00	**MODULE REPLACEMENT**			
20.01	Complete panel replacement duration (at site)	Hours		
20.02	CB Module replacement duration (at site)	Hours		
20.03	Bushing Replacement duration (at site)	Hours		

ANNEXURE – F – SINGLE LINE DIAGRAMS

ANNEXURE-F1



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

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

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

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

LEGEND:

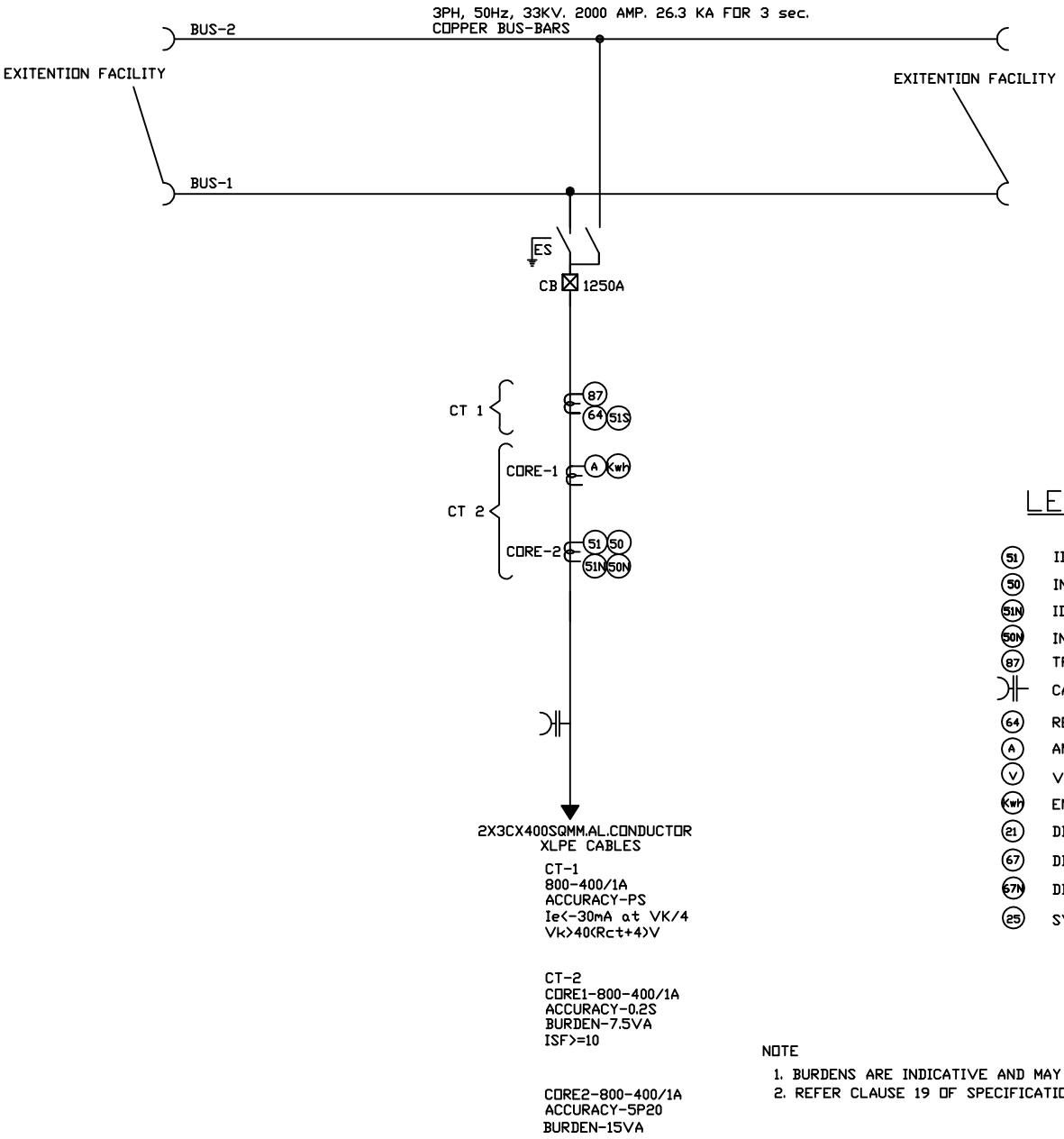
51	IDMT PHASE OVER CURRENT RELAY
50	INSTANTANEOUS PHASE OVER CURRENT RELAY
51N	IDMT EARTH FAULT RELAY
50N	INSTANTANEOUS EARTH FAULT RELAY
87	TRANSFORMER DIFFERNTIAL RELAY
	CAPACITIVE VOLTAGE INDICATOR
64	RESTRICTED EARTH FAULT RELAY (33 KV OF TRANSFORMER)
A	AMMETER WITH SELECTOR SWITCH
V	VOLTMETER WITH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

NOTE

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

DRAWN	R.K/A.H J.A/A.M	TITLE:- STANDARD SLD FOR 33KV INCOMER	BSES
CHECKED	S.G/A.S		
APPD.	G.S/G.N		SPECIFICATION NO. BSES-TS-65-33GIS-R0
DATE	28.04.22		SLD-GIS-33KV-01
SCALE	NTS		

ANNEXURE-F2



LEGEND:

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

NOTE

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

DRAWN	R.K/A.H J.A/A.M
CHECKED	S.G/A.S
APPD.	G.S/G.N
DATE	28.04.22
SCALE	NTS

TITLE:-

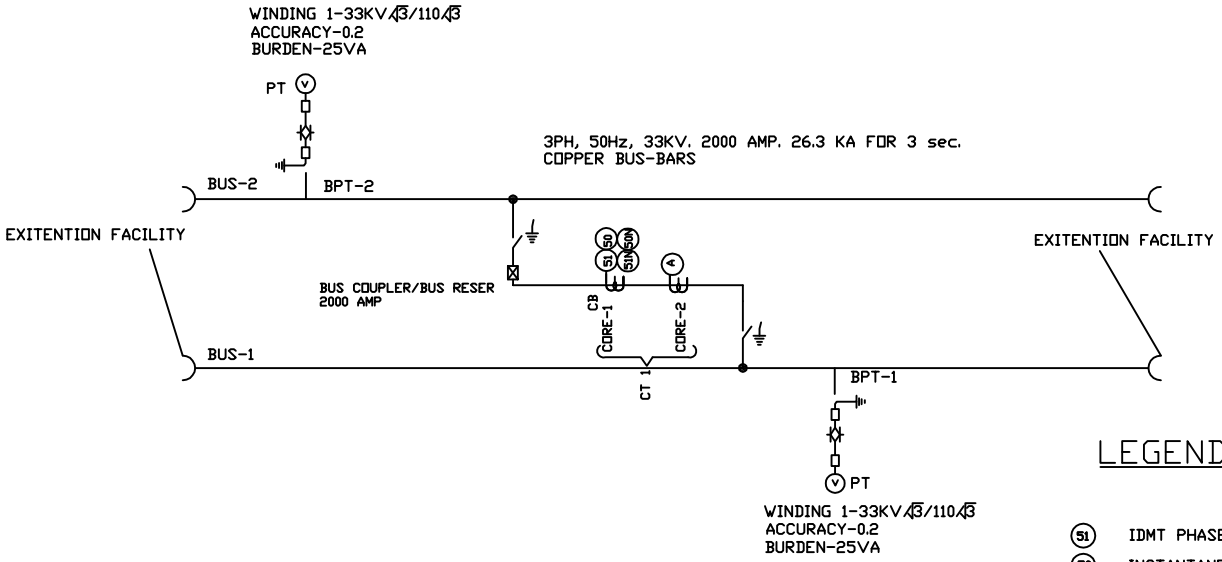
STANDARD SLD FOR 33KV TRANSFORMER FEEDER

BSES

SPECIFICATION NO. BSES-TS-65-33GIS-R0

SLD-GIS-33KV-02

ANNEXURE-F3



CT-1

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

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

LEGEND:

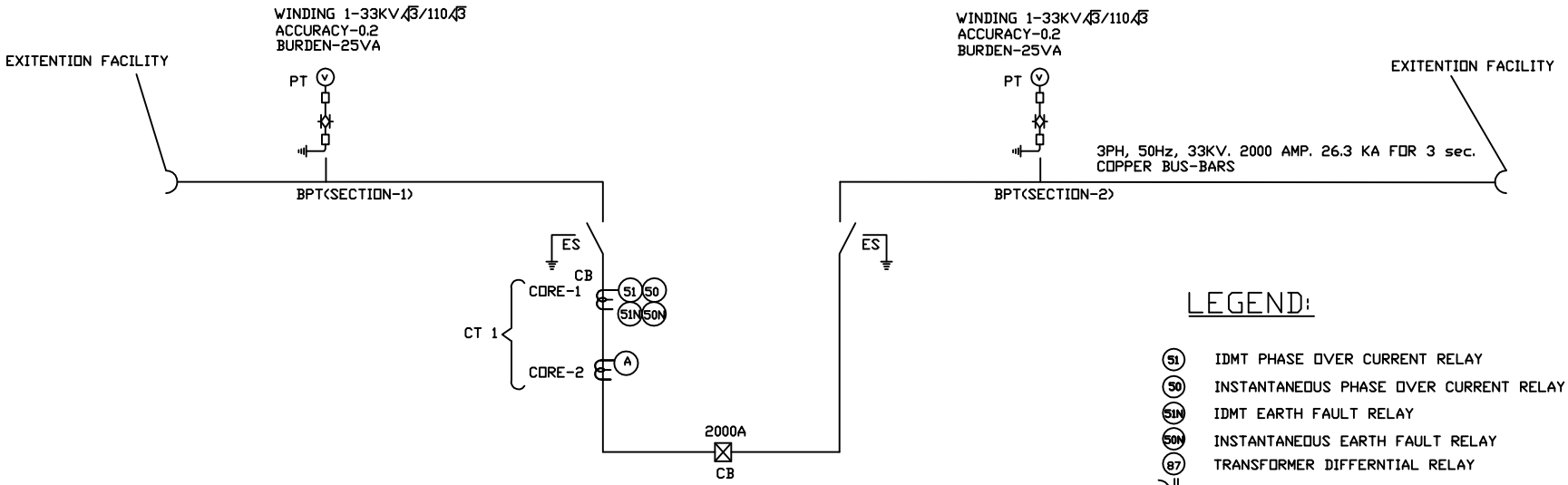
51	IDMT PHASE OVER CURRENT RELAY
50	INSTANTANEOUS PHASE OVER CURRENT RELAY
51N	IDMT EARTH FAULT RELAY
50N	INSTANTANEOUS EARTH FAULT RELAY
87	TRANSFORMER DIFFERNTIAL RELAY
	CAPACITIVE VOLTAGE INDICATOR
64	RESTRICTED EARTH FAULT RELAY (33 KV OF TRANSFORMER)
A	AMMETER WITH SELECTOR SWITCH
V	VOLTMETER WITH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

NOTE

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

DRAWN	R.K/A.H J.A/A.M	TITLE:- STANDARD SLD FOR 33KV BUS COUPLER CUM BUS PT	BSES
CHECKED	S.G/A.S		
APPD.	G.S/G.N		SPECIFICATION NO. BSES-TS-65-33GIS-R0
DATE	28.04.22		SLD-GIS-33KV-03
SCALE	NTS		

ANNEXURE-F4



CT-1

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

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

LEGEND:

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

NOTE

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

DRAWN	R.K/A.H J.A/A.M
CHECKED	S.G/A.S
APPD.	G.S/G.N
DATE	28.04.22
SCALE	NTS

TITLE:-

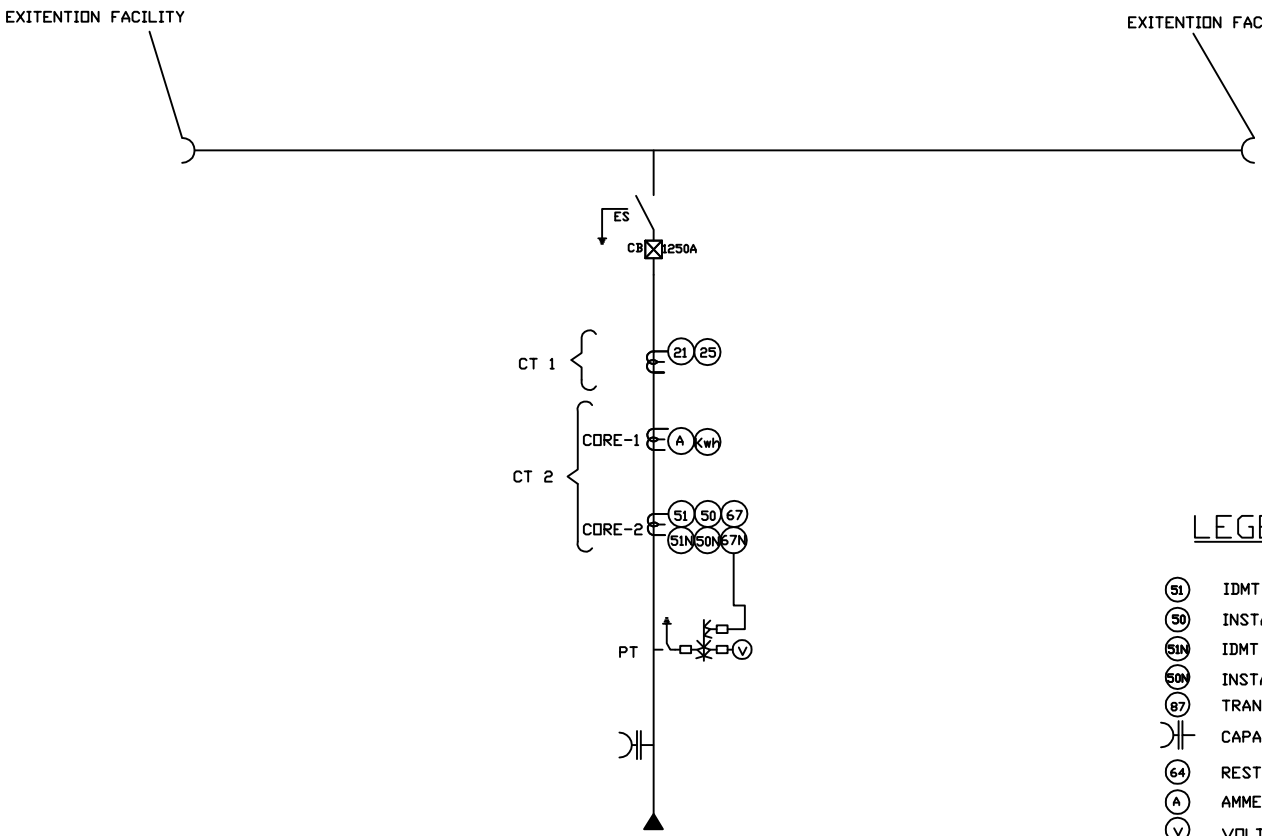
STANDARD SLD FOR 33KV BUS SECTIONALIZER CUM RISER CUM BUS PT

BSES

SPECIFICATION NO. BSES-TS-65-33GIS-R0

SLD-GIS-33KV-04

ANNEXURE-F5



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

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

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

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

LEGEND:

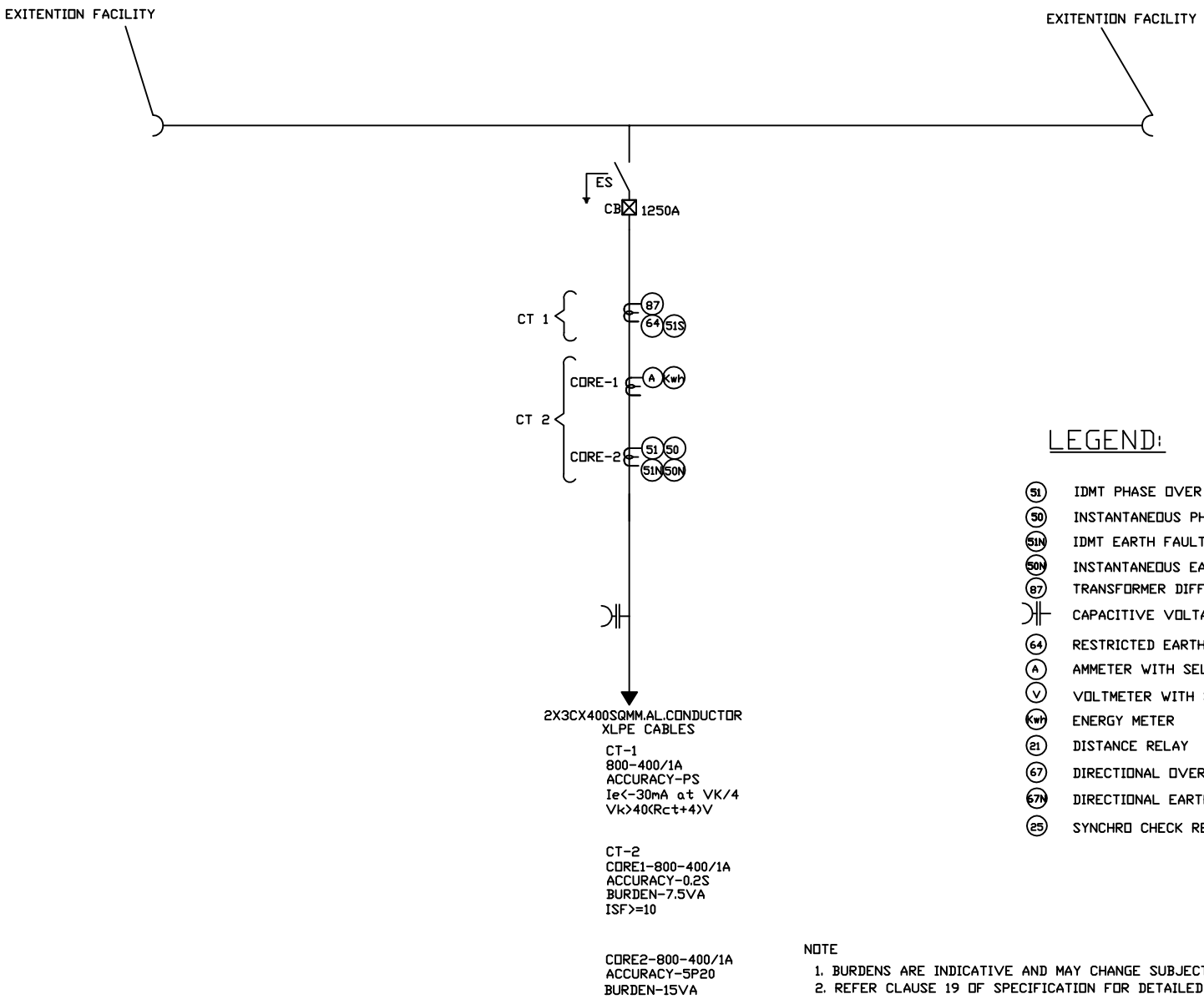
51	IDMT PHASE OVER CURRENT RELAY
50	INSTANTANEOUS PHASE OVER CURRENT RELAY
51N	IDMT EARTH FAULT RELAY
50N	INSTANTANEOUS EARTH FAULT RELAY
87	TRANSFORMER DIFFERNTIAL RELAY
	CAPACITIVE VOLTAGE INDICATOR
64	RESTRICTED EARTH FAULT RELAY (33 KV OF TRANSFORMER)
A	AMMETER WITH SELECTOR SWITCH
V	VOLTMETER WITH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

NOTE

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

DRAWN	R.K/A.H J.A/A.M	TITLE:- STANDARD SLD FOR 33KV INCOMER	BSES
CHECKED	S.G/A.S		
APPD.	G.S/G.N		SPECIFICATION NO. BSES-TS-65-33GIS-R0
DATE	28.04.22		SLD-GIS-33KV-05
SCALE	NTS		

ANNEXURE-F6



LEGEND:

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

NOTE

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

DRAWN	R.K/A.H J.A/A.M	TITLE:- STANDARD SLD FOR 33KV TRANSFORMER FEEDER	BSES
CHECKED	S.G/A.S		
APPD.	G.S/G.N		SPECIFICATION NO. BSES-TS-65-33GIS-R0
DATE	28.04.22		SLD-GIS-33KV-06
SCALE	NTS		

BSES

Technical Specification of Power Transformer

Specification no – BSES-TS-24-TRPU-R0

Rev:		0
Date:		08 Apr 2022
Pages		90
Prepared by	Abhishek Harsh	
	Javed Ahmed	
Reviewed by	Srinivas Gopu	
	Abhinav Srivastava	
Approved by	Gaurav Sharma	
	K. Sheshadri	

08/04/22

INDEX

RECORD OF REVISION

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

1.0 SCOPE OF SUPPLY

For scope of supply, refer Annexure A

2.0 CODES & STANDARDS

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

IS 2026	Power Transformers
IS 2026-4	Terminal Marking, tappings and Connections for Power Transformers.
IS:3347	Dimensions for Porcelain Transformer bushing
IS:3637	Gas operated relays
IS:3639	Fitting & Accessories for power transformers
IS:4201	Application guide for CT's
IS:8478	Application guide for On-load tap changer
IS:10028	Code of practice for selection, installation & maintenance of transformers
IS 5561	Electrical Power Connectors
IS 5	Colors for ready mix paints
IS:335	Insulating oil
IS 6272	Industrial cooling fans
IS 12615	Three phase induction motors
IS/IEC 60034	Rotating Electrical Machines. (e.g. For Cooler Fan Motors.)
IS/IEC 60071	Co-ordination of Insulation.
IS 16227/IEC 61869	Current Transformers.
IS 8468/ IEC 60214	On Load Tap Changers
IS2026-7/IEC 60076-7	Loading Guide for Oil-Immersed Power Transformers.
IS 2026-8 /IEC 60076-8	Application Guide for Power Transformers.
IS 2026-10/IEC 60076-10	Determination of Transformer Sound Levels.
IS/IEC 60529	Degrees of Protection Provided by Enclosures (IP Code).
IS/IEC 60947	Low-Voltage Switchgear and Control gear.
IS/IEC 60137	Bushing for alternating voltage above 1000V
IS:1271/IEC 60085	Thermal evaluation and classification of electrical insulation
IEC 60076	Power transformers.
IEC 60156	Method for Determination of the Electric Strength for Insulating Oils.
IEC 60296	Specification for Unused Mineral Insulating Oils for Transformers and Switchgear.
IEC 60445	Basic& Safety principles for man-machine interface, marking and identification, Identification of Equipment Terminals and conductor terminals
BS 148	Determination of Transformer and Reactor Sound Levels.

BS 223	Application Guide for Power Transformers.
BS 2562	Terminal and Tapping Markings for Power Transformers.
	Indian Electricity Rules
	Indian Electricity Act
	CBIP manual

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

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

3.0 MAJOR DESIGN CRITERIA & PARAMETERS OF THE TRANSFORMER

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

4.0 CONSTRUCTION & DESIGN

4.1	Type	ONAN/ONAF, Copper wound, three phase, oil immersed with on load tap changer
4.1.1	Essential provision for ONAF cooling	See note 1 of Annexure C
4.1.2	Provision of mounting cooling fan at site in future at service condition.	Required
4.1.3	Provision of replacement of cooling fan at site in future at service condition	Required
4.1.4	Fan guard if fans mounted in future.	Required
4.2	Major parts	
4.2.1	Tank	
4.2.1.1	Material of construction	Robust mild steel plate without pitting and low carbon content
4.2.1.2	Plate thickness	Adequate for meeting the requirements of pressure and vacuum type tests as per CBIP. Test will be conducted on each transformer tank for design validation.
4.2.1.3	Welding features	i) All seams and joints shall be double welded ii) All welding shall be stress relieved for sheet thickness greater than 35 mm iii) All pipes, radiators, stiffeners, welded to the tank shall be welded externally
4.2.1.4	Tank feature	i) Adequate space at bottom for collection of sediments ii) Stiffeners provided for rigidity and Designed to prevent accumulation of water iii) No internal pockets in which gas / air can accumulate iv) No external pockets in which water can lodge v) Tank bottom with welded skid base vi) Tank cover sloped to prevent retention of rain water vii) Minimum disconnection of pipe work and accessories for cover lifting viii) Tanks shall be of a strength to prevent permanent deformation during lifting, jacking, transportation with oil filled ix) Tank to be designed for oil filling under vacuum x) Fitted with lifting lug to lift the tank cover only xi) Manhole of sufficient size required for inspection of core and winding

		xii) Oil level indicator for transportation
4.2.1.5	Flanged type adequately sized inspection cover rectangular in shape required for	i) HV line bushing ii) LV line bushing iii) LV neutral bushing and NCT connection iv) OLTC to winding connection from both sides v) Core assembly ear thing Inspection covers should be provided with jacking screws & handle and shall not weigh more than 25 KG . Overall design shall be in such a way that there shall not be any hindrance/overlapping of some other component, in front of any of the inspection covers.
4.2.1.6	Fittings and accessories on main tank	See under fittings and accessories
4.2.2	Conservator for the main tank	
4.2.2.1	Capacity	Adequate between highest and lowest visible levels to meet the requirement of expansion of oil volume in the transformer and cooling equipment from minimum ambient temperature to 100 °C
4.2.2.2	Conservator oil preservation system	By flexible rubber bag (air cell) placed inside conservator
4.2.2.3	Air cell material	Special type of fabric coated with special grade nitrile rubber, outer surface oil resistant and inner surface ozone resistant
4.2.2.4	Conservator features	i) Conservator shall be bolted into position so that it can be removed for cleaning / other maintenance purposes ii) Main pipe from tank shall project about 20 mm above conservator bottom for creating a sump for collection of impurities iii) Conservator minimum oil level corresponding to minimum temperature shall be well above the sump level iv) It shall be possible to remove and Replace the air cell if required v) Conservator to main tank piping shall be supported at minimum two points.
4.2.2.5	Fittings and accessories on main tank conservator	i) Prismatic oil gauge with NORMAL, MINIMUM and MAXIMUM marking. ii) End cover. iii) Oil filling hole with cap iv) Magnetic oil gauge with LOW LEVEL Alarm contact. v) Silica Gel dehydrating breather with Oil seal and dust filter with clear acrylic single piece clearly transparent cover resistant to UV rays.

		vi) Drain cum filling valve (gate valve) with locking rod and position Indicator made of Brass, 25 mm with Cover plate. vii) Shut off valve (gate valve) with position indicator made of Brass Located before and after Buccholz relay, 80 mm. viii) Flange for breather connection. ix) Air release valve on conservator (gate valve) made of Brass, 25 mm with cover plate x) Air release plug as required
4.2.2.6	Essential provision for mounting of conservator	Conservator to be mounted in such a manner that the top cover of the transformer can be lifted without disturbing the conservator
4.2.2.7	Essential provision for breather	i) Breather body should be Aluminum pressure die casted, shot blasted and power coated. ii) Container and oil cup should be 143R grade UV resistant polycarbonate. iii) All gaskets should be of nitrile cork rubber. iv) Breather should be flanged type not threaded type v) Breather piping shall not have any valve placed in between vi) Breather piping from conservator shall be supported in such a manner that the maximum unsupported length of the of the breather piping shall not be more than 3 meters vii) Breather shall be removable type mounted at a height of 1400 mm from ground level. viii) Silica Gel used in breather should be of ix) ROUND BALL type & 2.5 mm dia. Breather shall be tested for 0.35 kg/cm for all joints
4.2.3	Conservator for OLTC	
4.2.3.1	Capacity	i) Adequate between highest and lowest visible levels to meet the requirement of expansion of oil volume in the OLTC from minimum ambient temperature to 100 deg cent. . ii) Separate conservator to be provided for OLTC and Main tank
4.2.3.2	Conservator oil preservation system	Conventional
4.2.3.3	OLTC conservator features	Same as 4.2.2.4 except air cell features
4.2.3.4	Fittings and accessories on OLTC conservator	i) Prismatic oil gauge with NORMAL and MINIMUM marking ii) End cover

		iii) Oil filling hole with cap iv) Magnetic oil gauge with LOW LEVEL Alarm contact v) Silica gel dehydrating breather with oil seal and dust filter with clear acrylic single piece clearly transparent cover resistant to UV rays vi) Drain valve (gate valve)With locking rod and position Indicator made of Brass, 25 mm with cover plate vii) Shut off valve (gate valve) with Position indicator made of Brass ocated before oil surge relay, 25 mm viii) Flange for breather connection ix) Air release plug as required
4.2.3.5	Essential provision for mounting of OLTC conservator	OLTC conservator to be mounted in such a way that the OLTC can be inspected / maintained without disturbing the OLTC conservator
4.2.3.6	Essential provision for OLTC breather	i) Breather piping shall not have any valve placed in between ii) Breather piping from conservator shall be supported in such a manner that the maximum unsupported length of the of the breather piping shall not be more than 3 meters iii) Breathers shall be removable type mounted at suitable height from ground so that it can be attended to easily for inspection / maintenance
4.2.4	Radiators	
4.2.4.1	Material	Pressed Steel
4.2.4.2	Thickness	Minimum 1.2 mm
4.2.4.3	Features	Detachable type with lifting lugs, air release plug, drain plug, isolating valve top and bottom in each radiator, Radiator support from ground if required
4.2.4.4	Essential provision if radiators mounted separately	Expansion bellow to be provided in the pipes between main tank and radiator headers
4.2.4.5	Essential provision for all type of radiators provided	Radiator header pipes shall not originate from tank top cover to make the tank top cover removable at site with minimum manpower.
4.2.5	Core	
4.2.5.1	Material	High grade, non ageing, low loss, high permeability, grain oriented, cold rolled silicon steel lamination
4.2.5.2	Grade	Premium grade minimum M3 or better
4.2.5.3	Lamination thickness	Max. 0.23 mm with insulating coating on both sides
4.2.5.4	Design flux density at rated conditions at principal tap	As per manufacturers design.

4.2.5.5	Maximum flux density at 10% over excitation / over fluxing	As per Annexure C , Cl. 35.0
4.2.5.6	Core design features	i) Magnetic circuit designed to avoid short circuit paths within core or to the earthed clamping structure ii) Magnetic circuit shall not produce flux components at right angles to the plane of lamination to avoid local heating iii) Least possible air gap and rigid clamping for minimum core loss and noise generation iv) Adequately braced to withstand bolted faults on secondary terminals without mechanical damage and damage / dis-placement during transportation and positioning v) Percentage harmonic potential with the maximum flux density under any condition limited to avoid capacitor overloading in the system vi) All steel sections used for supporting the core shall be thoroughly sand blasted after cutting, drilling, welding vii) Provision of lifting lugs for core coil assembly viii) Supporting framework designed not to obstruct complete drainage of oil from transformer ix) The insulation of core to bolts and core to clamps plates shall be able to withstand a voltage of 2 kV rms for one minute, however boltless construction shall be preferred to avoid generation of hot spots and decomposition of oil as well as to reduce noise level.
4.2.6	Winding	
4.2.6.1	Material	Electrolytic Copper
4.2.6.2	Maximum current density allowed	3 A/mm^2
4.2.6.3	Winding Insulating material	Class A, non catalytic, inert to transformer oil, free from compounds liable to ooze out, shrink or collapse
4.2.6.4	Winding Insulation	Uniform
4.2.6.5	Design features	i) Stacks of winding to receive adequate shrinkage treatment before final assembly ii) Connection braced to withstand shock during transport, switching, short circuit, or other transients. iii) Minimum out of balance force in the transformer winding at all voltage ratios. iv) Conductor width on edge exceeding six

		times its thickness v) Transposed at sufficient intervals. vi) Threaded connection with locking facility vii) Winding leads rigidly supported, using guide tubes if practicable viii) Winding structure and major insulation not to obstruct free flow of oil through ducts ix) Provision of taps as indicated in the technical particulars
4.2.6.6	Essential provision for core coil assembly	i) Core coil assembly shall be mounted on bottom of the tank. ii) Earthing of core clamping structure and earthing of magnetic circuit shall be in line with CBIP reference manuals.
4.2.7	Transformer Oil	Should be in accordance with specification as per Annex D of this document.
4.2.8	Bushings and terminations	
4.2.8.1	Type below 52 kV	Oil communicating , outdoor, removable
4.2.8.2	Type 52kv and above	Oil filled porcelin condenser & non oil communicating type with oil level gauge, oil filling plug and drain valve if not hermetically sealed, tap for capacitance and loss factor measurement, removable without disturbing bushing CT'S.
4.2.8.3	Arcing horns.	Not required.
4.2.8.4	Termination on HV side bushing	By bimetallic connectors suitable for ACSR/AAAC conductor, cable connection through cable box with disconnecting link as per annexure A Scope of Supply.
4.2.8.5	Termination on LV side bushing	Cable connection through cable box with disconnecting link as per annexure A, scope supply.
4.2.8.6	Minimum creepage distance of bushing	As per annexure C cl 38.0
4.2.8.7	Protected creepage distance	At least 50 % of total creepage distance
4.2.8.8	Continuous current rating	Minimum 20 % higher than the current corresponding to the minimum tap of the transformer.
4.2.8.9	Rated thermal short time current	As per annexure C Cl 38.0
4.2.8.10	Atmospheric protection for clamp and fitting of iron and steel.	Hot dip galvanizing as per IS 2633
4.2.8.11	Bushing terminal lugs in oil and air.	Tinner copper.
4.2.8.12	Sealing washers /gasket ring.	Nitrile rubber/ Expanded TEFLON(PTFE) as applicable
4.2.9	HV, LV, LV Neutral cable box	Required.
4.2.9.1.1	Material of construction	Sheet steel min 4.0 mm thick. Inspection covers

		shall be min 3mm thick.
4.2.9.1.2	Cable box doors (33kV and 11kV Cable boxes)	The doors should be internal anti theft hinge with minimum opening angle of 120º, minimum 3 nos. with lockable handle & with padlocking facility
4.2.9.2	Cable entry	At bottom through detachable gland plate with cable clamps of non magnetic material
4.2.9..3	Cable size for HV	As pe annexure C Cl 15.1
4.2.9.4	Cable size for LV	As per Annexure C Cl 15.2
4.2.9.5	LV Neutral connection	As per Annexure C Cl 15.3
4.2.9.6	Detachable gland plate material for HV, LV, LV Neutral box	As per GTP
4.2.9.7	Gland plate thickness for HV, LV, LV Neutral box	As per GTP
4.2.9.8	Cable gland for HV, LV, LV Neutral cables	As per GTP
4.2.9.9	Cable lug for HV& LV cables	As per CL 4.9 of this spec and suitable for cable size as per GTP
4.2.9.10	Essential parts	i) Disconnecting chamber ii) Flexible disconnecting link of tinned copper iii) Tinned copper busbar for Owner's cable termination with busbar supports iv) Detachable gland plate as per Schedule A GTP Cl. 24.4, 24.5, 25.4, 25.5, 26.4, 26.5 v) Earthing boss for the cable box vi) Earthing link for the gasketted joints at two points for each joint vii) Earthing provision for cable armour / screen viii) Flange type Inspection cover with handle for Inspecting bushing and busbars on top as well as on front cover ix) Anti theft hinged type door with lockable handle & with padlocking facility for cable box. x) Drain plug xi) Rainhood on gasketted vertical joint xii) Danger plate made of Anodized aluminum with white letters on red background on HV and LV side fixed by rivets. xiii) Phase marking plate inside cable box near termination as well as on front cover of cable box made of anodized aluminum with black letters on satin silver background on HV and LV side fixed by rivets xiv) Support insulators for the busbars shall be epoxy resin cast type. xv) Space heaters for HV and LV cable box controlled by thermostat

4.2.9.11	Terminal Clearances	As per Annexure C technical particulars
4.2.9.12	Termination height required for cable termination	Minimum 1000 mm
4.2.9.13	Essential provision for LV neutral cable box	i) Neutral shall be outdoor type bushing OR with cable box. Box shall have adequately sized inspection cover suitable for inspection of bushings / replacement / maintenance of neutral CT. For Outdoor Bushing the NCT shall be mounted in IP55 box. ii) Knife switch with locking arrangement to be provided to disconnect the neutral from grounding. Connection from Neutral bushing to the knife switch shall be with 100x12mm Tinned copper bus bar. Bus Bar shall brought down to the bottom of the transformer supported by suitable support insulator made of epoxy resin cast (insulator shall be suitable for outdoor application suitable for connecting. iii) Knife switch shall be suitable for connecting 2 runs of 75 x 10 mm size GS strip. iv) Height of knife switch shall be at maximum 1500 mm. Housing of Knife switch shall be suitable for easy & quick operations.
4.2.10	Current Transformers	
4.2.10.1	WTI CT	As per GTP
4.2.10.1.1	Rating	As per GTP
4.2.10.1.2	Mounting	In the turret of the bushing
4.2.10.1.3	Essential provision	i) CT mounting shall be such that CT can be replaced without removing tank cover ii) CT secondaries shall be wired upto TB with TB spec. as per Cl. 4.7of this specification
4.2.10.2	Neutral CT	
4.2.10.2.1	Type	Cast resin
4.2.10.2.2	Rating	As per GTP
4.2.10.2.3	Location of NCT	Separate box with TB arrangement for secondary Bushing type not acceptable.
4.2.10.2.4	Essential provision	i) CT mounting shall be such that CT can be replaced without removing the neutral cable box. ii) CT secondary shall be wired upto TB
4.2.10.2.5	Size of NCT Box	Overall size of NCT box shall not exceed 1200x600x1000 mm including canopy on top.
4.2.11	Marshalling Box Cubicle	
4.2.11.1	Material of construction	Construction of Marshalling Box should be stainless steel 304 grade (Min) with powder coating of specified color shed
4.2.11.2	Door hinges of marshalling	Required

	box should be from inner side and should not be exposed to rain.	
4.2.11.3	Major equipments in Marshalling box	i) Mechanical gauge for HV and LV WTI ii) Mechanical gauge for OTI iii) Power supply unit (PSU) for remote monitoring of OTI and WTI temperatures. PSU suitable for 48V-265V AC/DC supply. iv) Make of OTI and WTI is Precimeasure 1005AH/1007H model with PSU v) Electronic OTI/WTI Scanner vi) Capillaries for WTI and OTI min 15M length vii) Control & Protection Equipment for Fan Control viii) DC contactors to be provided for all trouble free signals. Same to be wired up to the TB ix) Other panel accessories listed elsewhere
4.2.11.4	Gland plate	i) Min. 3 mm thick detachable with knockout 6 x 1 inch ii) Gland plate mounting should be from inside only
4.2.11.5	Contacts wired to terminal block	i) WTI alarm and trip ii) OTI alarm and trip iii) Buchholz relay alarm and trip iv) OSR trip contacts v) MOG low level alarm vi) MOG on OLTC low level alarm vii) PRV main tank trip viii) PRV OLTC trip ix) Sudden pressure relay trip x) WTI and OTI PSU/ relay contacts of the temperature scanner. xi) Note: 2NO +2NC auxiliary contacts for all the above to be provided for customer use (By using auxiliary relay)
4.2.11.6	Signals to be wired to terminal block	i) WTI CT ii) NCT iii) Capillaries for WTI and OTI iv) 4 to 20 mA signals for WTI and OTI repeater located elsewhere
4.2.11.7	Ingress protection	IP 55 plus additional rain canopy to be provided
4.2.11.8	Welding	Continuous welding on joints, welding at regular intervals on joints and filling of gaps with use of M seal not accepted
4.2.11.9	Cable entry	Bottom for all cables
4.2.11.10	Panel internal Access	Front only through front door double leaf with antitheft hinges
4.2.11.11	Pane back access	None
4.2.11.12	Mounting of marshalling box	Separately mounted as per GTP
4.2.11.13	Panel supply	415 V AC, Three phase, 50 Hz

4.2.11.14	Panel accessories	i) Cubicle lamp with door switch and separate fuse / MCB ii) Approved space heaters controlled by thermostat and separate fuse / MCB iii) Incoming fuse switch / MCB for the incoming supply iv) Panel wiring diagram fixed on back of panel door on Aluminum plate engraved fixed by rivet v) Stainless steel door handle with lock & additional facility for padlock vi) Earthing boss for the marshaling box vii) Single phase power plug industrial type 15/5 Amp. With MCB viii) Single phase preventer
4.2.11.15	Painting of marshalling box	As per Cl. 4.10 of the specification
4.2.11.16	Hardware, Gasket, Cables and Wires, Terminal blocks, Cable gland, Cable lugs of marshalling box	As per Cl. 4.3, 4.4, 4.6, 4.7, 4.8, 4.9 of the specification respectively.
4.2.11.17	Fan motors control installed in marshalling box or separate fan control cubicle	i) 2 x 50% fans ii) Complete fan control with fuse switch, contactor, Bimetallic relay, in starter circuit with type 2 coordinated rating as per IS iii) Automatic control from WTI contact iv) Provision for manual control both from local/ remote. v) Fan Control Cubicle should be separately mounted. vi) 2RC/2RS type bearings shall be used instead of ball bearings. vii) Fan enclosure shall be perforated sheet with holes at motor side with ground support.
4.2.11.18	Control Cable Length	All the control Cable shall have minimum 15 Meters of length for all control cable, OTI, WTI Capillaries and NIPFPS control cables also.
4.3	Hardware	
4.3.1	External	M12 size & below Stainless Steel & above M12 Hot Dip galvanized steel.
4.3.2	Internal	Cadmium plated except special hardware for frame parts and core assembly as per manufacturer's design
4.3.3	Provision of fully enclosed Aluminium hoods/Canopy for following accessories of power transformer for protection against water ingress.	All Oil Surge Relays, Buchholz Relay, Pressure release Valve.
4.4	Gasket	
4.4.1	For transformer, OLTC	Nitrile rubber based

	chamber, PT chamber, surfaces interfacing with oil like inspection cover etc.	
4.4.2	For cable boxes, marshalling box, OLTC drive mechanism etc.	Neoprene rubber based
4.4.3	Tank top cover gasket	It shall be double O ring type sealing arrangement seating over a double groove made in transformer tank & top cover.
4.5	Valves	
4.5.1	Material of construction	Gun metal/Brass
4.5.2	Type	Both end flanged gate valve / butterfly valve depending on application
4.5.3	Size	As per manufacture's standard
4.5.4	Essential provision	Position indicator, locking rod, padlocking facility, valve guard, cover plate.
4.6	Cable routing on Transformer	Control cable for accessories on transformer tank to marshalling box and WTI, OTI Capillaries shall be routed through perforated Covered GI trays
4.6.1	Control cable specification	i) PVC insulated, extruded PVC inner sheathed, armoured, extruded PVC outer sheathed 1100V grade control cable as per latest edition of IS 1554 Part 1 ii) Minimum 2.5 sqmm for signals and 4 sqmm for CT with multistrand copper conductor
4.6.2	Specification of wires to be used inside marshalling box, OLTC drive mechanism.	PVC insulated multistrand flexible copper wires of minimum 2.5 sqmm size, 1100 V grade as per latest edition of relevant IS
4.6.3	Essential provision for Capillary routing from transformer to marshalling box	Routing shall be done in such a way that adequate protection is available from mechanical and fire damage.
4.7	Terminal Blocks to be used by the vendor	Nylon 66 material, minimum 6 sqmm stud type screw driver operated for control wiring and potential circuit. Terminal blocks to be located in such a way to achieve the termination height as min 250 mm from grand plate.
4.7.1	Essential provision for CT terminals	Sliding link type disconnecting terminal block screwdriver operated stud type with facility for CT terminal shorting material of housing melamine/Nylon66
4.8	Cable glands to used by the vendor	Nickel plated brass double compression weatherproof cable gland
4.9	Cable lugs to be used by the vendor	
4.9.1	For power cables	Long barrel medium duty bi-mettalic lug with knurling on inside surface
4.9.2	For control cable	Tinned copper pre insulated Pin Ring, Fork type as applicable. For CT connection ring type lug shall be used.

4.10	Painting of transformer, conservator, OLTC, Radiator, cable boxes marshalling box.	
4.10.1	Surface preparation	By 7 tank pretreatment process or shot blasting method
4.10.2	Finish on internal surfaces of the transformer interfacing with oil	Bright Yellow heat resistance and oil resistant paint two coats. Paint shall neither react nor dissolve in hot transformer insulating oil.
4.10.3	Frame parts	Bright Yellow heat resistance and oil resistant paint two coats. Paint shall neither react nor dissolve in hot transformer insulating oil.
4.10.4	Finish on inner surface of the marshalling box	White Polyurethane paint anti condensation type two costs, minimum dry film thickness 80 microns
4.10.5	Finish on outer surface of the transformer, conservator, radiator, cable boxes, marshalling box	Smoke Grey (IS shade 692) polyurethane paint two coats, minimum dry film thickness 80 micros

5.0 MINIMUM PROTECTIVE DEVICES ON TRANSFORMER

5.1	Spring loaded with detachable diaphragm type pressure relief valve with two trip contacts for the main tank of LSM model with limit switch design IP 65 with additional rain hood. PRV Oil discharge pipe arrangement	Required
5.2	Spring loaded with detachable diaphragm type pressure relief valve with two trip contacts for OLTC of LSM model with limit switch design IP 65 with additional rain hood. Oil discharge pipe arrangement	Required
5.3	Double float bucchholz relay with alarm and trip contacts, service and test position, with test cock for the main tank, terminal box shall be IP 65 with drain plug for rainwater draining. Additional rain hood shall be provided.	Reed Switch Type shall be required
5.4	Oil surge relay with two contacts, services and test position, with test cock for OLTC tank, terminal box shall be IP 65 with drain plug for rainwater draining. Additional rain hood shall be provided.	Required
5.5	Sudden pressure relay with trip contact for the main tank	Required

5.6	Oil temperature indicator metallic bulb type 150 mm diameter with maximum reading pointer, potential free independent adjustable alarm and trip contacts, resetting device with temperature sensing element	Required
5.7	Winding temperature indicator 150 mm diameter with maximum reading pointer, two sets of potential free independent adjustable alarm and trip contacts, resetting device with temperature sensing element, thermal image coil	Required
5.8	2 No's PT 100 sensors/RTDs for winding emperature indication wired upto TB's in marshalling box for external connection.	Required
5.9	Magnetic switching for all the protective devices including Buchholz (alarm and Trip) OSR,SPR,WTI and OTI. Mercury switching is not acceptable	Required

6.0 FITTINGS AND ACCESSORIES ON TRANSFORMER

6.1	Rating and diagram plate	Required
6.1.1	Material	Anodized aluminum 16SWG
6.1.2	Background	SATIN SILVER
6.1.3	Letters, diagram & boder	Black
6.1.4	Process	Etching
6.1.5	Name plate details	Following details shall be provided on rating and diagram plate as a minimum i) Type / kind of transformer with winding material ii) Standard to which it is manufactured iii) Manufacture's name iv) Transformer serial number v) Month and year manufacture vi) Rated frequency in Hz vii) Rated voltages in kV viii) Number of phases ix) Rated power in kVA x) Type of cooling (ONAN) xi) Rated currents in A xii) Vector group symbol xiii) 1.2/50µs wave impulse voltage withstand level in kV xiv) Power frequency withstand voltage in kV

		xv) Impedance voltage at rated current and frequency in percentage at principal, minimum and maximum tap xvi) Load loss at rated current xvii) No load loss at rated voltage and frequency xviii) Auxiliary loss xix) Continuous ambient temperature at which ratings apply in □ C xx) Top oil and winding temperature rise at rated load in deg C xxi) Temperature gradient of HV and LV winding xxii) Winding connection diagram xxiii) Weight of radiator xxiv) Volume and weight of oil in radiator xxv) Transport weight of transformer xxvi) Weight of core and frame xxvii) Weight of winding xxviii) Weight of core and winding xxix) Weight of tank and fittings xxx) Total weight xxxi) Volume of oil xxxii) Weight of oil xxxiii) NCT, WCT, details xxxiv) Type of OLTC xxxv) Tapping details xxxvi) Name of the purchaser xxxvii) PO no and date xxxviii) Guarantee period
6.2	Instruction plate for OLTC anodized aluminum black lettering on satin silver background fixed by rivet	Required
6.3	Oil filling instruction plate anodized aluminum black lettering on satin silver background fixed by rivet	Required
6.4	Valve schedule plate anodized aluminum black lettering on satin silver background fixed by rivet	Required
6.5	Instruction plate anodized aluminum black lettering on satin silver background for flexible air cell for oil conservator	Required
6.6	Terminal marking plate for bushing WTI, OTI & RTD anodized aluminum black lettering on satin silver background fixed by rivet	Required
6.7	Company monogram plate	Required

6.8	Lifting lugs / bollards with antiskid head to lift complete transformer with oil	Required
6.9	Lashing lug	Required
6.10	Jacking pad with Haulage hole to raise or lower complete transformer with oil	Required
6.10.1	Essential provision for jacking pads. Designed in such a way that jacking of complete transformer with oil shall be possible with 3 nos jacking pads out of 4 nos jacking pads provided as minimum	Required
6.11	Detachable bi-directional roller assembly with corrosion resistant bearing, fitting / nipple for lubrication or with permanently lubricated bearing, anti earthquake locking device. The wheels shall be capable of swiveling when transformer is lifted with provision for locking the swivel movement. Roller shall be suitable for 90 lb rail. Suitable antirolling clamp for 90 lb rail minimum 4 nos. shall be provided	Required
6.12	Pockets for OTI, WTI, & RTD on tank	Required (with one spare pocket for future use)
6.13	Pockets for ordinary thermometer on tank cover, top and bottom header of radiator, top of each radiator	Required
6.14	Ordinary thermometer 4 nos.	Required
6..15	Drain valve (gate valve) for the main tank, 80 mm	Required
6.16	Drain valve (gate valve) for OLTC, 50 mm	Required
6.17	Drain valve (gate valve) for all headers, 50 mm	Required
6.18	Filter valve (gate valve) at top and bottom of the main tank, 50 mm	Required
6.19	Sampling valve (gate valve) at top and bottom of the main tank, 15 mm	Required
6.20	Vacuum breaking valve (gate valve), 25 mm	Required
6.21	Drain plug on tank base	Required
6.22	Air release plug on various fitting and accessories	Required
6.23	Earthing pad on tank for transformer earthing complete with non ferrous nut, bolt, washers, spring washers	Required

	etc.	
6.24	Vacuum pulling pipe with blanking plate on main conservator pipe work	Required
6.25	Rainhood (canopy) for Buccholz relay, PRV on main transformer and OLTC, OSR relay of OLTC	Required
6.26	Rainhood for vertical gasketted joints, in cable boxes	Required
6.27	Oil level gauge on tank for transformer shipment	Required
6.28	Earthing bridge by copper strip jumpers on all gasketted joints at least two points for electrical continuity	Required
6.29	Aluminium ladder with anticlimbing device and safety flap, with lockable hinged plate for at least 1.5 m from ground level. Ladder shall be located in such a way that it avoids any hindrance to operation of nearby electrical/mechanical accessories etc.	Required
6.30	OLTC panel as specified	Required
6.31	Skid base welded type	Required
6.32	Core, frame to tank earthing	Required
6.33	Danger plate made of anodized aluminium white lettering on red background fixed by rivet	Required
6.34	Identification plate for all accessories, protective devices, instruments, thermometer / RTD pockets, earthing terminals, all inspection covers, cable boxes, marshalling boxes etc.made of anodized aluminium black lettering on silver background fixed by rivet	Required
6.35	Provision for Valves and NRV for mounting of Nitrogen fire protection System	Required
6.36	Separate structure for mounting of cooling fans	Required
6.37	Terminal box of contacts from, Core and Yoke with shorting link at top cover of Transformer	Required. The IR test will be performed on these terminals on trailer prior to unloading at site.
6.38	Aluminum ladder on transformer top cover to conservator top	Required
6.39	Space heaters with thermostat control in HV and LV cable box	Required

7.0 OLTC

7.1	Requirement	i) For 33kV – CTR make EQ16 or equivalent. ii) For 66kV – CTR make FQ 16 or equivalent No in-tank OLTC acceptable.
7.2	OLTC gear location	Side mounted on conservator side not in front of HV bushing
7.3	Type of OLTC gear	i) The tapings shall be controlled by a high speed resistor transition type gear in which tap change is carried out virtually under 'no volt' 'no ampere' condition and the selector switches do not make and break any current, main current is never interrupted and a resistor is provided to limit the arching at diverter contacts to a minimum suitable for outdoor mounting and continuously rated for operating at all position including positions in the middle of tap change. In particulars, the tap change gear shall be suitable when delivering the full output plus permissible overload and operating the lowest voltage tap on the HV side. ii) The value of the transition resistor shall be indicated on the rating plate of the OLTC with continuous current rating with reference to design ambient temperature specified.
7.4	Tappings	As per Cl. 34 of Annexure C
7.5	Operation of OLTC gear	Selection of local / remote operation by selector switch on OLTC drive mechanism
7.5.1	local operation	From OLTC drive mechanism through pistol grip rotary switch as well as emergency mechanical hand operation.
7.5.2	Remote operation	From digital RTCC provided by customer /SCADA depending on the selection of control on digital RTCC panel.
7.6	Safety interlocks in OLTC	Following safety interlock to be provided in OLTC as minimum i) Positive completion of tap changing step once initiated ii) Blocking of reverse tap change command during a forward tap change already in progress until the mechanism resets and vice – versa iii) Cutting of electrical circuits during mechanical operation iv) Mechanical stops to prevent overrunning of the mechanism at the end taps v) Interlock to avoid continuous tap change

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

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

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

8.0 APPROVED MAKE OF COMPONENTS

8.1	CRGO	Nippon/JFE/Posco
8.2	Copper	Birla copper/Sterlite
8.3	Pre compressed Pressboard	Raman Board, Mysore/ Senapathy Whiteley
8.4	Laminated Wood	Permalli Wallance / Rochling Engineers
8.5	Oil	Apar/Savita/Raj
8.6	Condensor Bushings (OIP)	CGL/BHEL/ABB/ALSTOM
8.7	Porcelain Bushing	CJI/Jayshree Insulators/BHEL
8.8	Steel	TATA/Jindal/SAIL
8.9	Lugs/Glands	Jainson/Dowells/Comet
8.10	Radiators	CTR/Hi-Tech Radiators/Tarang Engineers
8.11	Fans	Marathon / Khaitan
8.12	Magnetic Oil Level Indicator	Sukrut /Yogna
8.13	Pressure relief valve	Sukrut / Qualitrol
8.14	Bucchholz Relay	Proyog / ATVUS
8.15	Oil surge Relay	Proyog / ATVUS

8.16	Winding Temperature Indicator	Precimeasure / Perfect Controls / Pradeep sales
8.17	Oil Temperature Indicator	Precimeasure / / Perfect Controls/ Pradeep Sales
8.18	Sudden Pressure Relay	Sukrut / Qualitrol/ATVUS
8.19	Aircell	Sukrut(Unirub)/Pronol / Rubber Product
8.20	Neutral CT	Pragati /ECS / KAPPA/ Reputed equivalent
8..21	WCT	Pragati / ECS / KAPPA/ Reputed equivalent
8.22	Switch	L&T (Salzer) / Siemens
8.23	HRC Fuse Links	Siemens / L&T/GE
8.24	Fuse base	Siemens / L&T/GE
8.25	AC Contactors & O/L Relay	L&T / Siemens / Schneider
8.26	Terminals	Connectwell / Elmex
8.27	Push buttons / Actuator	L&T / Siemens
8.28	Thermostat	Velco/Girish
8.29	Heater	Velco/Girish
8.30	Voltmeter Selector Switch	Siemens/ equivalent
8.31	Control selector switch	Siemens/ equivalent
8.32	Auxiliary Relays	Jyoti / Easun Rayrole
8.33	Timers	L&T /Siemens
8.34	Tap Position Indicator	Accord
8.35	Annunciator	Accord
8.36	Digital tap change counter	Selectron
8.37	LED cluster type indication lamp	MIMIC/ Siemens/ Binay

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

9.0 QUALITY ASSURANCE

9.1	Quality assurance	To be submitted before contract award. Program shall contain following i) The structure of the organization. ii) The duties and responsibilities assigned to staff ensuring quality of work. iii) The system for purchasing, taking delivery and verification of materials. iv) The system for ensuring quality of workmanship v) The system for control of documentation

		vi) The arrangements for the suppliers internal auditing vii) The system for retention of records. viii) A list of the administration and work procedures required to achieve and verify contracts quality requirements. These procedures shall be made readily available to the purchaser for inspection on request.
9.2	Quality plan	To be submitted by the successful bidder for approval. Plan shall contain following as a minimum i) An outline of the proposed work and programme sequence ii) The structure of the suppliers organization for the contract. iii) The duties and responsibilities assigned to staff ensuring quality of work for the contract. iv) Hold and notification points. v) Submission of engineering documents required by the specification. vi) The inspection of materials and components on receipt vii) Reference to the suppliers work procedures appropriate to each activity viii) Inspection during fabrication /construction. ix) Final inspection and test. x) Successful bidders shall include submittal of Mills invoice, Bill of lading, Mills test certificate for grade, physical tests, dimension, specific watt loss per KG for the core material to the purchaser for verification in the quality plan suitably.
9.3	Manufacturing environment	Bidder to ensure the following manufacturing areas should be maintain positive atmospheric pressure, clean, dust free (Clean room class ISO 9 or better as per ISO 14644-1) and humid controlled environment. i) Insulation storage ii) Core storage iii) Glue stacking area iv) core cutting line v) Winding manufacturing bay vi) Core building area vii) Core coil assembly area viii) Testing lab ix) Packing & dispatch area
9.4	Accessories environment	Bidder to ensure the following accessories to be kept in clean and coved location i) Piping ii) Radiators iii) Tank iv) Bushing (as per manufacturer's guideline) v) Marshalling box vi) Turret

		vii) Conservator viii) Insulating oil
9.5	Manufacturing Quality Assurance Plan	Refer Annexure G

10.0 PROGRESS REPORTING

10.1	Online document	To be submitted for purchaser approval for outline of production , inspection,testing,packing dispatch ,documentation programme
10.2	Detailed progress report	To be submitted to the purchaser once a month containing i) Progress on material procurement ii) Progress on fabrication iii) Progress on assembly iv) Progress on internal stage inspection v) Reason for any delay in total programme. vi) Details of test failures if any in manufacturing stages. vii) Progress on final box up. viii) Constraints/ Forward path.

11.0 INSPECTION & TESTING

11.1	Inspection and Testing during manufacture	
11.1.1	Tank and conservator	i) Check correct dimension between wheels demonstrate turning of wheels through 90 deg and further dimensional check. ii) Check for physical properties of material for lifting lugs, jacking pads etc. all load bearing welds, including lifting lug welds shall be subjected to required load tests iii) Leakage test of the conservator as per CBIP iv) Certification of all test results v) Oil leakage test on all tanks at normal head of oil plus 35 kN / sqm at the base of the tank for 24 hrs vi) Vacuum and pressure test on tank as type test as per CBIP vii) Leakage test of radiators as per CBIP.
11.1.2	Core	The below mentioned core critical points should complied by the bidder
11.1.2.1	Mother Core coil	i) Core material shall be directly procured either from the BSES approved manufacturer or through their authorized service centre/distributor and not through any contractor. ii) Verification & inspection of the mother coil at port & putting stamp & seal may be inspected by BSES.

11.1.2.2	Core cutting	Bidder should have in house core cutting facility for proper monitoring & control on quality. In case it is done outside cutting shall be done in presence of BSES.
11.1.2.3	Hydraulic core lifting	Bidder should have hydraulic core lifting facility to avoid any jerk at the time of core building
11.1.2.4	Core sample type testing	Reconciliation of mother coil by checking stamp & seal at factory before slitting. One sample of CRGO to be sealed for testing at ERDA/CPRI. Following Tests shall be conducted on the sample per P.O. i) Specific core loss measurement ii) Magnetic polarization iii) Magnetic permeability iv) Specific core loss measurement after accelerated ageing test v) Surface insulation resistivity vi) Electrical resistivity measurement vii) Stacking factor viii) Ductility(Bend test) ix) Lamination thickness x) Magnetization characteristics (B-H curve)
11.1.2.5	Core physical verification	i) Check on the quality of varnish if used on the stampings. a) Measurement of thickness and hardness of varnish on stampings. b) Solvent resistance test to check that varnish does not react in hot oil. c) Check over all quality of varnish by sampling to ensure uniform hipping colour, no bare spots. No ever burnt varnish layer and no bubbles on varnished surface. ii) Check on the amount of burns. iii) Bow check on stampings. iv) Check for the overlapping of stampings. Corners of the sheet are to be apart. v) Visual and dimensional check during assembly stage. vi) Check on complete core for measurements of iron-loss and check for any hot spot by exciting the core so as to induce the designed value of flux density in the core. vii) Check for inter laminar insulation between core sectors before and after pressing. viii) Visual and dimensional checks for straightness and roundness of core, thickness of limbs and suitability

		of clamps. ix) High voltage test (2 KV for one minute) between core and clamps. x) Certification of all test results.
11.1.2.6	Documents verification	Following documents to be submitted during the stage inspection i) Invoice of supplier ii) Mills test certificates iii) Packing list iv) Bill of lading v) Bill of entry certificates by customs
11.1.3	Insulating material	i) Sample check for physical properties of material ii) Check for dielectric strength iii) Visual and dimensional checks iv) Check for the reaction of hot oil on insulating materials v) Certification of all test results
11.1.4	Windings	i) Sample check on winding conductor for mechanical properties and electrical conductivity ii) Visual and dimensional check on conductor for scratches, dept. mark etc. iii) Sample check on insulating paper for PE value, bursting strength, electric strength iv) Check for the reaction of hot oil on insulating paper v) Check for the binding of the insulating paper on conductor vi) Check and ensure that physical condition of all materials taken for winding is satisfactory and free of dust vii) Check for absence of short circuit between parallel strands viii) Check for Brazed joints wherever applicable ix) Measurement of voltage ratio to be carried out when core / yoke is completely restocked and all connections are ready x) Certification of all test results
11.1.4.1	Checks before drying process	i) Check conditions of insulation on the conductor and between the windings ii) Check insulation distance between high voltage connection cables and earthed and other live parts iii) Check insulation distance between low voltage connection cables and earthed and other parts iv) Insulation test of core earthing v) Check for proper cleanliness vi) Check tightness of coils i.e. no free movements vii) Certification of all test results
11.1.4.2	Checks during drying process	i) Measurement and recording of temperature and drying time during vacuum treatment. ii) Check for completeness of drying

		iii) Certification of all test result.
11.1.5	Oil	i) As per IS 335 and annexure-D ii) One sample of oil drawn from every lot of transformer offered for inspection should be tested at CPRI/ERDA for tests as listed under table 1 of IS 1866(2000).The cost of this testing should be included within the cost of transformer. Test result shall be confirming to Annexure D of this specification
11.1.6	Test on fittings and accessories	As per manufacturer's standard
11.2	Routine tests/Acceptance tests	The sequence of routine testing shall be as follows i) Visual and dimension check for completely assembled transformer ii) Measurements of voltage ratio iii) Measurements of winding resistance at principal tap and two extreme taps. iv) Vector group and polarity test v) Measurements of insulation resistance and polarization index. vi) Separate source voltage withstand test. vii) Measurements of iron losses and exciting current at rated frequency and 90%, 100% and 110% rated voltage. viii) Induced voltage withstand test. ix) Load losses measurement. x) Impedance measurement at principal tap (HV and LV) of the transformer. xi) Routine test of tanks xii) Induced voltage withstand test (to be Repeated if type tests are conducted). xiii) Measurement of iron loss (to be repeated if type tests are conducted). xiv) Measurement of capacitance and Tan Delta for for transformer winding and HV bushing (including bushing C1 and C2 Values) and Tan Delta for transformer oil (for all transformers). xv) Phase relation test, polarity, angular displacement and phase sequence. xvi) Ratio of HV WTI CT, LV WTI CT and neutral CT xvii) Excitation and knee point voltage test on class PS core of neutral CT. xviii) Routine test on on–load tap changer. xix) IR test from terminals mentioned in Clause no 6.37 xx) Oil leakage test on assembled transformer xxi) Magnetic balance test xxii) Power frequency voltage withstand test on all auxiliary circuits xxiii) Temperature rise test. xxiv) Certification of all test result

		xxv) SFRA xxvi) Aircell charging and discharging test a) Insulation resistance measurement shall be carried out at 5 kV. Value of IR should not be less than 2000M ohms. Polarization index (PI = IR10min/IR1min) should not be less than 1.5 (if one minute IR value is above 5000Mohms and it is not be possible to obtain an accurate 10 minutes reading, in such cases polarization index can be disregarded as a measure of winding condition.) b) Temperature rise test may be necessary to be carried out on 100% of the order quantity at the manufacturer's works or third party lab. c) BSES may appoint recognized testing authority like CPRI /ERDA with their instruments & engineer's team and measure no load loss, load loss and percentage impedance of the transformer at supplier's works at Vendor cost . Bidder shall agree and give them full co-operation during their stay & testing at shop floor. The losses & impedance values so obtained will be considered as final.
11.3	Type tests	On one transformer of each rating and type (In Govt. recognized independent test laboratory / Internationally accredited test lab or at manufacturer's facility if it is approved by component authority. i) Impulse withstand test on all three HV and LV limbs of the transformers for chopped wave as per standard ii) Temperature rise test as per IS iii) Dissolved gas analysis before and after Temperature Rise test to be carried out from CPRI/ERDA iv) Pressure relief device test v) Pressure and Vacuum test on tank(stage inspection)
11.4	Special tests	On one transformer of each rating and type i) Dynamic & Thermal short circuit test short circuit test as per IS ii) Measure of zero seq. impedance (Cl.16.10 IS 2026 part-1) iii) 3) measurement of acoustic noise level (Cl.16.12 IS 2026 part-1) iv) Measurement of harmonic level on no load current v) High voltage withstand test shall be performed on the auxiliary equipment and wiring after complete assembly. vi) CRGO testing for specific core loss, accelerated ageing test, surface insulation resistivity, AC permeability and magnetization, stacking factor, ductility etc

		vii) Oil testing to be tested at CPRI/ERDA labs, whose samples shall be selected & sealed by customer. Cost of such tests, if extra, shall be quoted separately by the bidder.
11.5	In house NABL accreditation	i) Bidder should have in-house NABL accredited testing facility. ii) NABL accreditation certificate to be submitted.
11.6	Note for special tests and type test	Cost of the above tests, if extra, shall be quoted separately by the bidder which shall be considered in the price evaluation.
11.7	Notification to bidders	The product offered must be of type tested design with valid type test report of not more than 5 years. In case the product offered is never type tested for tests as per above list, type tests to be conducted by bidder at his own cost at Govt. recognized independent test laboratory / Internationally accredited test lab or at manufacturer's facility if it is approved by component authority. Valid type test reports for dynamic short circuit test as per IS may be forwarded for customer's review and approval. In case the product offered is never tested for dynamic short circuit the same to be conducted by bidder at his own cost at Govt. recognized independent test laboratory/internationally accredited test lab.
11.7	Site Acceptance test	Following tests shall be conducted at BYPL site/store in presence of BYPL official. i) Insulation Resistance from terminal box mentioned in clause no 6.37. The test shall be conducted on following basis: a) The IR test will be performed on the terminals mentioned in clause no 6.37 on trailer prior to unloading at site. b) The results shall be compared with the results obtained during inspection. c) The IR value in any of the tests (Factory as well as site) should not be less than 2000M Ohm d) To access internal physical damage during transportation, Transformer will not be received if the site results are less than 2000MOhm. ii) SFRA with same kit done at factory (Instrument shall be in Vendors scope iii) Magnetic Balance test iv) Measurement of Voltage ratio v) Measurement of capacitance and Tan Delta for transformer winding and HV bushing (for all

		vi) transformers). vii) Vector Group and Polarity viii) Physical checks ix) Oil BDV Note: Testing instruments shall be in scope of Vendor.

12.0 PACKING, SHIPPING, HANDLING AND STORAGE

12.1	Packing	
12.1.1	Packing protection	Against corrosion, dampness, heavy rains, breakage and vibration.
12.1.2	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection
12.1.3	Packing details	On each packing case details required as follows i) Individual serial number: ii) Purchaser's name: iii) PO Number: iv) Destination: v) Suppliers name: vi) Name and address of suppliers agent vii) Description and numbers of contents: viii) Manufacturers name: ix) Country of origin;: x) Case measurements: xi) Gross and net weights in kilograms xii) All necessary slinging and stacking instructions.
12.2	Shipping	The bidder shall ascertain at an early date and definitely before the commencement of manufacture, any transport limitations such as weights, dimensions, roads culverts, overhead lines, free access etc. from the manufacturing plant to project site :and furnish to the purchaser confirmation that the proposed packages can be safely transported, as normal or oversize packages up to the plant site. Any modifications required in the infrastructure and cost thereof in this connection shall be brought to the notice of the purchaser.
12.3	Handling and storage	As per manufacturers instruction.

13.0 COMMISIONING SUPPORT

13.1	Commissioning support	Supervision of Erection and Commissioning inclusive of all testing equipments/instruments shall be included for minimum 3 days for each Transformer. It includes following: i) BSES will give vendor 7 days advance notice prior to erection testing and commissioning of Transformer. ii) After successful erection testing and commissioning of Transformer Vendor shall issue erection quality check certificate to BSES.

14.0 TRAINING

14.1	Training at factory and at site after installation	Training on installation, commissioning, operation and maintenance shall be included in the proposal.

15.0 DEVIATIONS

15.1	Deviation	Deviations from this Specification shall be stated in writing with the tender by reference to the Specification clause/GTP/Drawing and a description of the alternative offer. In absence of such a statement, it will be assumed that the bidder complies fully with this specification. No deviation will be acceptable post order.

16.0 DRAWINGS AND DOCUMENTS

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

S.no	Documents to be submitted	With the bid	After Award	
			For Approval	Prior to dispatch
1	Copy of specification along with company seal & signature on each page.	✓	✓	
2	Guaranteed technical particulars	✓	✓	
3	Outine dimension drawing for each major component, general arrangement drawing showing component layout an general schematic diagrams.	✓	✓	
4	Type test certificates, where	✓	✓	

S.no	Documents to be submitted	With the bid	After Award	
			For Approval	Prior to dispatch
	available, and sample routine test reports			
5	Detailed reference list of customers already using equipment offered during the last 5 years with particular emphasis on units of similar design and rating	✓		
6	Details of manufacturers quality assurance standard and programme and ISO 9000 series or equivalent national certification.	✓		
7	Deviations from this specification. Only deviations approved in writing before award of contract shall be accepted.	✓		
8	Recommended spare parts and consumable items for the five years of operation with prices and spare parts catalogue with price list for future requirements.	✓		
9	Transport / shipping dimension and weights, space required for handling parts for maintenance	✓		
10	Write up on oil preservation system.	✓	✓	
11	Write up on OLTC.	✓	✓	
12	Quality assurance program.	✓	✓	
13	Programme for production and testing		✓	
14	General description of the equipment and all components, including brochures		✓	
15	Detailed dimension drawing for all components ,general arrangement drawing showing detailed component layout and detailed schematic and wiring drawings for all components like marshalling box and OLTC drive mechanism box.		✓	
16	Calculations to substantiate choice of electrical, structural, mechanical component size, ratings		✓	
17	Detailed loading drawing to enable the purchaser to design and construct foundations for the transformer.		✓	

S.no	Documents to be submitted	With the bid	After Award	
			For Approval	Prior to dispatch
18	Transport /shipping dimension with weights ,wheel base details, untanking height etc.		✓	
19	Terminal arrangements and cable box details		✓	
20	Flow diagram of cooling system showing no. of cooling banks		✓	
21	Drawings of major components like bushing,CT etc		✓	
22	Valve schedule diagram plate		✓	
23	Instruction plate for flexible separator		✓	
24	Rating and diagram plate with OLTC connection details		✓	
25	Lists of makes of all fittings and accessories		✓	
26	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		✓	
27	Detailed installation and commissioning instructions		✓	
28	Inspection and test reports carried out in manufacturers works			✓
29	Test certificates of all bought out items.			✓
30	Operation and maintenance instructions as well as trouble shooting charts.			✓

ANNEXURE – A – SCOPE OF SUPPLY

Design, manufacture, assembly, testing at stages of manufacture as per Cl. 11 of this specification, final testing at manufacturer works on completely assembled transformer before dispatch, packing, transportation, delivery and submission of all documentation for the Power transformer with all accessories as below and ratings & requirements as specified in Annex C.

Sr No	Description	Scope of Supply
1.0	Fully assembled transformer with all major parts like conservator, Radiators, Marshalling box, Protective devices as per Clause 5.0 of this specification, Fittings and accessories as per Clause 6.0 of this specification	YES
1.1	OLTC as per this specification	YES
1.2	RTCC panel as per this specification	No
1.3	HV, LV ,LV NEUTRAL cable boxes	YES
1.4	Support steel material for support of cable boxes from ground	YES
1.5	Foundation Bolts for complete transformer	YES
1.6	Nickel Plated brass double compression weather proof glands for 33kV cables	YES
1.7	Long barrel medium duty Aluminum lugs for power cables	YES
1.8	Nickel Plated brass double compression weatherproof glands and tinned copper lugs for control cable termination in Marshalling box for vendor's cables	YES
1.9	Cables and wires for transformer accessories and internal wiring of marshalling box.	YES
1.10	Touch up paint, minimum 5 liters.	YES
1.11	Extra Transformer oil 10 % in non returnable drums	YES
1.12	One spare complete set of gaskets.	YES
1.13	One set (4 Nos in a set) of anti rolling clamp for 90 lb rail.	YES
1.14	Ordinary thermometers 4 Nos'	YES
1.15	Recommended spares as per manufacturer	YES
2.0	Routine testing as per Clause 11 of this specification	YES
3.0	Type testing as per Clause 11 of this specification	YES
4.0	Special testing as per Clause 11 of this specification	YES
5.0	Submission of Documentation as per clause 16 of this specification	YES

ANNEXURE – B – SERVICE CONDITIONS

1.0	Delhi Atmospheric condition	
1.1	Average grade atmosphere	Heavily polluted, dry
1.2	Maximum altitude above sea level	1000M
1.3	Ambient air temperature	50 deg C
1.4	Relative humidity	90% Max
1.5	Seismic zone	4
1.6	Rainfall	750 mm concentrated in four months

ANNEXURE – C – TECHNICAL PARTICULARS (DATA BY OWNER)

Sr No	Description	Data by Owner	
1.0	Location of equipment	OUTDOOR	
2.0	Reference design ambient temperature	40 deg C	
3.0	Type	Oil immersed, core type, step down	
4.0	Type of cooling	ONAN / ONAF	
5.0	Reference standard	IS: 2026	
6.0	No. of phases	3	
7.0	No. of winding per phase	2	
8.0	Rated frequency (Hz)	50 Hz	
9.0	Rated voltage (kV)		
9.1	HV winding	33	66
9.2	LV winding	11	11
10.0	Vector group reference	Dyn11	Dyn11
11.0	Nominal continuous rating, KVA		
11.1	For 20/25 MVA		
	ONAN	20	20
	ONAF	25	25
11.2	For 25/31.5 MVA		
	ONAN	25	25
	ONAF	31.5	31.5
12.0	Impedance at principal tap at rated frequency with IS tolerance		
12.1	For 20/25 MVA	15% (for 25MVA)	15% (for 25MVA)
12.2	For 25/31.5 MVA	15% (for 31.5MVA)	15% (for 31.5MVA)
13.0	Maximum no load loss at rated condition allowed without any positive tolerance kW		
13.1	For 20/25 MVA	12kW (for 25 MVA),	12kW (for 25 MVA),
13.2	For 25/31.5 MVA	14 kW (for 31.5 MVA)	14 kW (for 31.5 MVA)
14.0	Maximum load loss at rated condition @ 75 deg C and principal tap allowed without any positive tolerance, kW		
14.1	For 20/25 MVA	85 kW (for 25MVA),	85 kW (for 25MVA),
14.2	For 25/31.5 MVA	115 kW (for 31.5 MVA	115 kW (for 31.5 MVA

15.0	Terminal connection / cable / conductor size		
15.1	HV side	33kV	66 kV
		By 2 runs of 3C X400sq mm A2XFY ,33kV(E) grade cable for 20/25 MVA.	By single /Double ACSR “ZEBRA” conductor per phase
15.2	LV side	1) By 3 runs of 1C x 1000 sqmm per phase A2XY unarmoured cable 11 kV (E) grade cable (For 25MVA) 2) By 4 runs of 1C x 1000 sqmm per phase A2XY unarmoured cable 11 kV (E) grade cable (For 31.5MVA)	
15.3	LV neutral	By G .S. strip mim 2x75x10 mm size	By G.S. strip min 2x75x10 mm size
16.0	Highest system voltage HV side, kV	36	72.5
17.0	Highest system voltage LV side, kV	12	12
18.0	Lightning impulse withstand voltage, kV peak		
18.1	For nominal system voltage of 11 kV	75	
18.2	For nominal system voltage of 33 kV	170	
18.3	For nominal system voltage of 66 kV	325	
19.0	Power frequency withstand voltage kV rms		
19.1	For nominal system voltage of 11 kV	28	
19.2	For nominal system voltage of 33 kV	70	
19.3	For nominal system voltage of 66 kV	140	
20.0	Clearances phase to phase, mm		
20.1	For nominal system voltage of 11 kV	280	
20.2	For nominal system voltage of 33 kV	350	
20.3	For nominal system voltage of 66 kV	700	
21.0	Clearances phase to earth, mm		
21.1	For nominal system voltage of 11 kV	140	
21.2	For nominal system	320	

	voltage of 33 kV	
21.3	For nominal system voltage of 66 kV	660
21.4	Ground clearance – Live part to ground for 66kV – mm	4000
22.0	System fault level, HV side	1500 MVA for 33 kV 3600 MVA for 66 kV
23.0	System fault level, LV side	500 MVA for 11 kV
24.0	Short circuit withstand capacity of the transformer	
24.1	Three phases dead short circuit at secondary terminal with rated voltage maintained on the other side	For 3 secs.
24.2	Single phase short circuit at secondary terminal with rated voltage maintained on the other side	For 3 secs.
25.0	System earthing	
25.1	HV	Solidly earthed
25.2	LV	Solidly earthed
26.0	Overload capability	As per IS 2026 part 7
27.0	Noise level	Shall not exceed limit as per NEMA TR- 1 with all accessories running measured as per IEC 551 / NEMA standard
28.0	Radio influence voltage	Maximum 250 microvolt
29.0	Harmonic suppression	Transformer to be designed for suppression of 3^{rd}, 5^{th}, 7^{th} harmonic voltage and high frequency disturbances
30.0	Partial discharge	10 Pico C
31.0	Temperature rise of top oil by thermometer	40 deg C
32.0	Temperature rise of winding by resistance	45 deg C
33.0	Note for the bidders	(left blank)
34.0	Tapping to be provided on HV winding for OLTC	For 33/11 kV & 66/11kVTransformer +10% to -10% @step of 1.25 % 16 taps, 17 tap positions
35.0	Maximum flux density allowed in the core extreme over excitation /over	1.9 Tesla

	fluxing, Tesla	
36.0	Maximum current density allowed	3.0 Amperes per sqmm @ lowest tap.
37.0	AVR input voltage/ Auxiliary supply	Not applicable
38.0	Bushing parameters	
38.1	Rated Current for 20/25 MVA Xmer	1000 A for 33 kV bushing 2000 A for 11kV bushing
38.2	Creepage factor for all bushing mm /KV	31 mm / kV minimum
38.3	Rated thermal short time current for all bushing	25 times rated current for 2 secs
38.4	Angle of mounting	0 to 90 degree
38.5	Cantilever withstand load	for 33 kV bushing- as per std. vendor 2000N for 11kV bushing
38.6	Overall Length (Approx)	for 33 kV bushing- as per std. vendor 503 mm for 11 kV bushing
38.7	Diameter of base	100 mm

ANNEXURE – D – TECHNICAL SPECIFICATION FOR TRANSFORMER OIL

Codes and standards

Latest revision of following codes and standards with all amendments-

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

2.0 Properties

Sr No	Item description	Specification requirement
2.1	**Function**	
2.1.1	Viscosity	
2.1.1.1	Viscosity at 40^0C	15 mm^2/s, Max
2.1.1.2	Viscosity at 0^0C	1800 mm^2/s, Max
2.1.2	Pour Point	- 10^0C, Max
2.1.3	Water content	30 mg/Kg, Max
2.1.4	Breakdown voltage	
2.1.4.1	New unfiltered oil	30 kV, Min
2.1.4.2	After filtration	70 kV, Min
2.1.5	Density at 20^0C	0.895 g/ml, Max
2.1.6	Dielectric dissipation factor at 90^0C	0.005, Max
2.1.7	Particle Content	Manufacturer to specify the data
2.2	**Refining/Stability**	
2.2.1	Appearance of oil	Clear, free from sediment and suspended matter
2.2.2	Acidity	0.01 mg KOH/g, Max
2.2.3	Interfacial tension at 27^0C	0.04 N/m, Min
2.2.4	Total sulphur content	Manufacturer to specify the data
2.2.5	Corrosive sulfur	Not-corrosive
2.2.6	Potentially Corrosive sulfur	Not-corrosive
2.2.7	DBDS	Not detectable (<5 mg/kg)
2.2.8	Inhibitor	Not detectable (<0.01%)
2.2.9	Metal Passivator	Not detectable (<5 mg/kg)
2.2.10	Other additives	Manufacturer to specify the data
2.2.11	2-furfural and related Compounds content	Not detectable (<0.05 mg/kg) for each individual compound
2.3	**Performance**	
2.3.1	Oxidation stability, test duration 164 h	
2.3.1.1	Total acidity	1.2 mg KOH/g, Max
2.3.1.2	Sludge	0.8%, Max
2.3.1.3	DDF at 90^0C	0.5, Max
2.3.2	Gassing Tendency	Manufacturer to specify the data
2.3.3	ECT	Manufacturer to specify the data

2.4	**Health,safety and Environment**	
2.4.1	Flash point	135^0C, Min
2.4.2	PCA content Max	3%, Max
2.4.3	PCB content	Not detectable (<2 mg/Kg)

ANNEXURE – E – SPECIFICATION FOR NITROGEN INJECTION FIRE PROTECTION SYSTEM

1.0.0 SUPPLY AND SCOPE WORK

Design, manufacture, testing of the assembled system at manufacturer's works before dispatch, packing and supply at site, erection and commissioning of the Nitrogen Injection Fire Protection system

Installation testing and commissioning of Nitrogen Injection Fire Protection system shall be in scope of bidder. All material including Pipes, ducts control cables, tools, tackles, hardware, testing equipments and manpower required for the work shall be in scope of bidder except for any type of civil work like fire wall, soak pit etc. Bidder if feels shall conduct physical survey of the power transformer to check feasibility and quantum of work involved.

2.0.0 INTRODUCTION

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

Fire shall be extinguished within 3 minutes (Maximum) of system activation and within 30 seconds (maximum) of commencement of nitrogen injection.

3.0.0 APPLICABLE CODES AND STANDARDS

The design and installation of the complete fire protection system shall comply with the latest applicable Indian standards

a) IS 10028 (Part II) : Code of practice for selection, installation, and maintenance of transformer

b) Tariff Advisory Committee : Regulations for the electrical equipment of buildings

c) National fire Codes 1993 of National Fire Protection Association (NFPA) USA

d) Central Electricity Authority, The Gazette of India, Extraordinary 2010 : Safety provisions for electrical installations and apparatus of voltage exceeding 650V

4.0.0 ACTIVATION OF THE FIRE PROTECTIVE SYSTEM

Mal-functioning of fire prevention / extinguishing system could lead to interruption in power supply. The supplier shall ensure that the probability of chances of malfunctioning of the fire protective system is practically zero. To achieve this objective, the supplier shall plan out his scheme of activating signals which should not be too

complicated to make the fire protective system inoperative in case of actual need and should not be dependent on auxiliary power source. The system shall be provided with automatic control for fire prevention and fire extinction without any manual intervention. Besides automatic control, remote electrical push button control at Control box and local manual control in the fire extinguishing cubicle shall also be provided. The following electrical-signals shall be required for activating the fire protective system under prevention mode / fire extinguishing mode.

4.1.0 Auto Mode

4.1.1 For prevention of fire :
Differential relay operation + Buchholz relay paralleled with pressure relief valve or RPRR (Rapid Pressure Rise Relay) + Tripping of all or one circuit breakers (on HV & LV/IV side) associated with transformer / reactor is the pre-requisite for activation of system. The system shall have sufficient Input modules.

4.1.2 For extinguishing fire :
Fire detector + Buchholz relay paralleled with pressure relief valve (PRV) or sudden pressure relay (SPR) + tripping of all circuit breakers (on HV & LV/IV side) associated with transformer / reactor is the pre-requisite for activation of system.

4.2.0 Manual Mode (Local / Remote electrical)

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

4.3.0 Manual Mode (Mechanical)

Tripping of all circuit breakers (on HV & LV/IV side) associated with transformer / Reactor is the pre-requisite for activation of system.
The system shall be designed to be operated manually in case of failure of power supply to fire protection system.

5.0.0 GENERAL DESCRIPTION

Nitrogen injection fire protection system should be a dedicated system for each oil filled transformer / reactor. It should have a Fire Extinguishing Cubicle (FEC) placed on a plinth at 5-7m away (as per statutory requirement) from transformer / reactor or placed next to the fire wall if fire wall exists. The FEC shall be connected to the top of transformer / reactor oil tank for depressurization of tank and to the oil pit as per Indian standard and CBIP from its bottom through oil pipes. The fire extinguishing cubicle should house a pressurized nitrogen cylinder(s) which is connected to the oil tank of transformer/reactor oil tank at bottom. The Transformer Conservator Isolation Valve (TCIV) is fitted between the conservator tank and Buchholz relay.

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

receiving system activation signals. All panel or control equipments shall be fire proof so as to ensure that they do not fail themselves in event of fire.

6.0.0 OPERATION

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

7.0.0 SYSTEM COMPONENTS

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

7.1.0 Fire Extinguishing Cubicle (FEC)

The FEC shall be made of CRCA sheet of 3 mm (minimum) thick complete with the base frame, painted inside and outside with post office red colour (shade 538 of IS-5).It shall have hinged split doors fitted with high quality tamper proof lock. The degree of protection shall be IP55. The following items shall be provided in the FEC.

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

7.2.0 Control box

Control box is to be placed in the control room for monitoring system operation, automatic control and remote operation. Control supply will be 50/220VDC (15% tolerance) based on site requirement. The following alarms, indications, switches, push buttons, audio signal etc. shall be provided.

a. System on
b. TCIV open
c. Oil drain valve closed
d. Gas inlet valve closed
e. TCIV closed*

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

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

7.3.0 Transformer Conservator Isolation Valve

Transformer conservator isolation valve (TCIV) to be fitted in the conservator pipe line, between conservator and buchholz relay which shall operate for isolating the conservator during abnormal flow of oil due to rupture / explosion of tank or bursting of bushing. The valve shall not isolate conservator during normal flow of oil during filtration or filling or refilling, locking plates to be provided with handle for pad locking. It shall have proximity switch for remote alarm and indication glass window for visual inspection for physical checking of the status of valve.

The TCIV should be of the best quality as malfunctioning of TCIV could lead to serious consequence. The closing of TCIV means stoppage of breathing of transformer/reactor. Fire survival cable connecting TCIV shall be terminated in transformer marshalling box.

7.4.0 Fire detectors

The system shall be complete with adequate number of fire detectors (quartz bulb) fitted on the top cover of the transformer / reactor oil tank. The system generates signal after sensing higher temperature. The placing of fire detectors and numbers shall be designed and finalized by bidder as per requirement.

7.5.0 Signal box

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

7.6.0 Cables

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

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

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

7.7.0 Pipes

Heavy duty pipe connecting the transformer/reactor tank for oil rain, and for nitrogen injection shall be provided. Pipes connecting oil tank laid underground, shall be preferably be used for interconnection. Pipes, complete with connections, flanges, bends and tees etc. shall be supplied along with the system.

7.8.0 Other items

7.8.1 Oil drain and nitrogen injection openings with gate valves on transformer / reactor tank at suitable locations.

7.8.2 Flanges with dummy piece in conservator pipe between Buchholz relay and conservator Tank for fixing TCIV.

7.8.3 Fire detector brackets on transformer / reactor tank top cover.

7.8.4 Spare potential free contacts for activating the system i.e. in differential relay, Buchholz relay, Pressure Relief Device / RPRR, Circuit Breaker of transformer/reactor

7.8.5 Pipe connections between transformer / reactor and FEC and between FEC and oil pit required for collecting top oil.

7.8.6 Cabling for fire detectors mounted on transformer /reactor top cover

7.8.7 Inter cabling between signal box, control box and Fire Extinguishing Cubicle (FEC).
All external cables from / to the system i.e. signal box to control box and control box to FEC shall be provided by the purchaser. All internal cables within the system i.e. between detectors / signal box / marshalling box / FEC / TCIV shall be in the scope of NIFPS supplier.

7.8.8 Butterfly valves /Gate valves on oil drain pipe and nitrogen injection pipe which should be able to withstand full vacuum.

7.8.9 Supports, signal box etc. which are to be painted with enamelled paint.

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

8.0.0 MANDATORY SPARES

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

9.0.0 TESTS

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

The supplier shall demonstrate the functional test associated with the following:

- Fire Extinguishing Cubicle, Control Box.
- Fire Detector.
- Transformer Conservator Isolation Valve

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

10.0.0 DOCUMENTS TO BE SUBMITTED

10.1.0 To be submitted along with offer

10.1.1 General outline of the system.
10.1.2 Detailed write-up on operation of the offered protection system including maintenance and testing aspects / schedules.
10.1.3 Technical Data particulars (GTP), the format of which is attached in Annexure A of the specification
10.1.4 Data regarding previous supplies, date of commissioning, performance feedback etc.
10.1.5 Document related to Type test / proof of design as required by statutory body / electrical inspector

10.2.0 To be submitted after award of contract:

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

11.0.0 PACKING, SHIPPING, HANDLING & SITE SUPPORT

11.1.0	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.

11.2.0	Packing for accessories and spares	Robust non-returnable packing case with all the above protection & identification Label. Thebidder should get the packing list approved before dispatching the material.
11.3.0	Packing Identification Label	On each packing case, following details are required:
11.3.1	Individual serial number	
11.3.2	Purchaser's name	
11.3.3	PO number (along with SAP item code, if any) & date	
11.3.4	Equipment Tag no. (if any)	
11.3.5	Destination	
11.3.6	Manufacturer / Supplier's name	
11.3.7	Address of Manufacturer / Supplier / it's agent	
11.3.8	Description	
11.3.9	Country of origin	
11.3.10	Month & year of Manufacturing	
11.3.11	Case measurements	
11.3.12	Gross and net weight	
11.3.13	All necessary slinging and stacking instructions	
11.4.0	Shipping	The seller shall be responsible for all transit damage due to improper packing.
11.5.0	Handling and Storage	Manufacturer instruction shall be followed.
11.6.0	Detail handling & storage instruction sheet / manual to be furnished before commencement of supply.	

12.0.0 DEVIATIONS

List of deviations shall be stated in writing with the tender by reference to the Specification clause / GTP/ Drawing. In absence of such a statement, requirements of the Specification shall be assumed to be met without exception by the bidder.

ANNEXURE – F – SPECIFICATION FOR SILICAL GEL BREATHER

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

1.0 Scope of Supply

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

2.0 General

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

3.0 Specific Requirement

3.1 Breather

1.	Body	Aluminium pressure die caste Short Blasted & Powder Coated
2.	Container	Polycarbonate : 143R grade
3.	Oil Cup	Polycarbonate : 143R grade
4.	Gasket	Nitrile cork rubber for main body & oil cup gasket
5.	Silica Gel	Round ball type of size 2-5 mm (deep Blue)
6.	Paint	Powder Coated
7.	Mounting	Threaded for existing Transformers. Flanged type for New Transformers
8.	Hardware	Stainless Steel
9.	Flange Type, Size & hardware	Flange should be of circular shape with diameter of & with hardware of M10 bolts.

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

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

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

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

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

3.7 Oil filling indicator on oil cup.

3.8 Application

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

3.9 Silica Gel

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

4.0 Marking

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

5.0 Testing

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

6.0 Prototype

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

7.0 Packing & Keeping Quality

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

8.0 Compliance Status / Deviation

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

9.0 Documents Comprising The Bid

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

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

ANNEXURE – G – MANUFACTURING QUALITY ASSURANCE PLAN

SL NO	COMPONENT & CHARACTRISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
A	**RAW Material**										
1	**Winding Conductor (PICC)**										
1.1	Bare Dimensions & Finish of Conductor	Major	Measurement	1 sample per size per lot	MFR. STD / IS 13730 Part 27	MFR. STD / IS 13730 Part 27	Supplier's TC	P	V	R	
1.2	Increase in dimensions due to Paper covering	Major	Measurement	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.3	Resistivity @ 20°C	Major	Electrical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.4	No of Layers	Critical	Measurement	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.5	Conductor Tensile strength	Critical	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.6	Conductor Elongation	Critical	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.7	% Overlap of Paper	Critical	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.8	Corner Radius	Critical	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.9	**Kraft Paper Insulation**										
1.9.1	Thickness	Major	Measurement	1 sample per size per lot	MFR. STD/ IEC 60554	MFR. STD/ IEC 60554	Supplier's TC	P	V	R	
1.9.2	Apparent Density	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	

SL NO	COMPONENT & CHARACTRISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
1.9.3	Air Permeability	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.9.4	Tensile Index (Longitudinal and Transverse)	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.9.5	Electrical Strength in Air	Major	Electrical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.9.6	Ash Content	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.9.7	pH of 5% Aqueous Extract	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.9.8	Conductivity of 5% Aqueous Extract	Critical	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.9.9	Moisture Content	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.9.10	Heat Stability	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.9.11	Degree of Polymerization	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.9.12	Elongation (MD & CMD)	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.9.13	Tear index	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
2.0	**CRGO Laminations (Watt absorption)**										
2.1	Specific Core Loss	Major	Electrical	Random	MFR. STD/IS 3024	MFR. STD/IS 3024	Supplier's TC	P	V	R	
2.2	Surface Insulation resistance	Major	Electrical	-DO-	-DO-	-DO-	-DO-	P	V	R	

SL NO	COMPONENT & CHARACTRISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
2.3	Ageing Test	Major	Measurement	-DO-	-DO-	-DO-	-DO-	P	V	R	
2.4	Stacking Factor	Major	Measurement	-DO-	-DO-	-DO-	-DO-	P	V	R	
2.5	Waviness	Major	Measurement	-DO-	-DO-	-DO-	-DO-	P	V	R	
2.6	Edge Burr	Major	Visual	-DO-	-DO-	-DO-	-DO-	P	V	R	
2.7	Sample testing for Checking Specific Core loss, accelerated ageing test, Surface insulation resistivity, AC permeability and magnetization, stacking factor, Ductility	Major	Electrical	**100%**	MFR. STD/IS 3024	MFR. STD/IS 3024	--	--	P	**W**	Sample will be randomly selected by BSES & will be send for testing at CPRI/ERDA lab.
3.0	**Un-impregnated Laminated Wood**										
3.1	Thickness	Major	Visual	1 sample size / LOT	MFR.D STD/ IEC 61061	MFR.D STD/IEC 61061	Supplier's TC	P	V	R	
3.2	Density	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
3.3	Moisture Content	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
3.4	Oil Absorption	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
3.5	Cross breaking strength	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
3.6	Compressive Strength	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	

SL NO	COMPONENT & CHARACTRISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
3.7	Electric Strength in Oil	Major	Electrical	-DO-	-DO-	-DO-	-DO-	P	V	R	
3.8	Shrinkage in oil	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
3.9	Tensile Strength	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
4.0	**Press Boards (Pre-compressed)**										
4.1	Thickness	Major	Measurement	1 sample/Size/LOT	MFR. STD/ IEC 60641	MFR. STD/ IEC 60641	Supplier's TC	P	V	R	
4.2	Tensile Strength (MD & CMD)	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
4.3	Shrinkage in Air (MD & CMD)	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
4.4	Moisture Content	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
4.5	Oil Absorption	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
4.6	Electrical Strength in Oil and air	Major	Electrical	-DO-	-DO-	-DO-	-DO-	P	V	R	
4.7	pH of 5% aqueous extract	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
4.8	Conductivity of 5% aqueous extract	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
4.9	Compressibility	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
4.10	Ash Content	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	

SL NO	COMPONENT & CHARACTRISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
4.11	Apparent density	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
4.12	Elongation (MD & CMD)	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
5.0	**Tank and its accessories**										
5.1	Structural steel										
5.1.1	Thickness	Major	Measurement	Random	MFR. STD / IS 2062	MFR. STD / IS 2062	Suppliers TC	P	V	R	
5.1.2	Yield Strength	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
5.1.3	Tensile Strength	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
5.1.4	Elongation	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
5.1.5	Bend test	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
5.2	**Manufacturing of Tank and acc.**										
5.2.1	Dimension check	Major	Measurement	100%	MFR. Spec/ DRG	MFR. Spec/ DRG	MFR. Fabrication report	P	W	R	
5.2.2	Joint preparation	Major	Measurement	100%	-DO-	-DO-	-DO-	P	V	R	
5.2.3	Assembly and alignment	Major	Visual and measurement	100%	MFR. Spec/ DRG	MFR. Spec/ DRG	MFR. Fabrication report	P	V	R	
5.2.4	DP Test on Welds on	Major	DP Test	100%	-DO-	-DO-	-DO-	P	W	R	

SL NO	COMPONENT & CHARACTRISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
	Load bearing members eg. Jack Pads										
5.2.5	Pressure test	Major	Mechanical	On One unit	CBIP	CBIP	Test Report	--	P	W	**STAGE INSPECTION**
5.2.6	Vacuum test	Major	Mechanical	On One unit	CBIP	CBIP	Test Report	--	P	W	**STAGE INSPECTION**
5.2.7	Leakage test										
5.2.7.1	Main Unit	Major	Mechanical	100%	MFR. STD	MFR. STD	Test report	P	W	R	
5.2.7.2	Conservator	Major	Mechanical	100%	MFR. STD	MFR. STD	Test report	P	W	R	
5.2.7.3	Pipes	Major	Mechanical	100%	MFR. STD	MFR. STD	Test report	P	W	R	
5.2.8	Surface preparation	Major	Visual	100%	MFR. STD	MFR. STD	MFR. Fabrication report	P	V	R	
5.2.9	Final Paint Coat (including Primer), Thickness & Shade	Major	Measurement	100%	MFR. STD	MFR. STD	Test report	P	V	R	
5.2.10	Paint Peel off test	Major	Visual	100%	MFR. STD	MFR. STD	Test report	--	P	R	
6.0	**Porcelain insulators**										
6.1	Make and rating	Critical	Visual	100%	IS 8603/IS 2099/App.Drg.	IS 8603/IS 2099/App.Drg.	Supplier's TC	P	V	R	
6.2	Visual inspection for surface smoothness, any	Critical	Visual	100%	-DO-	-DO-	-DO-	P	V	R	

SL NO	COMPONENT & CHARACTRISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
	damage, etc.										
6.3	Important dimension including Creepage distance	Major	Measurement	One sample /size / lot	-DO-	-DO-	-DO-	P	V	R	
6.4	All Routine electrical tests	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
7.0	**Magnetic Oil Gauge**										
7.1	Make and dimensions	Major	Physical	100%	App.Drg./ Supplier Catalogue	App.Drg./ Supplier Catalogue	Supplier's TC	P	V	R	
7.2	Test for level (eg at 30° Max)	Major	Mechanical	100%	-DO-	-DO-	-DO-	P	V	R	
7.3	Switch contact test	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
7.4	Leakage test	Major	Mechanical	100%	-DO-	-DO-	-DO-	P	V	R	
7.5	Switch operating and setting	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
7.6	Di-electric test at 2 KV AC between live terminal and body	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
8.	**Buchholz relay**										
8.1	Make and type	Critical	Visual	100%	App.Drg./ Supplier Catalogue /IS 3637	App.Drg./ Supplier Catalogue /IS 3637	Supplier's TC	P	V	R	

SL NO	COMPONENT & CHARACTRISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
8.2	Bore size	Major	Measurement	One/size	-DO-	-DO-	-DO-	P	V	R	
8.3	Porosity and element test	Major	Critical	100%	-DO-	-DO-	-DO-	P	V	R	
8.4	Gas volume and surge test	Major	Mechanical	One/Size	-DO-	-DO-	-DO-	P	V	R	
8.5	HV test at 2 KV AC & IR test	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
8.6	Continuity for alarm/Trip	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
9.0	**Marshalling cum cooler control box**										
9.1	Dimensions	Critical	Measurement	100%	MFR. STD / App. DRG.	MFR. STD / App. DRG.	Supplier's TC	P	W	R	
9.2	Make and rating of Components	Major	Visual	100%	-DO-	App Make	Supplier's TC	P	W	R	
9.3	Functional test	Major	Electrical	100%	-DO-	MFR. STD / DRG	Supplier's TC	P	W	R	
9.4	HV test at 2 KV AC for 1 min	Major	Electrical	100%	-DO-	MFR. STD / DRG	Supplier's TC	P	W	R	
9.5	IP 55 test on marshalling cum cooler control box	Major	Environment	--	--	--	Test report	--	--	R	Supplier's Test certificate shall be submitted for review
10.0	**Radiator**										

SL NO	COMPONENT & CHARACTRISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
10.1	Dimension, number of sections	Major	Measurement	100%	MFR. DRG	VTD DRG	Supplier's TC	P	V	R	
10.2	Leakage Test with Air	Major	Visual	100%	As per CBIP	As per CBIP	Supplier's TC	P	V	R	
10.3	Paint shade	Major	Visual & Measurement	Random	MFR. Specs /Drg	MFR. Specs /Drg	Supplier's TC	P	V	R	
10.4	Surface Preparation	Major	Measurement	100%	SA 2.5 of ISO 8503/2	SA 2.5 of ISO 8503/2	Supplier's TC	P	V	R	
11	**OLTC and drive mechanism**										
11.1	Make, Rating and model	Major	Visual	100%	MFR. Spec/ IS 8468 /IEC 214-1989	MFR. Spec/ IS 8468 /IEC 214-1989	Supplier's TC	P	V	R	
11.2	Copper Contact surface finish	Major	Visual	100%	IS 8468	IS 8468	Supplier's TC	P	V	R	
11.3	Contact Resistance test	Major	Visual	100%	Supplier's STD	Supplier's STD	Supplier's TC	P	V	R	
11.4	Electrical Routine test	Major	Electrical	100%	IS 8468/ IEC 214	IS 8468/ IEC 214	Supplier's TC	P	V	R	
11.5	Mechanical test on diverter switch including pressure test	Major	Mechanical	100%	-DO-	-DO-	-DO-	P	V	R	
11.6	HV test for Auxiliary	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	

SL NO	COMPONENT & CHARACTRISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
	circuit										
11.7	Mechanical test on Tap selector switch with motor drive	Major	Mechanical	100%	-DO-	-DO-	-DO-	P	V	R	
11.8	Pressure test for Oil Compartment	Major	Mechanical test	100%	-DO-	-DO-	-DO-	P	V	R	
12.0	**Transformer Oil**	Major	Testing	One Sample from each lot	Annexure D of BSES spec.	Annexure D of BSES spec.	STC	P	V	R	One sample of oil shall be drawn from **each lot of Transformer** offered for final inspection by BSES representative and same shall be tested at CPRI/ERDA lab as per relevant std.
13.0	**OTI / WTI**										
13.1	Make and Model	Critical	Visual	100%	MFR. STD/App. Drg.	MFR. STD/App. Drg.	Suppliers TC	P	P	R	
13.2	Calibration	Major	Electrical	100%	-DO-	-DO-	-DO-	P	P	R	
13.3	Check for alarm & trip	Major	Electrical	100%	-DO-	-DO-	-DO-	P	P	R	

SL NO	COMPONENT & CHARACTRISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
	signal operation against set value										
13.4	HV test	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
13.5	Switch Setting	Major	Mechanical	100%	-DO-	-DO-	-DO-	P	P	R	
14.0	**Bushing Metal parts**										
14.1	Dimension Checks	Major	Mechanical	100%	MFR. STD /IS 3347	MFR. STD /IS 3347	Supplier's TC	P	V	R	
14.2	Surface Finish	Major	Visual	100%	-DO-	-DO-	-DO-	P	V	R	
15.0	**Current Transformers**										
15.1	Dimensions, make	Major	Measurement	100%	MFR. STD /App. DRG. / IS 2705	MFR. STD /App. DRG. / IS 2705	Supplier's TC	P	P	R	
15.2	Rating and terminal marking	Major	Physical	100%	MFR. APPD. DRG	MFR. APPD. DRG	Supplier's TC	P	P	R	
15.3	Measurement of ratio and phase angle error	Major	Electrical	100%	IS 2705	IS 2705	Supplier's TC	P	V	R	
15.4	High Voltage test	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
15.5	Inter-Turn insulation test	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
15.6	Knee Point Voltage	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	Only for CI-PS CT
15.7	Excitation Current	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	Only for CI-PS

SL NO	COMPONENT & CHARACTRISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
											CT
15.8	Secondary winding resistance	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	Only for CI-PS CT
15.9	Polarity	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
16.0	**Valves/ Butterfly valves**										
16.1	Make & operation	Critical	Visual	100%	APP.drg./MFR. STD	APP.drg./MFR. STD	Supplier's TC	P	P	R	
16.2	Leakage test for body	Major	Mechanical	100%	-DO-	-DO-	-DO-	P	P	R	
16.3	Leakage test for top spindle	Major	Mechanical	100%	-DO-	-DO-	-DO-	P	P	R	
16.4	Mounting dimensions	Major	Measurement	100%	-DO-	-DO-	-DO-	P	P	R	
16.5	Material of Body & Seat	Major	Chemical & measurement	1 sample per lot	-DO-	-DO-	-DO-	P	V	R	
17.0	**Air Cell**										
17.1	Make	Critical	Visual	100%	MFR. STD/App. drg.	MFR. STD/App. drg.	Supplier's TC	P	V	R	
17.2	Dimensional check	Major	Measurement	100%	-DO-	-DO-	-DO-	P	V	R	
17.3	Pressure test for 24 hrs. for leakage	Major	Mechanical	100%	-DO-	No Visible Damage	-DO-	P	V	R	
17.4	Inflation and deflation test (10 times)	Critical	Mechanical	100%	-DO-	-DO-	-DO-	P	V	R	

SL NO	COMPONENT & CHARACTRISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
18.0	**Pressure relief Valve**										
18.1	Make	Critical	Visual	100%	MFR. STD/ App. Drg.	MFR. STD/ App. Drg.	-DO-	P	P	R	
18.2	Operating pressure	Major	Mechanical	100%	-DO-	-DO-	-DO-	P	P	R	
18.3	Switch Contact test	Major	Electrical	100%	-DO-	-DO-	-DO-	P	P	R	
18.4	Mounting dimensions	Major	Measurement	100%	-DO-	-DO-	-DO-	P	V	R	
18.5	HV test between body & terminal	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
19.0	**Fan Motor & Cooler Fan**										
19.1	Verification of Make & rating	Major	Physical	100%	MFR. STD/App. DRG.	MFR. STD/App. DRG.	Supplier's TC	P	V	R	
19.2	Input current power speed	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
19.3	HV test at 2.0 KV	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
19.4	Insulation resistance test	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
20.0	**Gasket**										
20.1	Appearance & Finish	Major	Mechanical	1 sample per size per lot	IS 4253-II, 1980	IS 4253-II, 1980	Supplier's TC	P	V	R	
20.2	Hardness, IRHD	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
20.3	Tensile Strength	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	

SL NO	COMPONENT & CHARACTRISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
20.4	Compressibility	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
20.5	Compression set	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
20.6	Flexibility	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
21.0	**Silica gel Breather**										
21.1	Type / model	Major	Visual	100%	MFR. STD /DRG	MFR. STD /DRG	Supplier's TC	P	V	R	
21.2	Color of Gel	Major	Visual	100%	-DO-	-DO-	-DO-	P	V	R	
B	**In Process**										
1	**Winding**										
1.1	Check for Visual, physical and dimensional Parameters and no. of parallel conductors.										
1.1.1	Measurement of axial height, OD & ID& current density calculation.	Major	Measurement	100%	MFR. Data/Drg	MFR. Data/Drg	QC report	--	P	W	
1.1.2	Copper Conductor size (Bare & covered)	Major	Measurement	100%	-DO-	-DO-	-DO-	--	P	W	
1.1.3	No. of Turns / Disc	Major	Measurement	100%	-DO-	-DO-	-DO-	--	P	R	
1.2	Winding height	Major	Measurement	100%	-DO-	-DO-	-DO-	--	P	W	

SL NO	COMPONENT & CHARACTRISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
1.3	Visual inspection of Brazed joints as applicable	Major	Visual	100%	-DO-	-DO-	-DO-	--	P	R	
1.4	Tap Leads termination in case of tap winding	Major	Visual	100%	-DO-	-DO-	-DO-	--	P	R	
1.5	Current density calculation	--	--	--	--	--	--	--	P	W	
2.0	**Core Assembly**										
2.1	Visual & Key Dimensional check										
2.1.1	Diagonal distance	Major	Measurement	100%	MFR.Drg	MFR.Drg	QC report	--	P	W	
2.1.2	Window centre distance	Major	Measurement	100%	-DO-	-DO-	-DO-	--	P	W	
2.1.3	Window height	Major	Measurement	100%	-DO-	-DO-	-DO-	--	P	W	
2.2	Stack Thickness	Major	Measurement	100%	-DO-	-DO-	-DO-	--	P	W	
2.3	High Voltage test at 2 KV AC for l min between core & core clamp, Yoke bolt	Major	Electrical	100%	-DO-	-DO-	-DO-	--	P	W	
2.4	Pre-Core loss measurement	Major	Electrical	100%	-DO-	-DO-	-DO-	--	P	W	
3.0	**Core-Coil Assembly**										
3.1	Top & Bottom insulation	Major	Visual	100%	MFR.Data	MFR.Data	QC report	--	P	R	

SL NO	COMPONENT & CHARACTRISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
	arrangement				/DRG	/DRG					
3.2	Lead arrangement	Critical	Visual	100%	-DO-	-DO-	-DO-	--	P	R	
3.3	Tap & Lead End Brazing & Insulation	Critical	Visual	100%	-DO-	-DO-	-DO-	--	P	R	
3.4	Dimension of Coil After Shrinkage	Major	Measurement	100%	-DO-	-DO-	-DO-	--	P	R	
3.5	Verification of Major electrical clearances	Major	Visual & Measurement	100%	-DO-	-DO-	-DO-	--	P	R	
3.6	HV/LV Connection	Major	Visual	100%	-DO-	-DO-	-DO-	--	P	R	
4.0	**Core-Coil Assembly Before Ovening**										
4.1	Initial Ratio test	Major	Measurement	100%	-DO-	-DO-	-DO-	--	P	R	
5.0	**Core-coil assembly during drying**										
5.1	Measurement & recording of temperature & drying time during vacuum treatment.	Major	Visual	100%	MFR.Data /DRG	MFR.Data /DRG	QC report	--	P	R	
5.2	Check for completeness of drying	Major	Visual	100%	MFR.Data /DRG	MFR.Data /DRG	QC report	--	P	R	
5.3	Certification of all test	Major	Visual	100%	MFR.Data /DRG	MFR.Data /DRG	QC report	--	P	R	

SL NO	COMPONENT & CHARACTRISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
6.0	**Core-Coil Assembly After Ovening**										
6.1	Ratio Test & Magnetic Balance test	Major	Electrical	100%	-DO-	-DO-	-DO-	--	P	W	
6.2	Recording of time/Temp, Vacuum	Major	Measurement	100%	-DO-	-DO-	-DO-	--	P	R	
6.3	Record of Moisture extract	Major	Measurement	100%	MFR. STD	MFR. STD	QC report	--	P	R	
6.4	Verification of completeness & Drying	Major	Verify	100%	MFR. STD	MFR. STD	QC report	--	P	R	
6.5	Insulation resistance measurement by Megger	Major	Electrical	100%	MFR. STD	MFR. STD	Test report	--	P	R	
6.6	Earthing connection	Major	Visual	-DO-	MFR. STD	MFR. STD	QC Report	--	P	R	
7.0	**Tanking**										
7.1	Electrical clearance arrangement	Major	Measurement	100%	MFR. DRG	MFR. DRG	QC report	--	P	R	
7.2	Verification of Core-Frame Clamping arrangement	Major	Visual	100%	-DO-	-DO-	-DO-	--	P	R	
7.3	Core to frame insulation resistance test & HV test at 2 KV for min	Major	Electrical	100%	-DO-	-DO-	-DO-	--	P	R	

SL NO	COMPONENT & CHARACTRISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
8.0	**Final Assembly for testing**										
8.1	Fittings of external accessories	Major	Visual	100%	MFR. STD /DRG	MFR. STD /DRG	Job Card	--	P	R	
8.2	Internal Oil leakage test on main unit	Major	Visual	100%	CBIP	CBIP	QC report	--	P	R	
C	**Final testing**										
1	**Routine Test**										
1.1	Voltage Ratio test	Major	Electrical	100%	IS 2026	IS 2026	Test Report	--	P	W	
1.2	Winding Resistance at all tap corrected to 75°C	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.3	No Load Loss & Current @90%,100%&110% of rated voltage	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	To be repeated after type test.
1.4	Impedance Voltage/Short Circuit Impedance(Principal Tap) Load Loss @Principal, Max, Mini Tap	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.5	Induced over voltage	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	To be repeated after Impulse test
1.6	Separate Source Voltage	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	

SL NO	COMPONENT & CHARACTRISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
	Test										
1.7	Insulation Resistance &PI(10 min / 1 min)	Major	Electrical	100%	--	--	Test report	--	P	W	By 5 KV Megger PI Shall be more than1.5
1.8	Voltage Vector Relationship & Polarity	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.9	Magnetic Balance Test	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.10	Oil leakage test	Major	Visual	100%	CBIP	CBIP	Test report	--	P	W	
1.11	Auxiliary circuit insulation test for OLTC, 2.0 KV AC for 1 min	Major	Electrical	100%	--	Withstand 2 KV for 1 min	Test report	--	P	W	
1.12	Polarity check & Ratio Test of LVWTI CT/ HVWTI CT & NCT	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.13	Magnetic circuit Test at 2KV between Core & Frame	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.14	Measurement of auxiliary losses(Losses taken by Fan)	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.15	BDV test on Transformer Oil	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	

SL NO	COMPONENT & CHARACTRISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
1.16	Routine Test on Tank	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.17	Power frequency withstand on auxiliary circuit	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.18	Measurement of Cap & tandelta of Wdg, Oil and HV bushing	Major	Electrical	100%	--	--	Test report	--	P	W	
1.19	Excitation & Knee point Vol. of PS Core of NCT.	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.20	Routine (Functional) Test on OLTC	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.21	SFRA	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
2.0	**Type test (One unit of each type and rating of Transformer)**										
2.1	Heat Run Test (Temp. Rise Test)	Major	Testing	One Unit	IS 2026	IS 2026	Test Report	--	P	W	
2.2	Impulse withstand Test on all HV & LV Limb for Chopped wave.	Major	Testing	One Unit	IS 2026	IS 2026	Test Report	--	P	W	
2.3	DGA Test Before & After temperature rise	Major	Testing	One Unit	Relevant std.	Relevant std.	Test Report	--	P	W	
2.4	Pressure relief device test	Major	Testing	One Unit	MFR. STD	MFR. STD	Test Report	--	P	W	
3.0	**Other test**										

SL NO	COMPONENT & CHARACTRISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
3.1	**Marshalling cum cooler control box**										
3.1.1	BOM verification	Major	Verification	100%	App MFR.Drg	App MFR.Drg	QC report	--	P	W	
3.1.2	Operation / Continuity of Wiring with OTI, WTI operation & other accessories	Major	Electrical	100%	MFR. STD	MFR. STD	QC report	--	P	W	
3.1.3	2 KV (HV test) on Marshalling cum cooler control box	Major	Electrical	100%	MFR. STD	MFR. STD	QC report	--	P	W	
3.1.4	Operation of Instruments(BR)	Major	Electrical	100%	MFR. STD	MFR. STD	QC report	--	P	W	
3.1.5	Visual & Dimensional check	Major	Measurement	100%	APPD MFR.Drg.	APPD MFR.Drg.	QC report	--	P	W	
4.0	**Special Test (One unit of each type and rating of Transformer)**										
4.1	Zero Phase Sequence Test	Major	Testing	One Unit	IS 2026	IS 2026	Test Report	--	P	W	
4.2	Noise Level Test	Major	Testing	One Unit	NEMA TR-1	NEMA TR-1	Test Report	--	P	W	
4.3	No Load Harmonic Test	Major	Testing	One Unit	IS 2026	IS 2026	Test Report	--	P	W	
4.4	HV Test on all auxiliary equipment and wiring after complete assembly	Major	Testing	One Unit	--	--	Test Report	--	P	W	

SL NO	COMPONENT & CHARACTRISTICS	CLASS	TYPE OF CHECK	QUALITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
D	**Dispatch & Packing**										
1.1	Identification & packing	Major	Visual	100%	As per packing list	As per packing list	Packing List	--	P	--	
1.2	Check for proper Packing	Major	Visual	100%	As per packing list	As per packing list	Packing List	--	P	--	
1.3	Visual check before dispatch	Major	Visual	100%	As per packing list	As per packing list	Packing List	--	P	--	

LEGEND:

S: Supplier
M: Main Contractor (Manufacturer)
O: Owner (BYPL)

P - Perform
V - Verify
R – Review
W- Witness

ANNEXURE – H – TECHNICAL SPECIFICATION OF MATERIAL TRACKING -GPS DEVICE

Supply of GPS Device shall be in Vendors scope, however it shall be returned to Vendor once Goods are received.

Detailed requirement of GPS Device is as below:

Once the material is dispatched after Final clearance Transport Vehicle shall have GPS Tracking Device and status of dispatch of material shall be sent to all the stake holders via SMS thru GPS Device.

Approve make is Map my India Asset Tracking device.

SCHEDULE – A –GUARANTEED TECHNICAL PARTICULARS (DATA BY SELLER)

Sr.No.	Particular	Specified / Required	Offered
1.0	General		
1.1	Make		
1.2	Type	As per Annexure C of specification	
2.0	Nominal continuous rating, KVA		
2.1	ONAN	As per Cl 11.1 of Annexure C	
2.2	ONAF	As per Cl 11.2 of Annexure C	
3.0	Rated voltage (KV)		
3.1	HV winding	As per Cl 9.1 of Annexure C	
3.2	LV winding	As per Cl 9.2 of Annexure C	
4.0	Rated current (Amps)		
4.1	HV winding, ONAN / ONAF		
4.2	LV winding , ONAN / ONAF		
5.0	Connections		
5.1	HV winding	As per Annexure C of specification	
5.2	LV winding	As per Annexure C of specification	
5.3	Vector group reference	Dyn11	
6.0	Impedance at principal tap rated current and frequency%		
6.1	Impedance (%)	As per Cl. 12.0 of Annexure C	
6.2	Reactance (%)		
6.3	Resistance (%)		
6.4	Impedance at lowest tap rated current and frequency		
6.5	Impedance at highest tap rated current and frequency		
6.6	Transformer X/R ratio		
7.0	Resistance of the winding at 75^0C at principal tap (ohm)		
7.1	a) HV		
7.2	b)LV		
8.0	Zero sequence impedance (Ohm)		
8.1	a) HV		
8.2	b) LV		
9.0	Guaranteed maximum losses at principal tap at full load and 75^0 C without any positive tolerance kW		
9.1	No load losses (max.)	As per Cl 13.0 Annexure C	
9.2	Load losses (max.)	As per Cl 14.0 Annexure C	
9.3	Cooler fan losses (max.)		
9.4	Total I^2R losses of windings @ 75 deg C		
9.5	Total stray losses @ 75 deg C		

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

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

17.5.2	Pressure mm of Hg	Twice the normal head of oil / normal pressure + 35 kN/m^2 whichever is lower , As per CBIP	
17.6	Is the tank lid slopped?	Yes	
17.7	Inspection cover provided (Yes/No)		
17.8	Location of inspection cover (Yes/No)		
17.9	Min. dimensions of inspection cover (provide list of all inspection cover with dimension), mm x mm		
18.0	Core		
18.1	Type:	Core	
18.2	Core material grade	Premium grade minimum M3 or better	
18.3	Thickness of lamination mm	Max. 0.23 mm with insulating coating on both sides	
18.4	Insulation between core lamination		
18.5	Design flux density of the core at rated condition at principal tap,Tesla		
18.6	Maximum flux density allowed in the core at extreme overexcitation / overfluxing , Tesla		
18.7	Equivalent cross section area of core, mm^2		
18.8	Guaranteed No load current at 90% / 100% / 110% rated voltage & frequency (Amp)	@ 100% - 0.5% of RFLC @ 110% - 1.0% of RFLC	
18.8.1	HV		
18.8.2	LV		
19.0	Type of winding		
19.1	HV		
19.2	LV		
19.3	Conductor material	Electrolytic copper as per relevant standard	
19.4	Maximum current density allowed, Amp per mm^2	As per Annexure C	
19.5	Gauge/area of cross section of conductor, mm^2		
19.5.1	HV		
19.5.2	LV		
19.6	Maximum current density achieved in winding (LV/HV/HVT) – Amps/ mm^2		
19.7	Insulating material		
19.7.1	HV turn		
19.7.2	LV turn		
19.7.3	LV- core		
19.7.4	HV-LV		

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

23.0	Terminal connections			
23.1	HV	As per Annexure C of specification		
23.2	LV	As per Annexure C of specification		
23.3	LV Neutral	As per Annexure C of specification		
24.0	H.V. Cable box/Terminals			
24.1	Suitable for cable/conductor type size	As per Annexure C of specification		
24.2	Termination height , mm	1000 mm , minimum		
24.3	Gland plate dimension mm x mm			
24.4	Gland plate material	Aluminium		
24.5	Gland plate thickness , mm	5 mm minimum		
24.6	Phase to clearance inside box / terminals , mm			
24.7	Phase to earth inside box / terminals , mm			
24.8	Cable box door arrangement as per clause 4.2.9.2			
25.0	L.V line side cable box			
25.1	Suitable for cable type , size	As per Annexure C of specification		
25.2	Termination height , mm	1000 mm , minimum		
25.3	Gland plate dimension mm x mm			
25.4	Gland plate material	Aluminum		
25.5	Gland plate thickness , mm	5 mm minimum		
25.6	Phase to clearance inside box / terminals , mm			
25.7	Phase to earth inside box , mm			
25.8	Cable box door arrangement as per clause 4.2.9.2			
26.0	LV Neutral cable box			
26.1	Suitable for cable type , size	As per Annexure C of specification		
26.2	Termination height , mm			
26.3	Gland plate dimension mm x mm			
26.4	Gland plate material	Aluminum		
26.5	Gland plate thickness , mm	5 mm minimum		
26.6	Phase to clearance inside box, mm			
26.7	Phase to earth inside box , mm			
27.0	Marshalling box cubical provided as per clause no. 4.2.11 of spec. (Yes / no)			
27.1	Mounting of marshalling box	Separate mounted		
28.0	Neutral Current Transformer (NCT)			
28.1	Type			
28.2	Make			
28.3	Reference standard			
28.4	Rated Voltage	12kV		
28.5	CT Ratios	20/25 MVA, Dyn11	25/31.5 MVA, Dyn11	

		Core 1	Core 2	Core 1	Core 2	
		1600/1 A	1600/1A	1600-2000/1 A	1600-2000/1 A	
28.6	Burden ,VA	-	20	-	20	
28.7	Class of Accuracy	PS	5P20	PS	5P20	
28.8	KPV , volts , minimum	40(Rct +8)	-	40(Rct+ 8)	-	
28.9	Resistance, ohm @ 75 deg C, maximum	1	-	1	-	
28.10	Magnetizing current @ Vk/4 , mA , maximum	30	-	100	-	
28.11	Short time withstand current	26.3 kA for 3 sec.				
29.0	Winding current transformer (WCT)					
29.1	Type					
29.2	Make					
29.3	Reference standard					
29.4	CT ratio					
29.5	Burden ,VA	Manufacturer Std.				
29.6	Class of accuracy	Manufacturer Std.				
30.0	Pressure release device					
30.1	Minimum pressure the device is set to rupture					
30.1.1	For main tank					
30.1.2	For OLTC					
31.0	Alarm and trip contact ratings of protective devices					
31.1	Rated/making/ breaking currents , Amp @ voltage for					
31.1.1	PRV for main tank					
31.1.2	PRV for OLTC					
31.1.3	Buchholz relay					
31.1.4	Oil surge relay for OLTC					
31.1.5	Sudden pressure relay					
31.1.6	OTI					
31.1.7	WTI					
31.1.8	Magnetic oil gauge					
32.0	Fittings accessories each transformer furnished as per clause No. (Bidder shall attach separate sheet giving details, make and bill of materials)					
33.0	Painting: as per clause for the transformer , cable boxes, radiator, marshalling box, etc (Yes/No)					
34.0	Over all transformer dimensions					
34.1	Length , mm	6.5 metres maximum				

34.2	Breadth , mm	5.0 metres maximum	
34.3	Height , mm	5.0 metres maximum	
35.0	Transformer tank dimensions		
35.1	Length , mm		
35.2	Breadth , mm		
35.3	Height , mm		
36.0	Marshalling box dimensions		
36.1	Length , mm		
36.2	Breadth , mm		
36.3	Height , mm		
37.0	Weight data		
37.1	Core, kG		
37.2	Frame parts, kG		
37.3	Core and frame, kG		
37.4	Total winding, kG		
37.5	Core and frame winding, kG		
37.6	Tank, kG		
37.7	Tank lid, kG		
37.8	Empty conservator tank , kG		
37.9	Each radiator empty , kG		
37.10	Total weight of all radiator empty , kG		
37.11	Weight of oil in tank , kG		
37.12	Weight of oil in each conservator , kG		
37.13	Weight of oil in each radiators , kG		
37.14	Total weight of oil in radiator , kG		
37.15	OLTC gear including oil , kG		
37.16	Total transport weight of the transformer , kG		
37.17	Total transport weight of the transformer with OLTC and all accessories		
38.0	Volume data		
38.1	Volume of oil in main tank , liters		
38.2	Volume of oil between highest and lowest levels of main conservator ,liters		
38.3	Volume of oil between highest and lowest levels of OLTC conservator, liters		
38.4	Volume of oil in each radiator , liters		
38.5	Total volume of oil in radiators , liters		
38.6	Volume of oil in OLTC , liters		
38.7	Transformer total oil volume , liters		
39.0	Shipping data		

39.1	Weight of heaviest package, kG		
39.2	Dimensions of the largest package (L x B x H) mm		
40.0	Tests		
40.1	All in process tests confirmed as per Cl. (Yes /No)		
40.2	All types tests confirmed as per Cl. (Yes /No)		
40.3	All in routine tests confirmed as per Cl. (Yes /No)		
40.4	All in special tests confirmed as per Cl. (Yes /No)		

SCHEDULE – B –GUARANTEED TECHNICAL PERTICULARS OF TRANSFORMER OIL

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

S no	Item description	Specification requirement	Data by Vendor
1.0	Manufacturer Name		
1.1		Address	
1.2		Contact person	
1.3		Contact telephone no	
2.0	**Function**		
2.1	Viscosity		
2.1.1	Viscosity at 40^0C	15 mm^2/s, Max	
2.1.2	Viscosity at 0^0C	1800 mm^2/s, Max	
2.2	Pour Point	- 10^0C, Max	
2.3	Water content	30 mg/Kg, Max	
2.4	Breakdown voltage		
2.4.1	New unfiltered oil	30 kV, Min	
2.4.2	After filtration	70 kV, Min	
2.5	Density at 20^0C	0.895 g/ml, Max	
2.6	Dielectric dissipation factor at 90^0C	0.005, Max	
2.7	Particle Content	Manufacturer to specify the data	
3.0	**Refining/Stability**		
3.1	Appearance of oil	Clear, free from sediment and suspended matter	
3.2	Acidity	0.01 mg KOH/g, Max	
3.3	Interfacial tension at 27^0C	0.04 N/m, Min	
3.4	Total sulphur content	Manufacturer to specify the data	
3.5	Corrosive sulfur	Not-corrosive	
3.6	Potentially Corrosive sulfur	Not-corrosive	
3.7	DBDS	Not detectable (<5 mg/kg)	
3.8	Inhibitor	Not detectable (<0.01%)	
3.9	Metal Passivator	Not detectable (<5 mg/kg)	
3.10	Other additives	Manufacturer to specify the data	
3.11	2-furfural and related Compounds content	Not detectable (<0.05 mg/kg) for each individual compound	
4.0	**Performance**		

4.1	Oxidation stability, test duration 164 h		
4.1.1	Total acidity	1.2 mg KOH/g, Max	
4.1.2	Sludge	0.8%, Max	
4.1.3	DDF at 90^0C	0.5, Max	
4.2	Gassing Tendency	Manufacturer to specify the data	
4.3	ECT	Manufacturer to specify the data	
5.0	**Health,safety and Environment**		
5.1	Flash point	135^0C, Min	
5.2	PCA content Max	3%, Max	
5.3	PCB content	Not detectable (<2 mg/Kg)	

SCHEDULE – C–RECOMMENDED SPARES (DATA BY SUPPLIER)

List of recommended spares as following –

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

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.

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.	

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

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

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

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

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 ,

		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

		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

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

		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

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

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		

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		

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.

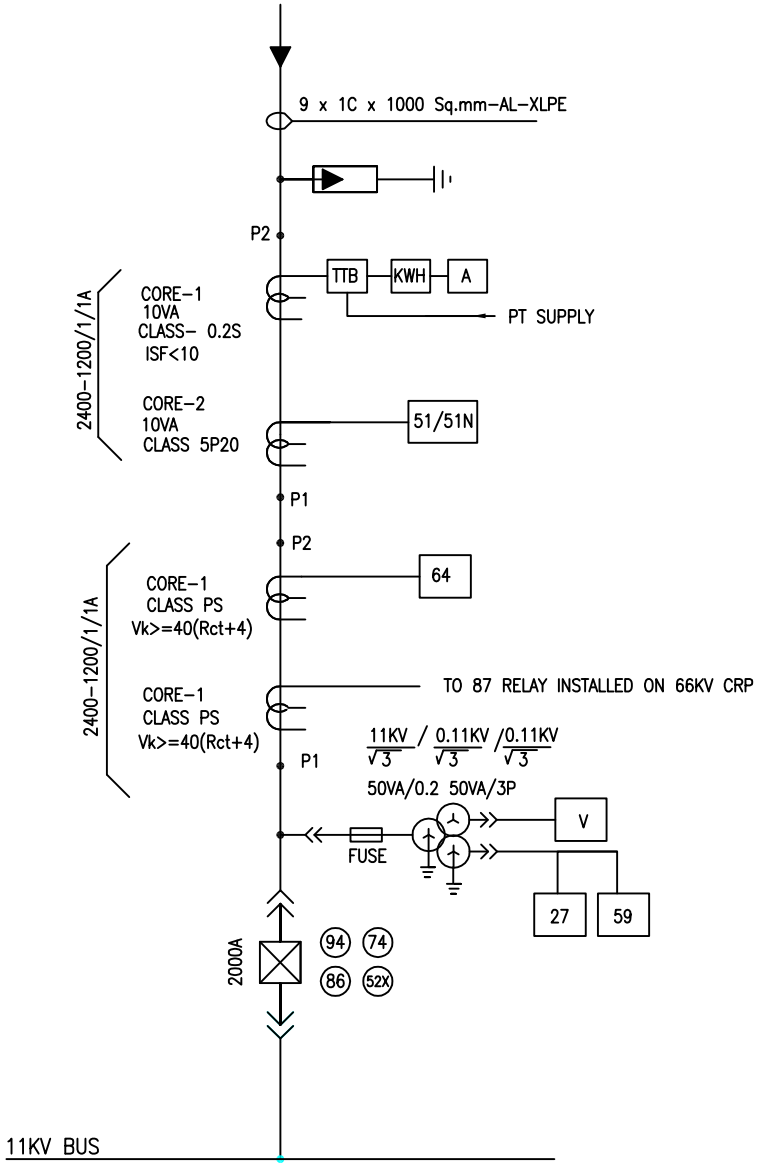
ANNEXURE – E – SPARES REQUIREMENT

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

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

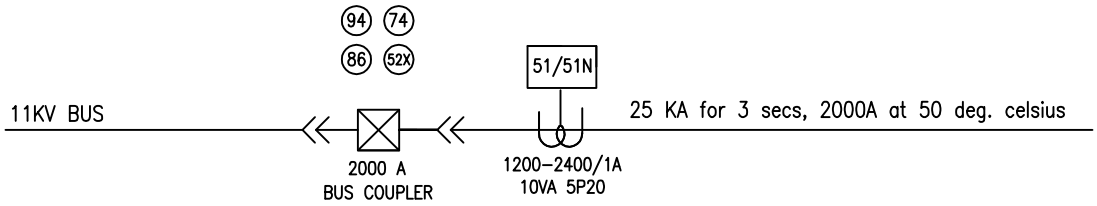
SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

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:–

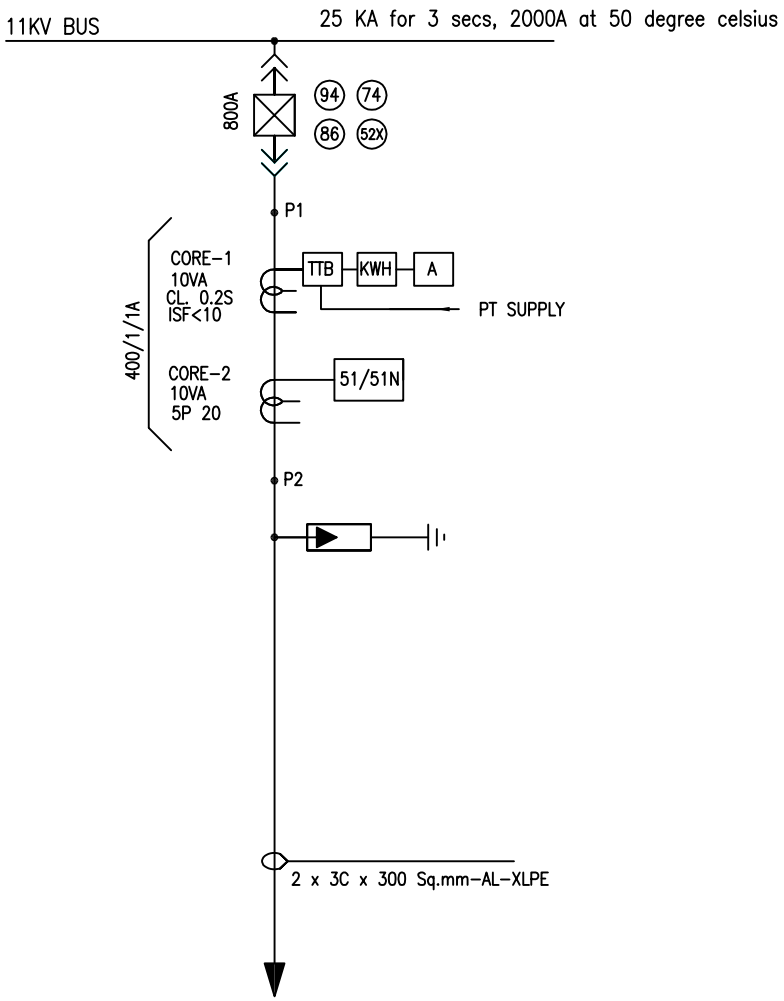
1. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

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

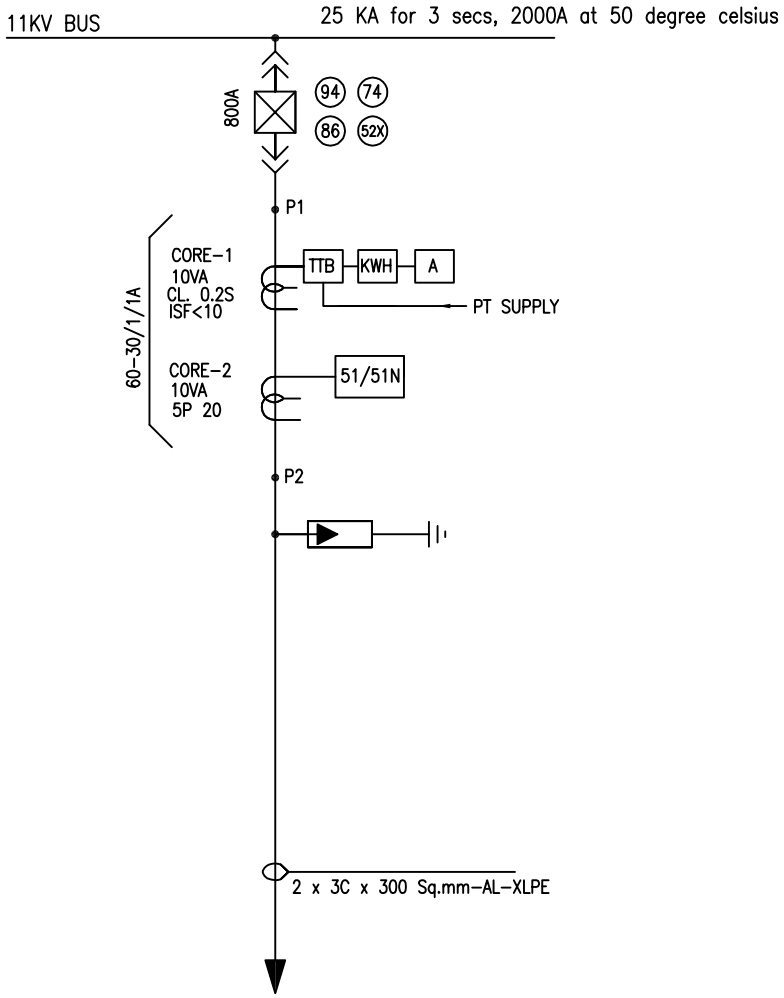
SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

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

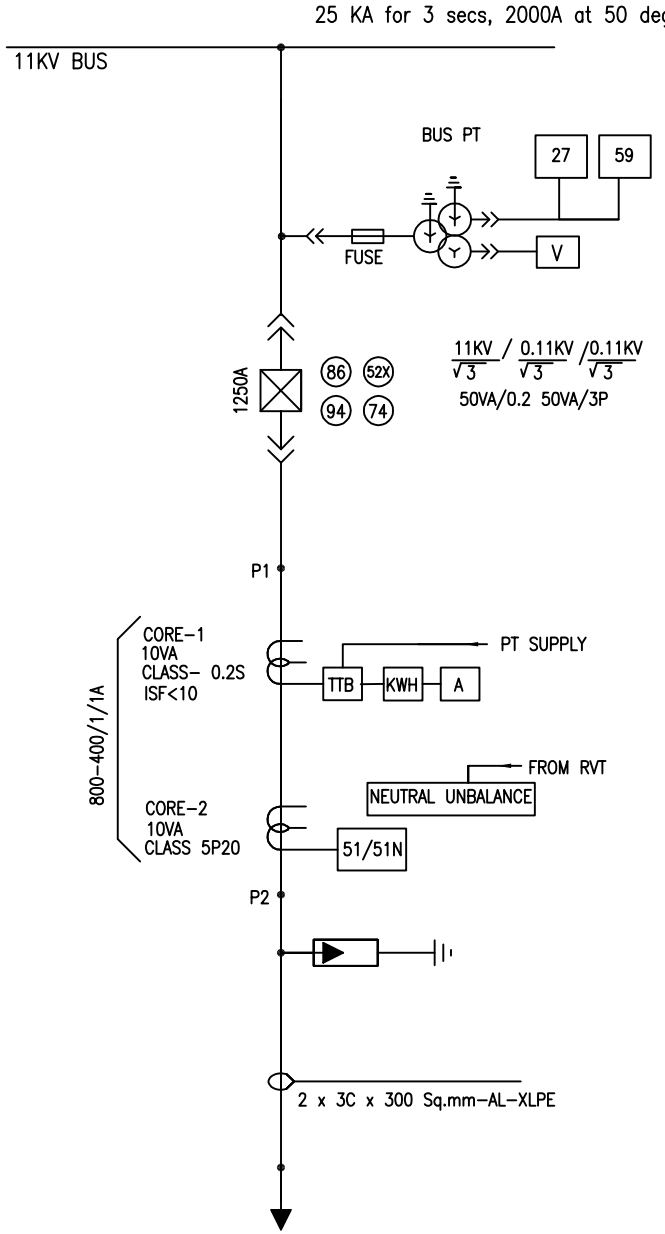
SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

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

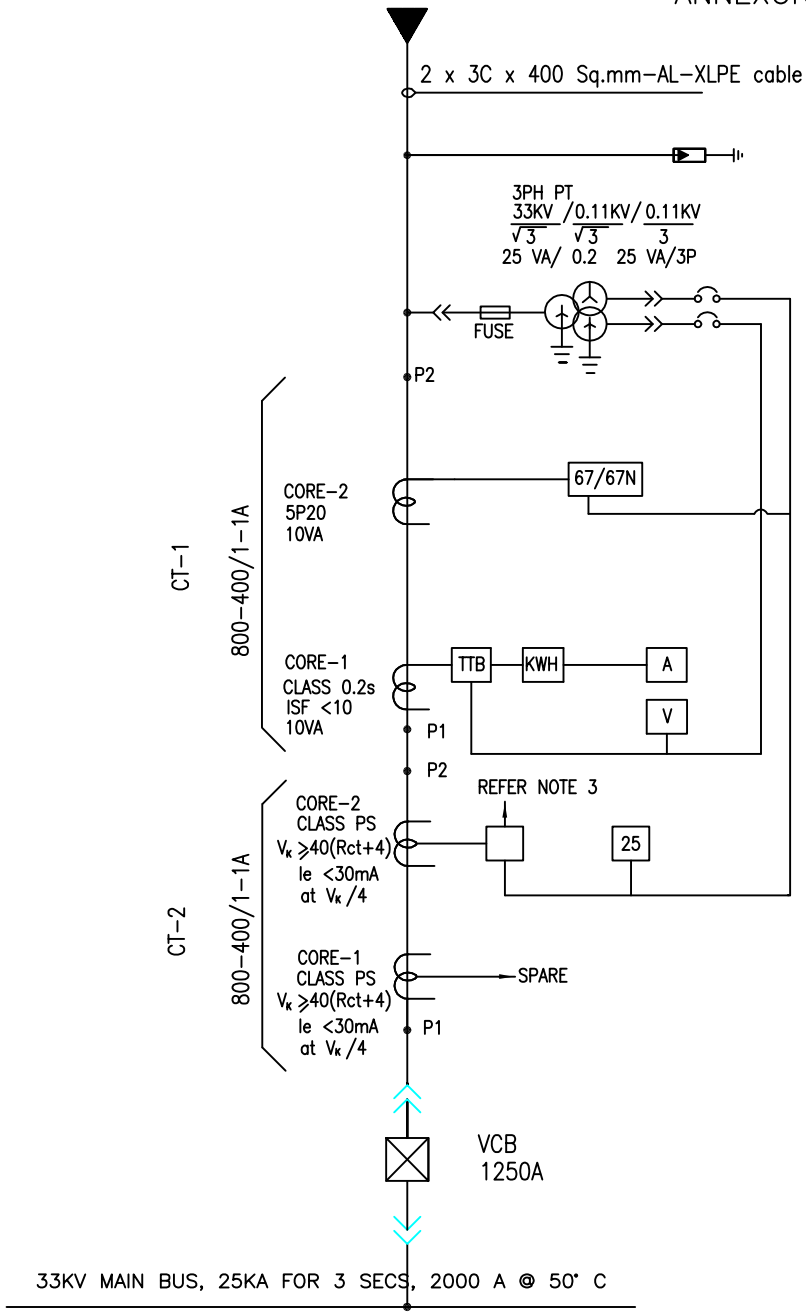
SYMBOL	DESCRIPTION
KWH	ENERGY METER
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

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

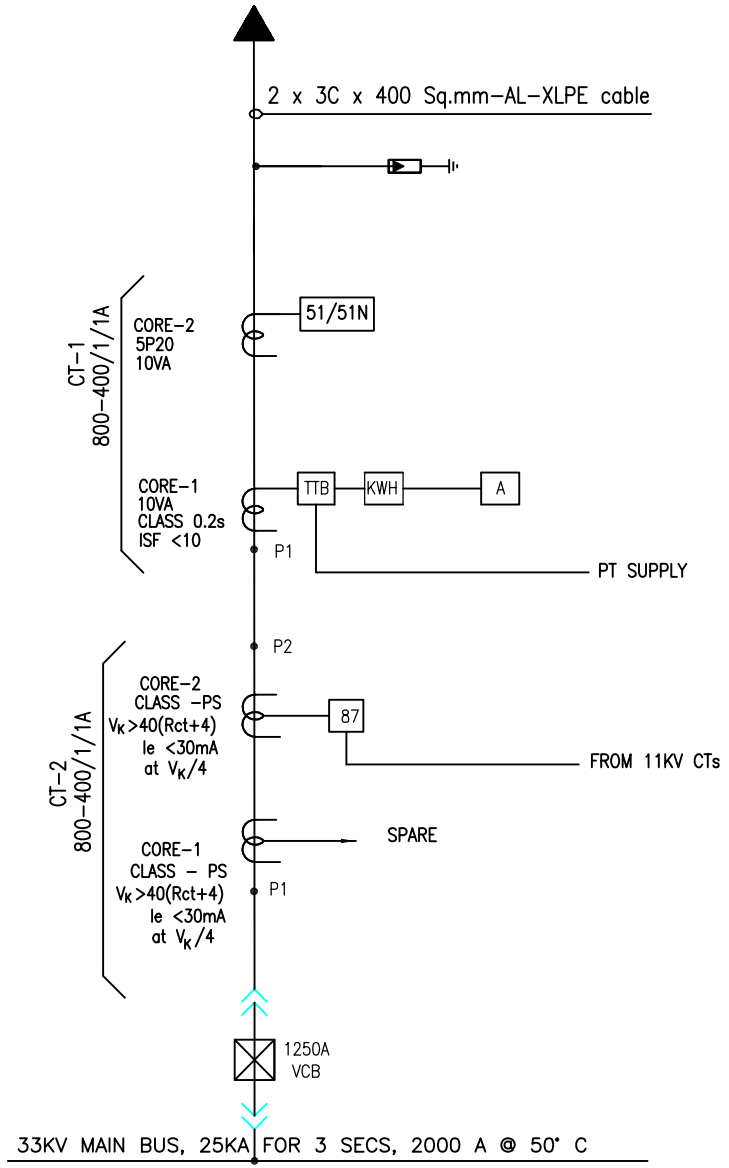
SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

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

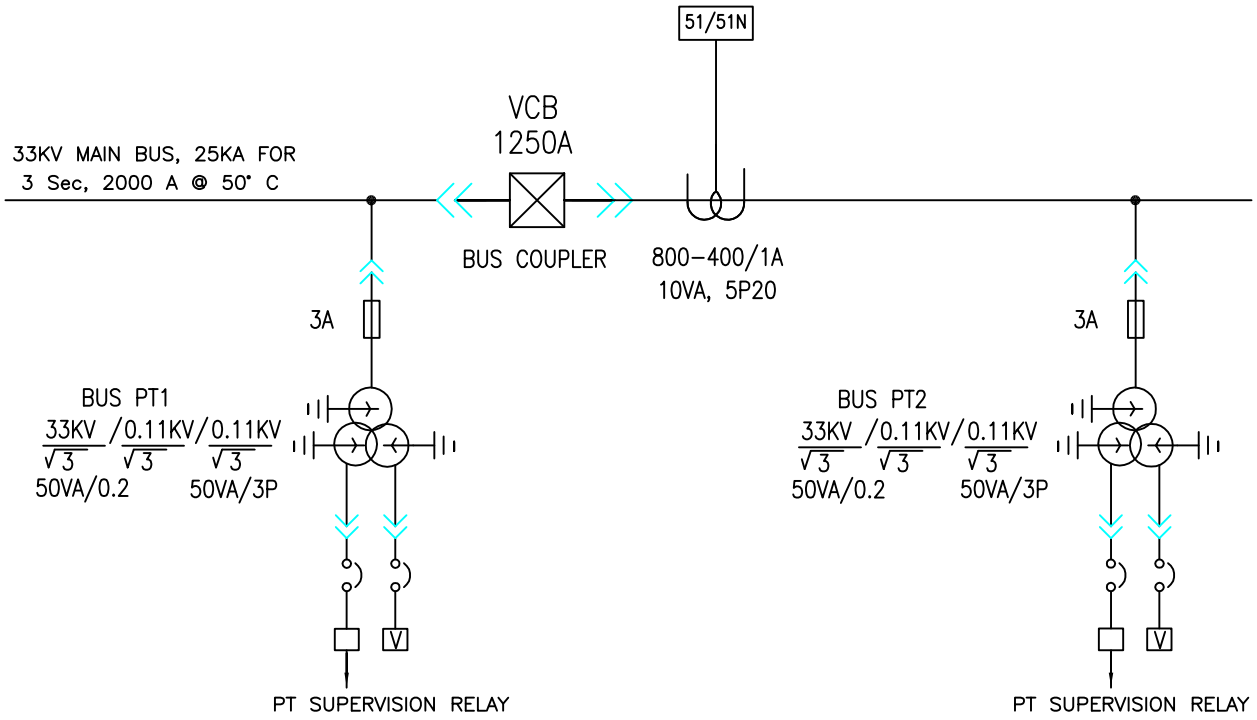
SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

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		
DATE	29.04.22		SLD-SWG-33KV-02
SCALE	NTS		

ANNEXURE–F8



LEGEND

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

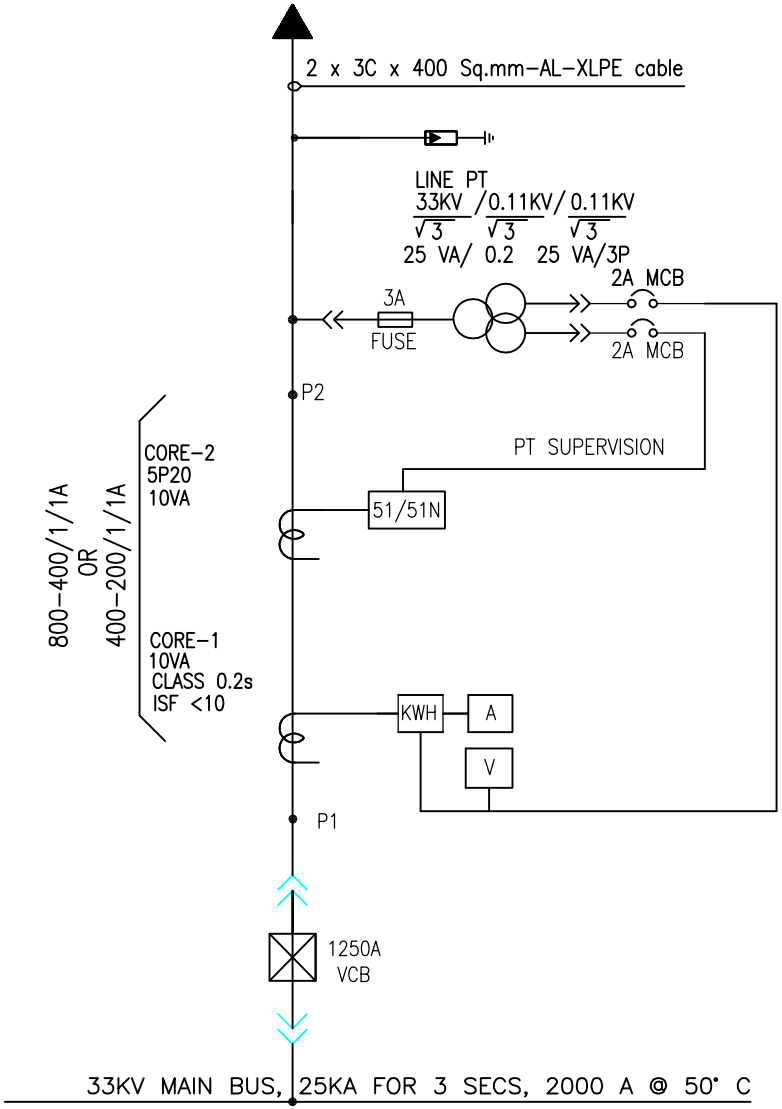
SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:–

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

DRAWN	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

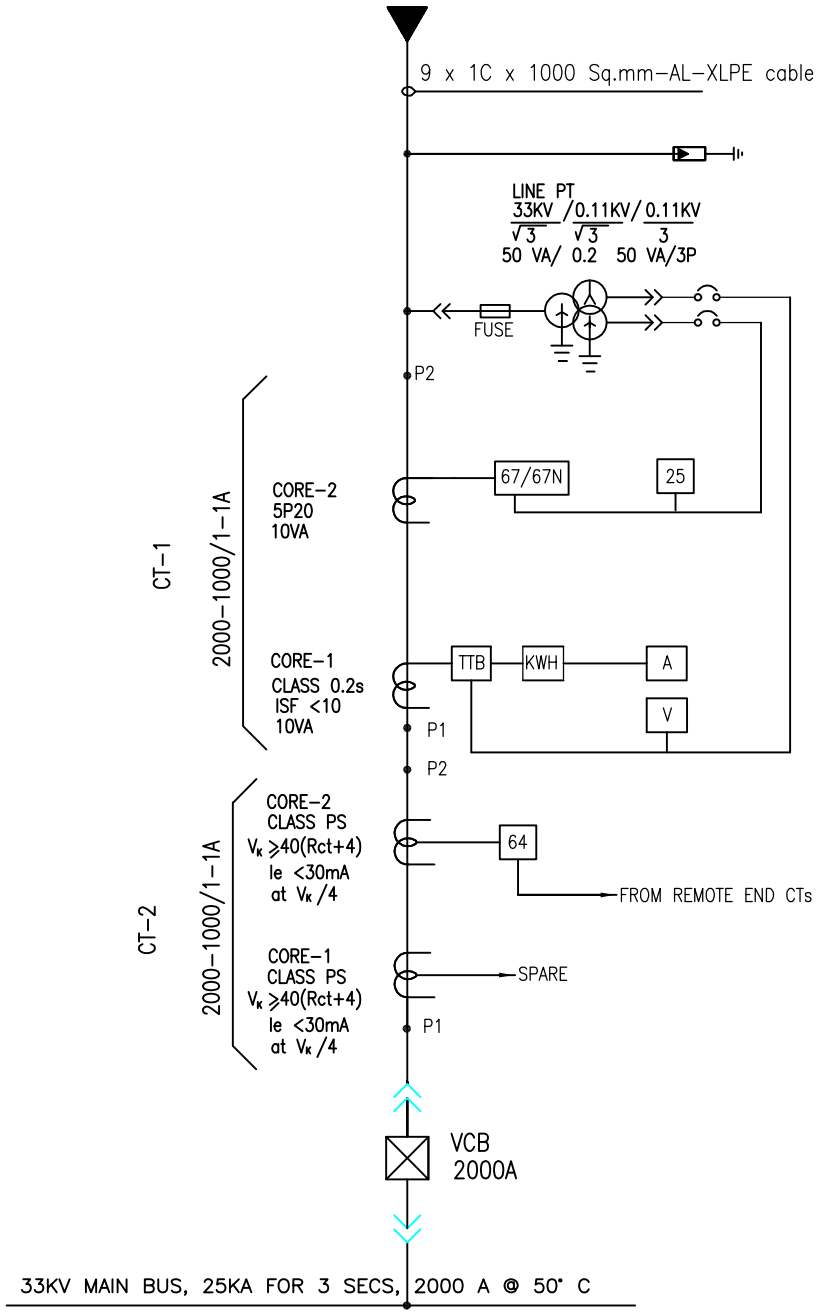
TYPICAL SLD FOR 33 KV OUTGOING FEEDER (FOR INSTALLATION AT KCC CONSUMERS PREMISES)

BSES

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

SLD-SWG-33KV-04

ANNEXURE–F10



LEGEND

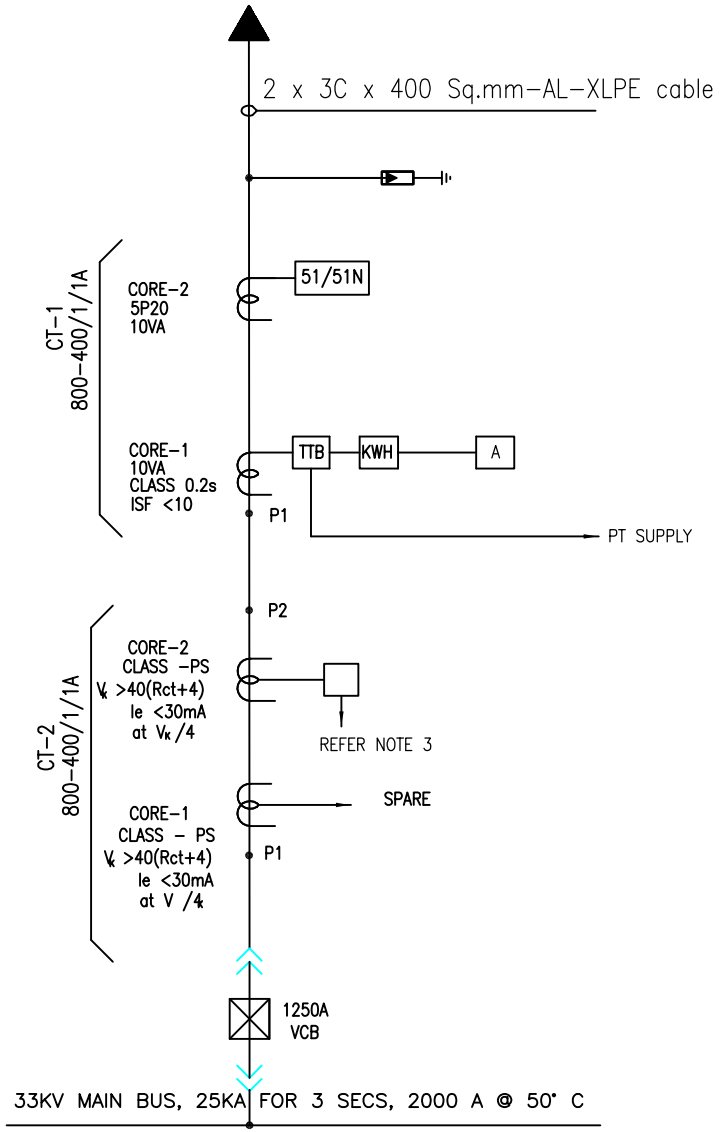
SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

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		SLD-SWG-33KV-05
DATE	29.04.22		
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

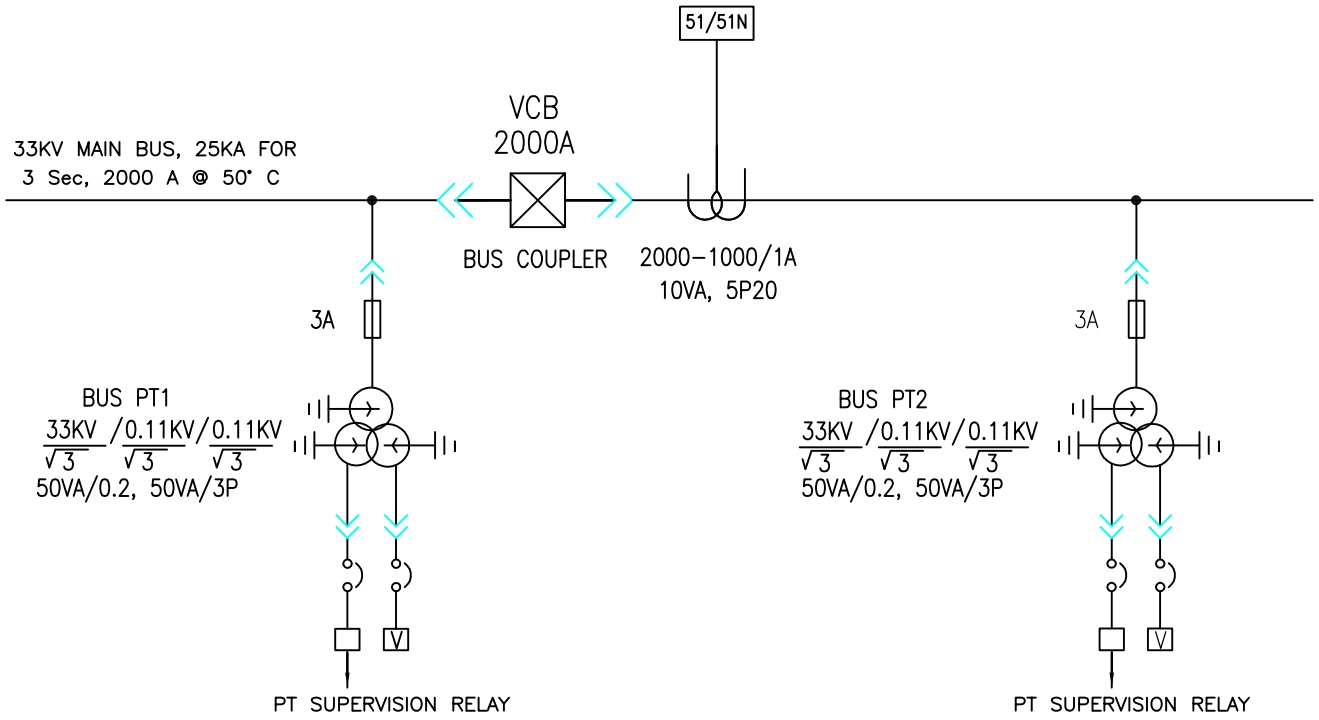
TITLE
TYPICAL SLD FOR 33KV OUTGOING FROM 66/33KV AUTO TRANSFORMER

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

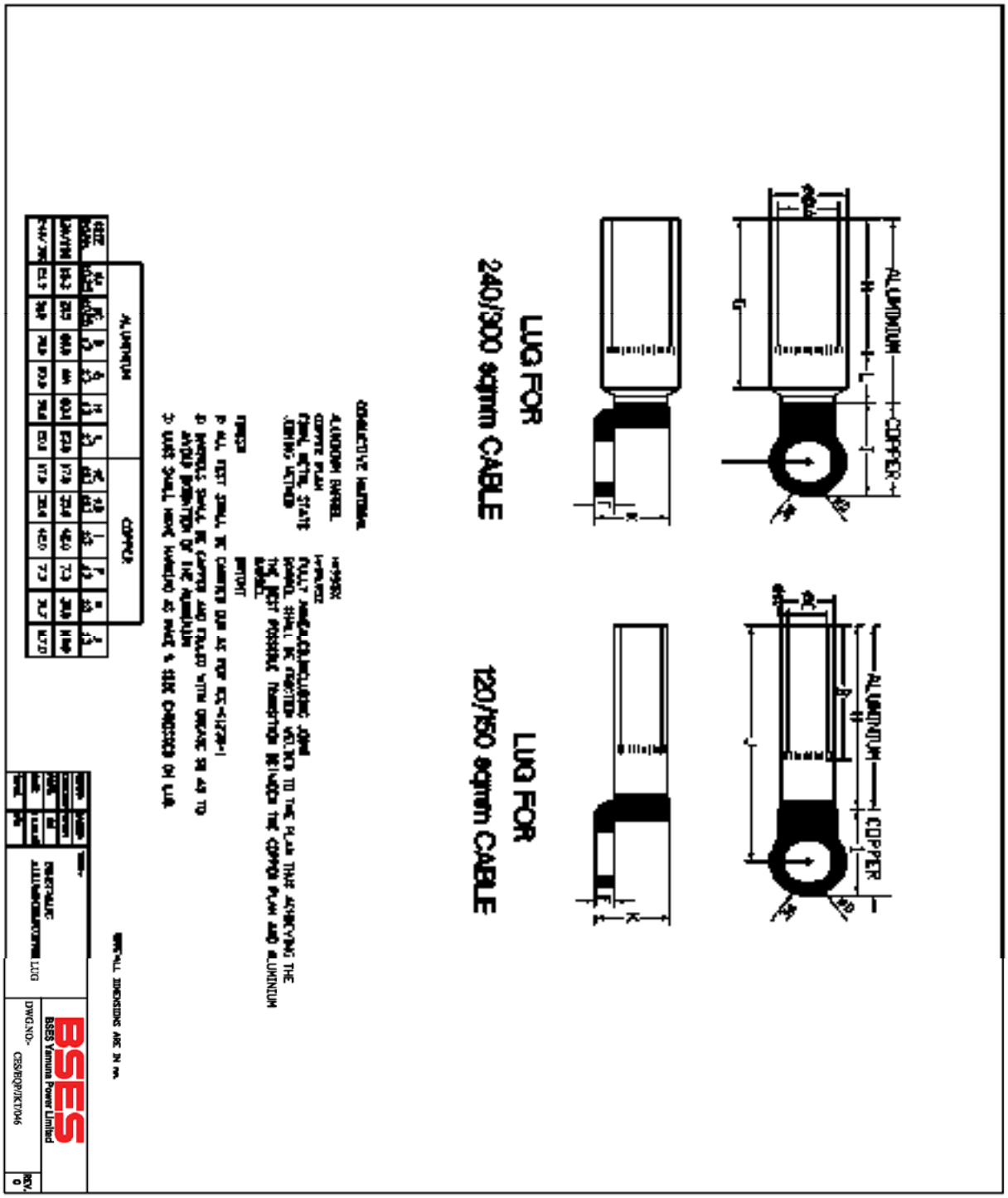
Sr No.	Clause No.	Deviation

Annexure – E: Service Conditions

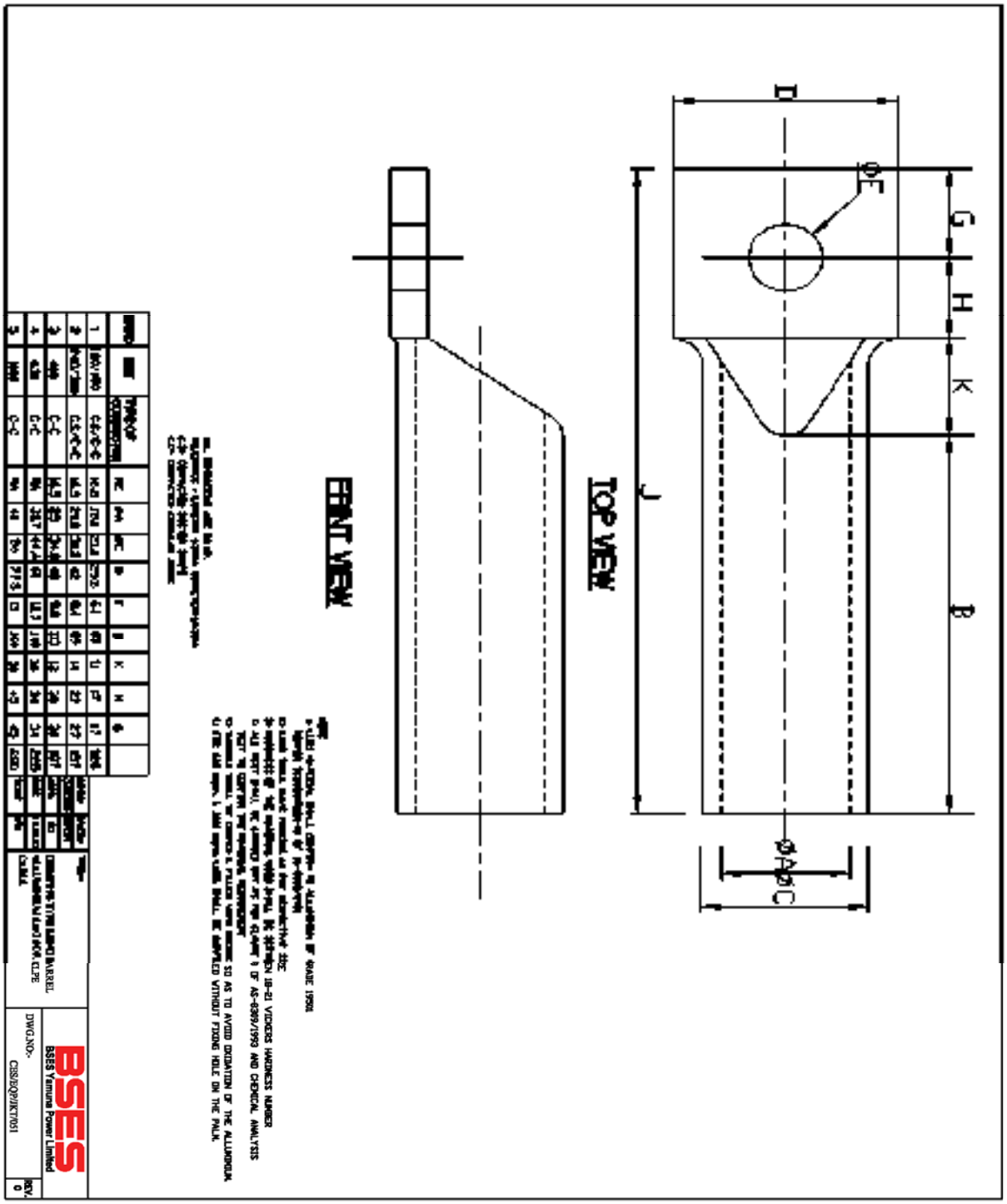
(Atmospheric conditions at Site)

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



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

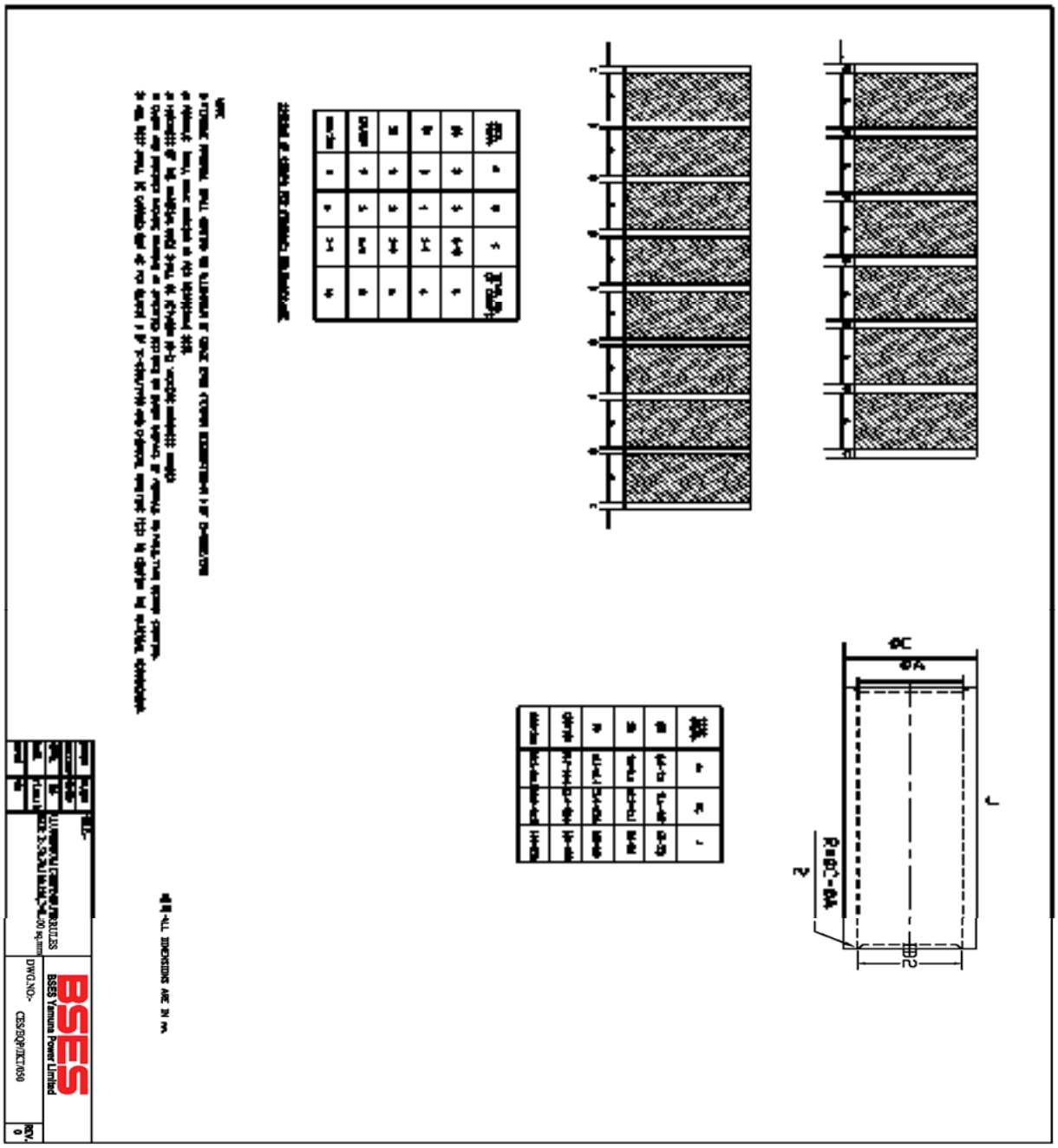
11.0.0 Deviations

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.

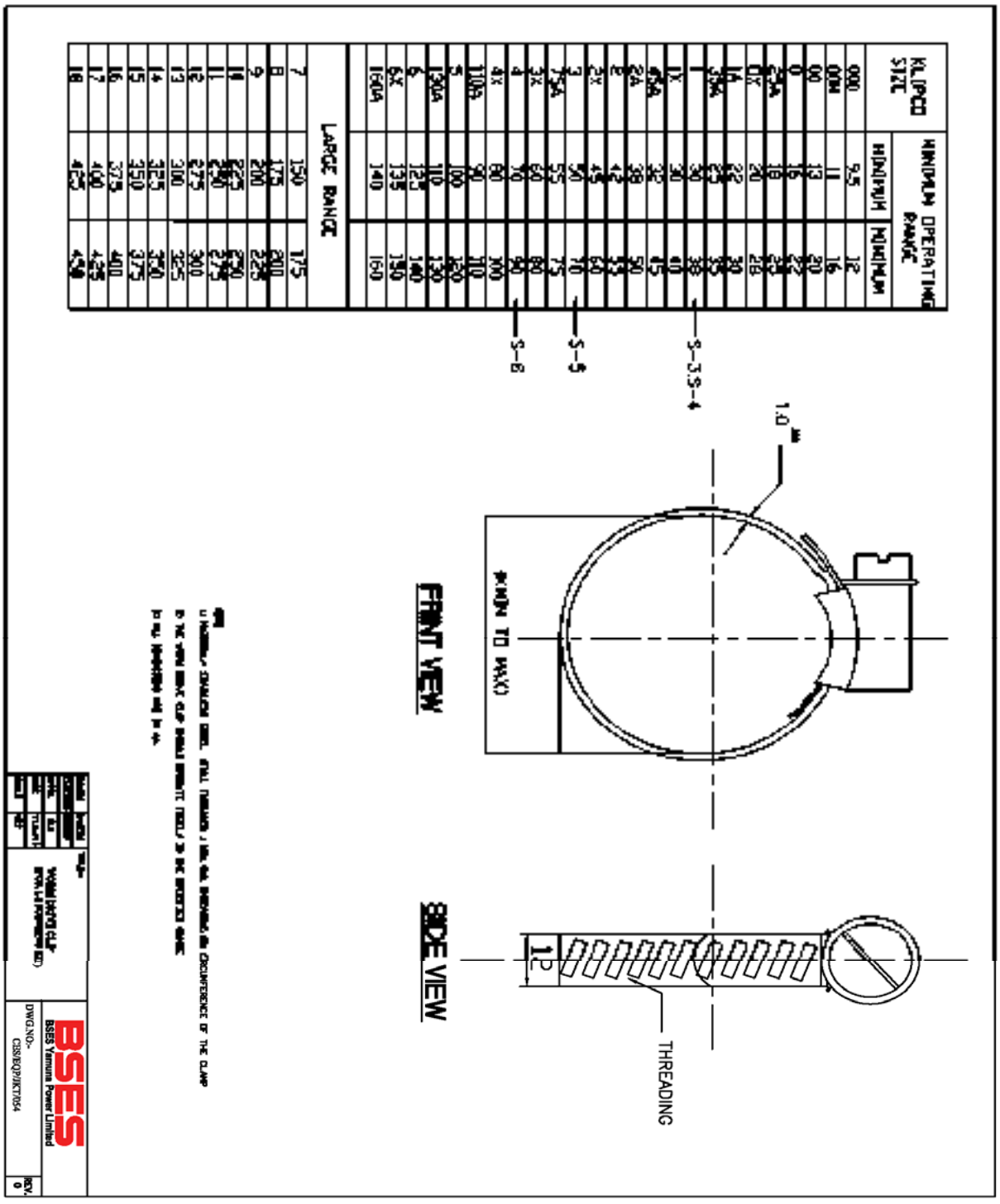
12.0.0 Drawing Submission:

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.

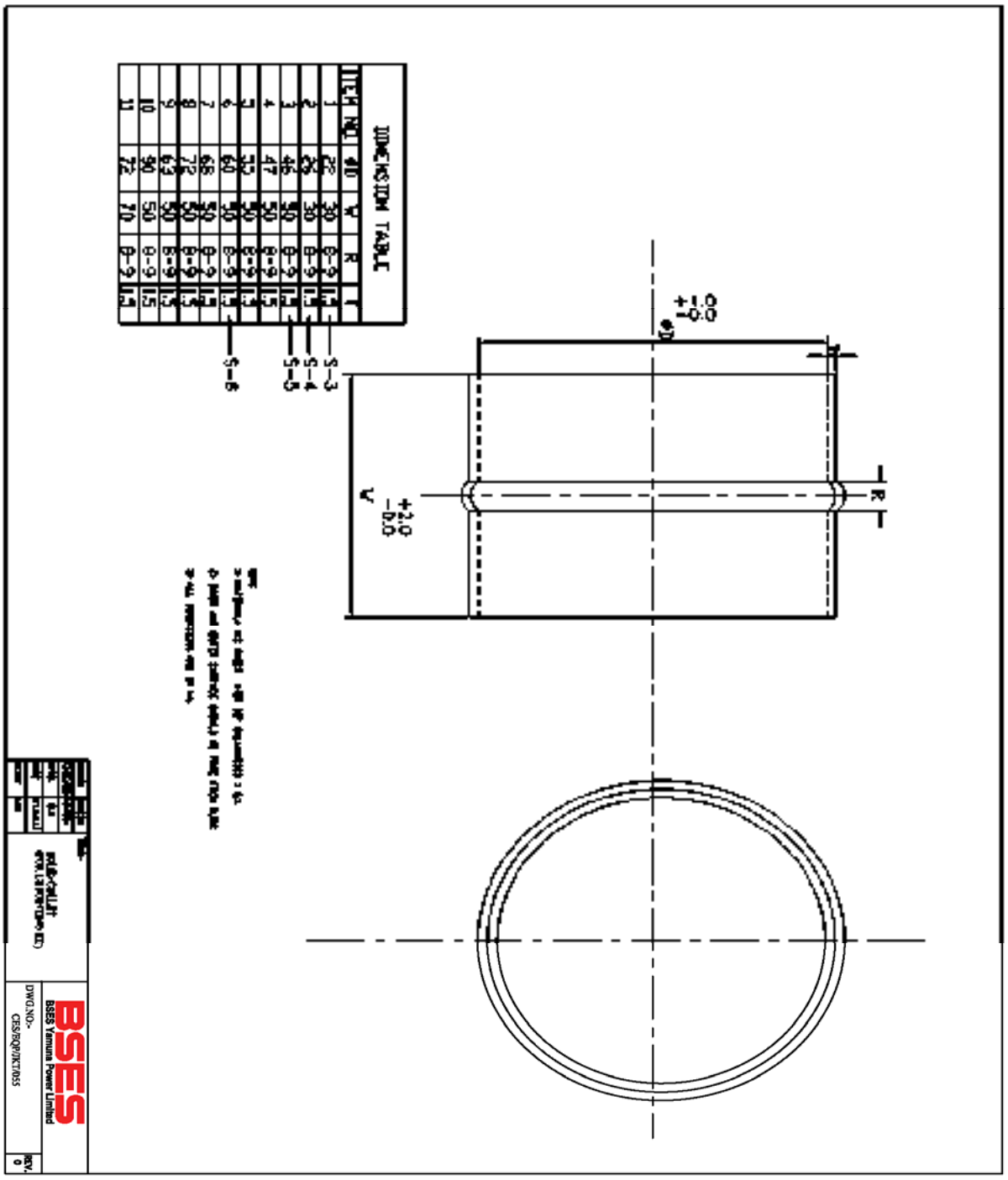
Annexure A: Drawing of Al Crimping Ferrule



Annexure B: Drawing of Worm Drive Clip

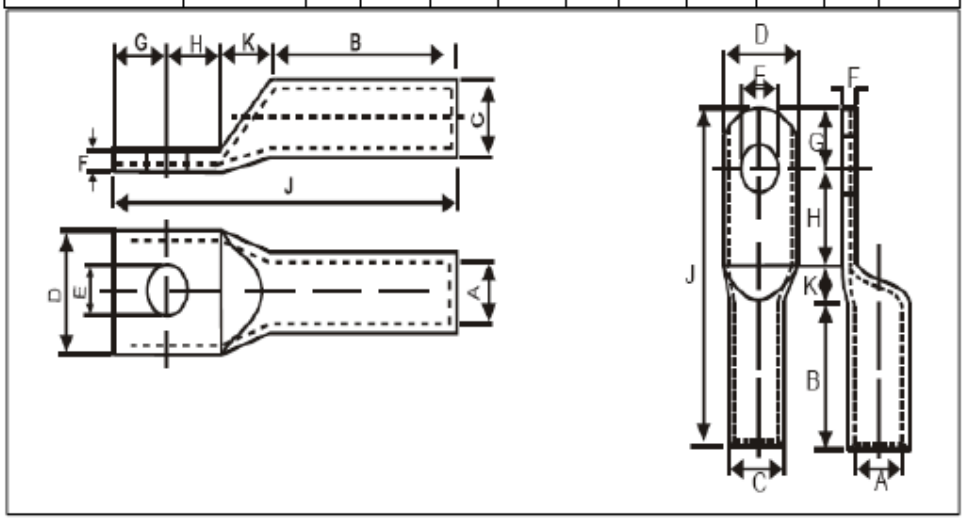


Annexure C: Drawing of Solid Collet



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	a1877a0d-ff71-43f8-8a8f-f1ebbc3d489f
	Abhishek Vashistha	7a74fd4f-a398-49df-bd05-e398d5a949f0
Reviewed by	Puneet Duggal	404db803-a91f-4234-85f0-0b2b5098ec32
Approved by	Gaurav Sharma	23dc2de2-95de-4472-99a7-dea873f472b6

INDEX

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

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

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.

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.

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

		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		

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

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.	

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

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

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

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

BSES

Technical Specification for

11 kV Cables

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

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

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

Rev:		0
Date:		6 Apr 2022
Prepared by	Abhishek Vashistha	
	Gautam Deka/Pronab Bairagi	
Reviewed by	Puneet Duggal	
	Amit Tomar	
Approved by	Gaurav Sharma	
	K. Sheshadri	

Index

General Specification

1.0.0 Codes & Standards

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

National Standards

IS 7098 Part-2	Cross linked polyethylene (XLPE) insulated PVC sheathed cables for working voltages from 3.3 kV up to and including 33 kV.
IS 5831 : 1984	PVC insulation & sheath of electric cables.
IS 10810 : 1984	Methods of test for cables.
IS 8130 : 1984	Conductors for insulated electric cables and flexible cords.
IS 3975 : 1999	Mild steel wires, formed wires and tapes for armouring of cables.
IS 0462 (Part 1) / 1983	Fictitious Calculation Method for determination of dimensions of protective covering of cables

International Standards

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

2.0.0 Cable Construction Features

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

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

Cable Code:

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

(N.A. - Not applicable for Specification)

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

2X	XLPE insulation	

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

Y	PVC outer sheath	

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Annexure – A

Scope, Documentation and Delivery schedule

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

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

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

Annexure - B

GUARANTEED TECHNICAL PARTICULARS (GTP)

Note:

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

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

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

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

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

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

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

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

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

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

Annexure - C

List of Sub-Vendors for critical items

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

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

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

Annexure - D

Service Conditions

(Atmospheric / Soil conditions at Site)

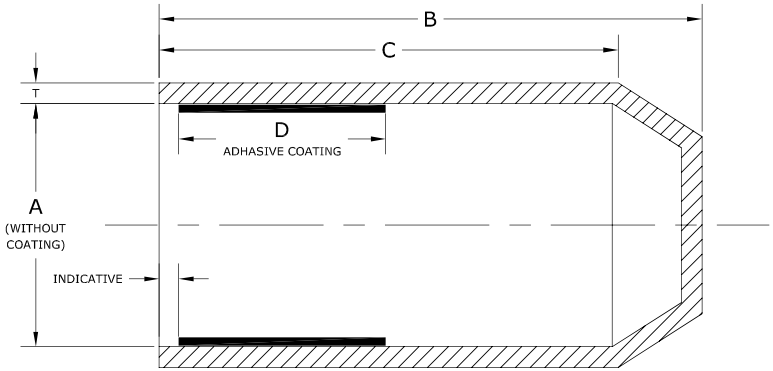
B.	**Delhi**	
a)	Average grade atmospheric condition	Heavily polluted, dry
b)	Maximum altitude above sea level	1000 M
c)	Air temperature Ambient	i) Highest : 50 deg C ii) Average : 40 deg C iii) Minimum : 0 deg C
d)	Relative Humidity	100 % max
e)	Thermal Resistivity of Soil	150 deg. C. cm / W max.
f)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

ANNEXURE E

DIMENSIONS

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

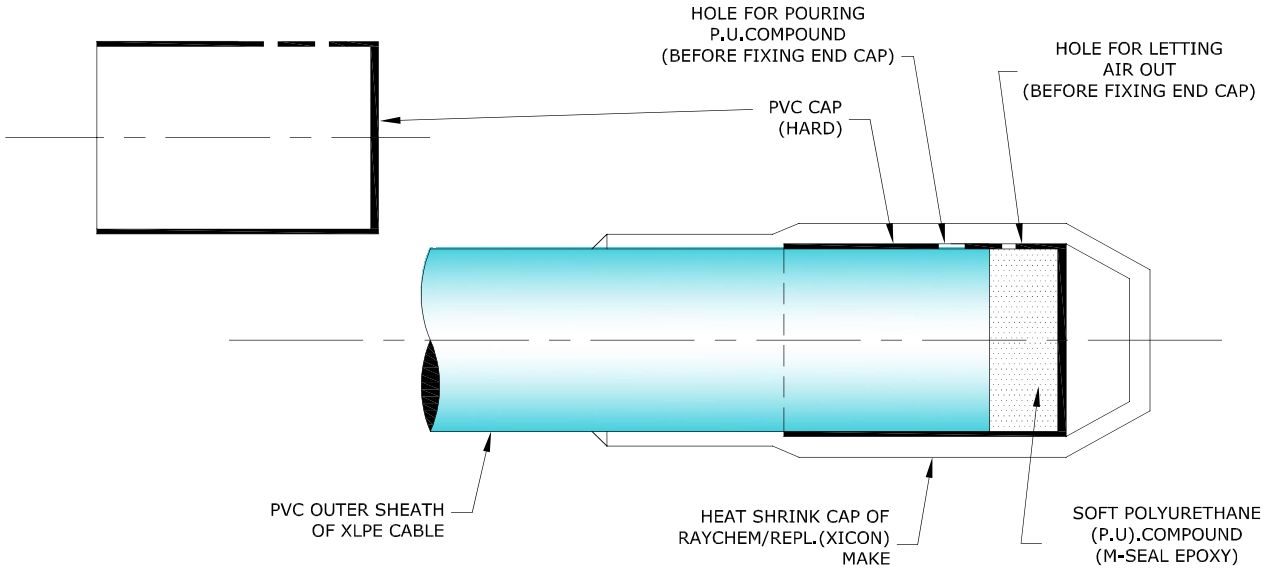
EXP - Expanded (as supplied), REC - Recovered freely, LC - Longitudinal Change,T - Wall Thickness, EC - End Cap



END CAP
(AS SUPPLIED)
SECTIONAL VIEW

MATERIAL SPECIFICATIONS

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



END CAP
(AFTER HEAT SHRINKING OVER THE CABLE END)

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

BSES

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

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

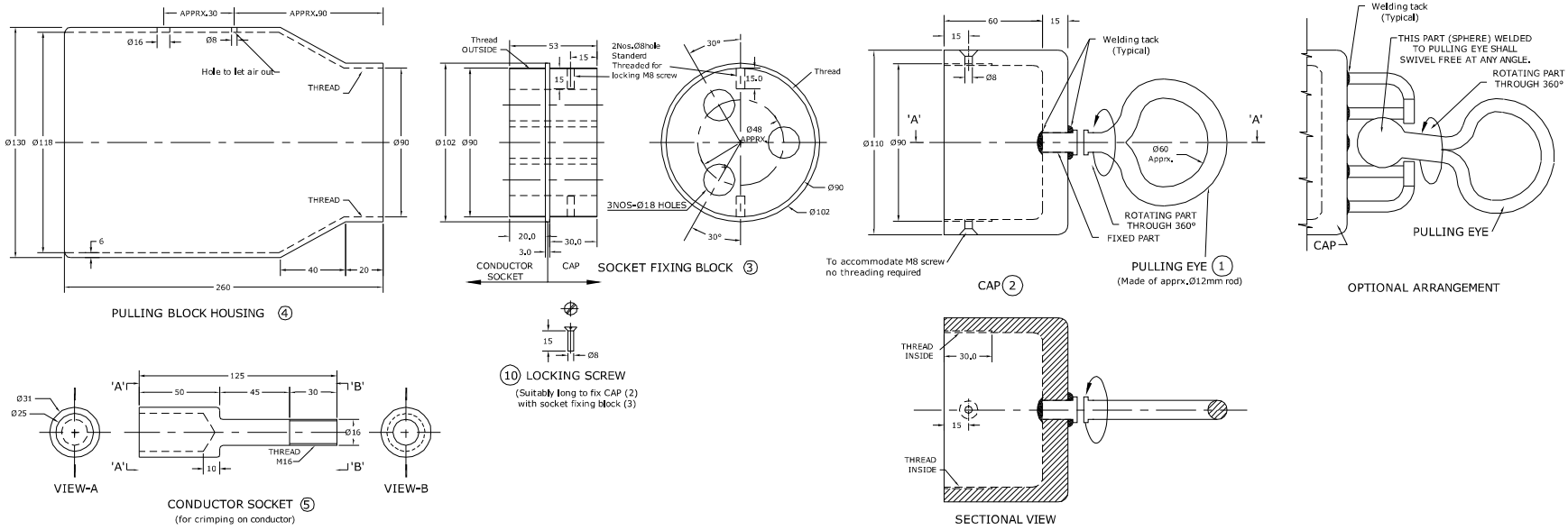
END SEALING CAP
(FOR XLPE CABLE)

DRAWN BY:	CHECKED BY:	APPROVED BY:

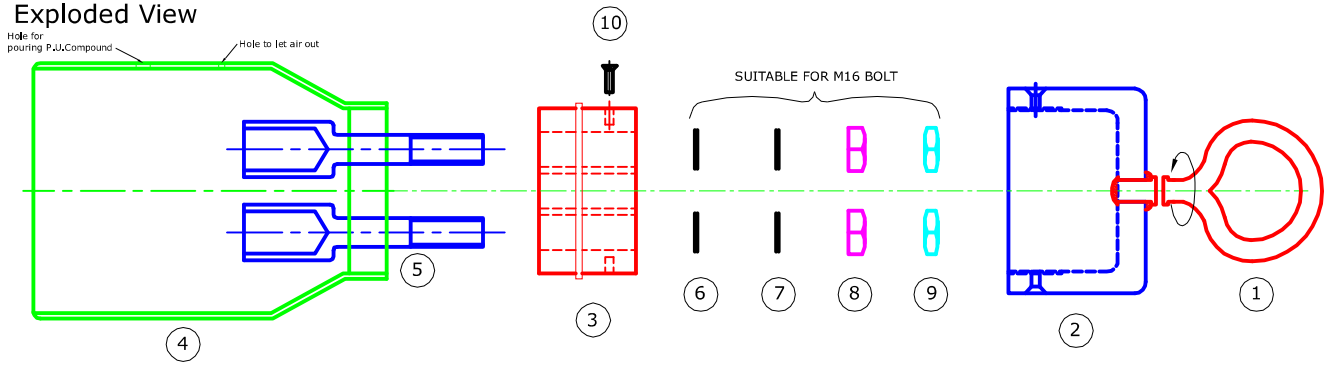
REVISIONS

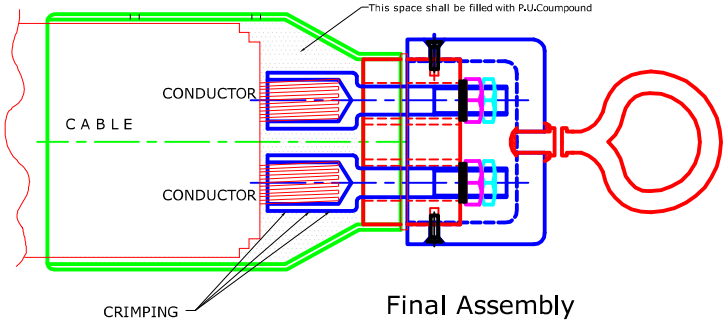
Addl V.P.

ANNEXURE F



Exploded View





Final Assembly

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

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

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

BSES

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

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

CABLE PULLING EYE ASSEMBLY (TYPICAL)

DRAWN BY: | CHECKED BY: | APPROVED BY:

REVISIONS

Addl V.P.

ANNEXURE G : QUALITY ASSURANCE PLAN (QAP)

FOR 11 kV H. T. CABLES

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

ANNEXURE G : QUALITY ASSURANCE PLAN (QAP)

FOR 11 kV H. T. CABLES

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

ANNEXURE G : QUALITY ASSURANCE PLAN (QAP)

FOR 11 kV H. T. CABLES

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

ANNEXURE G : QUALITY ASSURANCE PLAN (QAP)

FOR 11 kV H. T. CABLES

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

ANNEXURE G : QUALITY ASSURANCE PLAN (QAP)

FOR 11 kV H. T. CABLES

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

ANNEXURE G : QUALITY ASSURANCE PLAN (QAP)

FOR 11 kV H. T. CABLES

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

ANNEXURE G : QUALITY ASSURANCE PLAN (QAP)

FOR 11 kV H. T. CABLES

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

ANNEXURE G : QUALITY ASSURANCE PLAN (QAP)

FOR 11 kV H. T. CABLES

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

Note

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

Annexure- H

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

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

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

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

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

Annexure-I: Deviation Format

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

BSES

Technical Specification of

LT Power Cable(Single & Multi-Core)

Specification no – BSES-TS-01-LTPC-R0

Rev:		0
Date:		31 Mar 2022
Prepared by	Abhishek Vashistha	
	Rohit Patil	
Reviewed by	Puneet Duggal	
	Amit Tomar	31/03/2022
Approved by	Gaurav Sharma	
	K. Sheshadri	31/3/22

INDEX

Contents

1.0 SCOPE OF SUPPLY

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

2.0 CODES & STANDARDS

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

2.1	IS- 7098 (Part-1)	Cross linked polyethylene insulated PVC sheathed cables for working voltages upto and including 1100V.
2.2	IS- 6474	Polyethylene insulation & sheath of electric cables.
2.3	IS- 5831	PVC insulation and sheath of electrical cables.
2.4	IS : 10810	Methods of tests for cables.
2.5	IS : 8130	Conductors for insulated electrical cables and flexible cords.
2.6	IS : 3975	Low carbon galvanized steel wires, formed wires and tapes for armouring of cables.
2.7	IS- 4026	Aluminum ingots, billets and wire bars (EC grade)
2.8	IS-5484	EC Grade aluminium rod produced by continuous casting and rolling
2.9	IS : 10418	Specification for drums for electric cables.
2.10	IS : 3961	Recommended current ratings for cables.
2.11	IS:1255	Installation and Maintenance of power cables upto and including 33 kV rating.
2.12	IS:4826	Specification for hot-dipped galvanized coatings on round steel wires
2.13	IS:1717	Metallic Materials – Wire – Simple torsion test
2.14	IEC 60228	Conductors of insulated cables. Guide to the dimensional limits of circular conductors.
2.15	IEC 60331	Fire resisting characteristics of electric cables.
2.16	IEC 60332 – 3	Tests on electric cables under fire conditions. Part 3: Tests on bunched wires or cables.
2.17	IEC 60502	Extruded solid dielectric insulated power cables for rated voltages from 1kV to 30 kV.
2.18	IEC 60754 – 1	Test on gases evolved during combustion of materials from cables. Part 1: Determination of the amount of halogen acid gas evolved during combustion of polymeric material taken from cables.
2.19	IEC 60811	Common test methods for insulating and sheathing materials of electric cables
2.20	IEC 60885	Electric test methods for electric cables
2.21	IEC 60304	Standard colours for insulation for low frequency cables and wires.
2.22	IEC 60227	PVC insulated cables of rated voltages up to and including 460/760 V.

2.23	IEC 1034	Measurement of smoke density of electric cables burning under defined conditions
2.24	ASTMD 2843	Standard Test Method for density of Smoke from the burning or decomposition of cables
2.25	ASTM 2863	Standard Test Method for measuring of minimum oxygen concentration
2.26	IEC 60754-1	Test on gases evolved during combustion of materials for cables. Part 1 – Determination of the Halogen Acid gas Content
2.27	IS 1554 part 1	Specification for PVC insulated (Heavy duty) Electric cable

3.0 CABLE DESIGN

Description of each item mentioned in the specification (the text, BOQ, GTP or any site specific requirement) shall be followed along with IS: 7098 – P1

<table>
<tr><td>3.1</td><td>Conductor</td><td>a) Electrolytic Grade Stranded Aluminium Conductor
b) Grade: H2 as per IS: 8130/1984
c) Class 2
d) Chemical Composition as per IS 4026
e) Shape& Size:
<table>
<tr><th>S. no.</th><th>Shape</th><th>Single core (sq.mm)</th><th>Multi core (sq.mm)</th></tr>
<tr><td>1</td><td>Compacted Circular</td><td>• 1cx25
• 1cx95
• 1cx300
• 1cx630
• 1cx1000</td><td>• 2cx10</td></tr>
<tr><td>2</td><td>Sector</td><td>---</td><td>• 2cx25
• 4cx25
• 4cx50
• 4Cx150
• 4Cx300
• 4Cx400</td></tr>
</table></td></tr>
<tr><td>3.2</td><td>Insulation</td><td>Extruded XLPE insulation as per IS : 7098 part-1</td></tr>
<tr><td>3.3</td><td>Core Identification</td><td>a) Single Core Cable – Natural
b) Two Core Cable – Red & Black
c) Four Core Cable – Red, Yellow, Blue and Black</td></tr>
<tr><td>3.4</td><td>Inner Sheath</td><td>a) For Single Core Cable – Inner Sheath Not Required
b) For 2 Core cable- Pressurized Extruded, Black PVC type ST-2 (IS 5831-1984)
c) For 4 core cable –Extruded Black PVC type ST-2 (IS 5831-1984)</td></tr>
<tr><td>3.5</td><td>Armour</td><td>a) For 2C X 10 mm^2 – Galvanized Steel round wire.
b) For all sizes above 10 mm^2-Galvanized Steel Strip
c) Armour not required for single core cables
d) Minimum area of coverage of armouring shall be 90%</td></tr>
</table>

		e) The breaking load of armour joint shall not be less than 95% of that of armour wire / strip f) Zero negative tolerance for thickness of armour strip shall be as per IS:3975 g) Zinc rich paint shall be applied on strip/wire and its joint surface.
3.6	Outer Sheath	a) Extruded FRLS outer sheath of PVC (ST-2) shall be as per IS:5831 b) Colour : • For multi core cables-**Orange/Yellow as per tender requirement** • For single core cables **– Orange/Black as per tender requirement** c) FRLS Outer sheath of all the LT cables shall be UV resistant; as these cables are laid in air exposed to sun. Bidder to ensure the same for these requirements supported by required test. d) Shape of the cable over the outer sheath shall be circular, when manufactured/completed. e) The FRLS outer Sheath shall be embossed with following minimum text: i) The voltage designation ii) Type of construction /cable code (For e.g. A2XWY/A2XFY) iii) FRLS iv) Manufacture name/Trade mark v) Number of Cores and nominal cross section area of conductor vi) Name of buyer i.e BSES vii) Month & year of manufacturing viii) IS reference , i.e. IS:7098 ix) P.O No. and Date x) Font size shall be 5/5mm xi) ISI mark The embossing shall be progressive, automatic, in line and marking shall be legible and indelible. Following points shall be printed on every meter of cable i. Progressive (Sequential) length of cable at every meter, starting from zero for every drum. Colour filled in for the progressive marking, shall be with proper contrast in colouring. ii. Drum number marking on every meter of the cable length
3.7	Bending Radius	Bending Radius of cable shall comply to IS:1255
3.8	Sealing of cable end	Both ends of the cable shall be sealed by means of non-hygroscopic

		heat shrinkable PVC caps
3.9	FRLS Properties	Oxygen Index : Not less than 29% as per ASTM 2863
		Temperature Index : 250 Deg C at Oxygen Index 21 (when tested as per ASTM D 2863)
		Max Acid Gas Generation – Not more than 20% as per IEC -60754-1
		Light Transmission - Minimum 40% when tested as per ASTMD 2843 (Smoke Density rating shall be max 60%)
		Flammability Test – IEC 60332 part -1

4.0 CABLE DRUM

4.1	Reference Standard	Cable drum shall comply with IS: 10418.
4.2	Type of Drum	Wooden drums with anti termite treatment. (The drums shall be provided with M.S spindle plate and nut-bolts arrangement as per IS : 10418)
4.3	Drum Length & Tolerance	• For 2C X 10 mm^2 Cable - 1000+/-5% Mtr • For all Other cable sizes - 500 +/-5% Mtr
4.4	Overall Tolerance	-2 % for the total cable length for the entire order.
4.5	Short Length of Cable	a) Minimum acceptable length (Max. is 525 mtr) shall be 1 % of the total ordered qty. & no length shall be less than 250 mtr. Manufactures shall be taken prior approval from BSES Engineering for any short length supply. Short length will be accepted in last lot. b) Manufacture shall not be allowed to put two cable pieces of different short length in same cable drum
4.6	Preventive Measure for cable Drum	a) The surface of the drum and outer most cable layer shall be covered with water proof layer b) Ferrous part of wooden drum shall be treated with suitable rust preventive paint/coating to minimize rusting during storage.
4.7	Drum Identification Labels	a) Drum identification number b) Cable voltage grade c) Cable code (eg. A2XFY/A2XWY) d) Number of cores and cross sectional area e) Cable quantity i.e cable length (Meters) f) Purchase order number, date & SAP item code g) Total weight of cable and drum (kg) h) Manufacture's and Buyer's name i) Month & year of manufacturing j) Direction of rotation of drum; an arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled. k) Cable length final end-marking (i.e reading at the inner end

		and reading at the outer end, just before packing shall be marked on the drum.

5.0 PACKING, SHIPPING, HANDLING & STORAGE

5.1	Shipping information Plan	The seller shall be give complete shipping information concerning the weight ,size of each package
5.2	Transit Damage	The seller shall be held responsible for all transit damage due to improper packing/inside cable damaged found in store/site
5.3	Cable Drum Handling	The drum shall be with M.S spindle plate(with nut –bolts) of adequate size to suit the spindle rod , normally required for handling the drums , according to expected weight of the cable drums as per IS:10418

6.0 QUALITY ASSURANCE, TESTING& INSPECTION

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

6.1	Quality Assurance Plan	In event of order manufacturer has to submit the signed copy of QAP.
6.2	Inspection hold points	AS per approved QAP (QAP shall be approved at the time of GTP approval)
6.3	Routine Test	a) Measurement of Electrical Resistance b) HV test with power frequency AC voltage
6.4	Type Test	**For bid participation–** (a) Bidder must be submitted cable type tested report from CPRI/ERDA/NABL approved lab for the type, size & rating of similar or higher sizes of offered cable along with bid. **After award of P.O.-** (b) If a bidder has valid type test report from CPRI/ERDA lab for the type, size & rating of similar or higher sizes of offered cable (including FRLS)—No need to conduct fresh type test from CPRI/ERDA lab. (c) If a bidder has valid type test report from CPRI/ERDA lab for the type, size & rating of similar or higher sizes of offered cable (except FRLS)—Need to conduct only fresh type test of FRLS properties test from CPRI/ERDA/NABL lab(list of tests mentioned in clause 3.9)without any commercial implication to BSES. (d) If a bidder has valid type test report from NABL lab for the type, size & rating of similar or higher sizes of offered cable (including FRLS)—Need to conduct complete type test (including FRLS properties) from CPRI/ERDA lab without any

		commercial implication to BSES. (Type test shall not be more than 5 years old. If the type test report is more than 5 years old (max 10 years), it can be considered subject to no change in their design) (e) UV resistance test to be carried out on one sample from CPRI/ERDA/NABL Accredited Lab as per ASTM standard (sample shall meet minimum 80% retention in tensile strength and elongation after exposure of 21 days as per ASTM standard).
6.5	Acceptance Test (Shall be conducted as per Cl.15.2 of IS 7098 Part-1 & IS 1554 part 1 for each lot of cable)	a) For cable sizes up to 25 mm^2 – one sample for chemical composition and purity test of aluminium shall be conducted per300km of ordered quantity and multiple thereof. b) For cable sizes 50mm^2 – one sample for chemical composition and purity test of aluminium shall be conducted per 100km of ordered quantity and multiple thereof. c) For cable sizes above 50 mm^2 – one sample for chemical composition and purity test of aluminium shall be conducted upto 50km of ordered quantity and multiple thereof. d) Chemical composition and purity test of aluminium shall be conducted from the lot offered to BSES on each size involved in the purchase order. Test shall be carried out at NABL accredited third party lab without any price implication to BSES. e) The sample will be selected either during acceptance test or after receipt of cable in BSES Stores.
6.6	Inspection	a) The buyer reserves the right to witness all tests specified on completed cables b) The buyer reserves the right to inspect cables at the seller's works at any time prior to dispatch either in finished form or during manufacturing, to prove compliance with the specifications. c) In-process and final inspection call intimation shall be given in 10 days advance to purchaser/CES.
6.7	Test Certificates	Complete test certificates (routine & acceptance tests) need to be submitted along with the delivery of cables.

7.0 DOCUMENT SUBMISSION MATRIX

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

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

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

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

8.0 PROGRESS REPORTING

8.1	Outline Document	To be submitted for purchaser approval for outline of Production-inspection, testing-inspection, packing, dispatch, documentation programme.
8.2	Detailed Progress Report	To be submitted to purchaser once a month containing a) Progress on material procurement b) Progress on fabrication (As applicable) c) Progress on assembly (As applicable) d) Progress on internal stage inspection e) Reason for any delay in total programme f) Details of test failures if any in manufacturing stages. g) Progress on final box up constraints/forward path.

9.0 DEVIATION

a) Deviations from this specification shall be listed separately by bidder clause wise (format given below) along with optional offer and has to submit the list along with bid/quotation. BSES will review the deviations and if BSES is agreed with the deviation, seller has to take written confirmation from BSES on deviation during tender evaluation.

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

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

Deviation sheet format

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

10.0 Annexure -A

GUARANTEED TECHNICAL PARTICULARS (Multi-core)

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

For each size /rating separate GTP need to be furnished

Sr. No.	Description	Buyer's Requirement	Seller's data
	Manufacture Contact Person & Number		
	Purchase Req. No.	……..	
	Guarantee Period: (Min)	60 Months (from date of commissioning) / 66 months (from date of receipt at purchaser's store) whichever is earlier	
	Applicable IS / IEC Standard followed by vendor	As mentioned in the clause no – 2.0	
1	Make	…	
2	Type (as required by purchaser)		
A	For 2CX10Sqmm	A2XWY	
B	For Sizes above 10 mm^2	A2XFY	
3	Voltage Grade (kV)	1.1	
4	Maximum Conductor temperature		
A	Continuous	90°C	
B	Short time	250°C	
5	Conductor		
A	Material and Grade	As per Cl.3.1	
B	Make of Al	Ref Annexure D	
C	Size (mm^2)	…… mm^2	
D	Min no. of wires in each conductor (Nos.)	As per Manufacturer Standard	
E	Min Dia. of wires in each conductor before compaction (mm)	As per Manufacturer Standard	

Sr. No.	Description	Buyer's Requirement	Seller's data
F	Shape of Conductor	As per Cl.3.1 (e)	
G	Diameter over conductor (mm)	……	
H	Maximum Conductor resistance at 20 ° C(Ohm/Km)	As per Table 2 of IS 8130	
6	Insulation		
A	Insulation Material	As per Cl. 3.2	
B	Nominal thickness (mm)	As per Table 3 of IS 7098 Part-1	
C	Diameter over Insulation (mm) Approx.	……	
D	Make of insulation compound	Ref: Annexure D	
7	Inner Sheath		
A	Material and Type	As per Cl. 3.4	
B	Minimum thickness	As per Table 5 of IS 7098 Part-1	
C	Approx. dia. Over sheath (mm)	……	
8	Galvanized Steel Armour	as per purchaser's site - specific condition	
A	Material		
a)	For 2CX10 mm^2	G.I. Wire	
(i)	Wire Dia. (mm)	1.4+/-0.040	
(ii)	No. of wires	As per Manufacturer Standard	
b)	For sizes above 10 mm^2	G.I. Strip	
(i)	Strip size (Width and Thickness)	4x0.8 (Zero negative tolerance for thickness)	
(ii)	No. of Strips	As per Manufacturer Standard	
B	Area covered by Armour	Min 90% and calculations shall be strictly as per Annexure-D	
C	Dia. over Armour – Approx.(mm)	……	

Sr. No.	Description	Buyer's Requirement	Seller's data
9	Outer Sheath (FRLS)		
A	Material and Type	As per Cl. 3.6	
B	Minimum Thickness	As per Table 8 of IS 7098 Part-1	
C	Colour	Orange	
D	Embossing Details	As per Cl.3.6 (e)	
10	Approx. overall dia. (mm)	……	
11	Overall order tolerance	- 2 % for the total cable length for the entire order	
12	Cable Drum		
A	Type of Drum	Wooden	
B	Drum Length & tolerance	As per Spec. Cl. 4.3 & 4.4	
C	Marking on Drum	As per Spec. Cl. 4.7	
D	Drums provide with MS Spindle plate & nut bolts arrangement (as per IS:10418)	Required	
13	End Cap	Required	
14	Weights	……	
a)	Net Weight of cable (Kg/Km.) – Approx		
b)	Weight of empty drum	Kg	
c)	Weight of cable with drum	Kg	
15	Continuous current rating for standard I.S condition laid direct		
a)	In ground 30° C	Amps	
b)	In duct 30° C	Amps	
c)	In Air 40° C	Amps	
16	Short circuit current for 1 sec of Conductor (kAmp)	……	
17	Electrical Parameters at Maximum operating temperature:		
A	AC Resistance	Ohm/Km	

Sr. No.	Description	Buyer's Requirement	Seller's data
B	Reactance at 50 C/s	Ohm/Km	
C	Impedance	Ohm/Km	
D	Capacitance	Micro farad / Km	
18	Recommended minimum bending radius	..... x O/D	
19	De-rating factor for following Ambient temperature in	Ground / Air	
a)	At 30° C		
b)	At 35° C		
c)	At 40° C		
d)	At 45° C		
e)	At 50° C		
20	Group factor for following Nos. of cables laid	Touching / Trefoil	
a)	3 Nos.		
b)	4 Nos.		
c)	5 Nos.		
d)	6 Nos.		
21	Process of Cross linking of Polyethylene	Dry/ Sioplas Cure	
22	Type test	Is copy of latest valid TTR for respective Sizes enclosed? Yes /No	
23	FRLS Properties	As per IS 1554, Part-1	
	Oxygen Index	As per IS 1554, Part	
	Temperature Index	As per IS 1554, Part	
	Max Acid Gas Generation	As per IS 1554, Part	
	Light Transmission / Smoke Density	As per IS 1554, Part	

11.0 ANNEXTURE- B

GUARANTEED TECHNICAL PARTICULARS (Single Core)
(Separate GTP needs to be furnished for 25, 95, 300, 500, 630 & 1000 mm^2 cables)

S.No.	Description	Buyer's Requirement	Seller's data
	Manufacture Contact Person & Number		
	Purchase Req. No.	……..	
	Guarantee Period: (Min)	60 Months (from date of commissioning) / 66 months (from date of receipt at purchaser's store) whichever is earlier	
	Applicable IS / IEC Standard followed by Vendor	As mentioned in the clause no-2.0	
1	Make	……	
2	Type	A2XY (Un-armoured)	
3	Voltage Grade (kV)	1.1kV	
4	Maximum Conductor temperature		
A	Continuous	90°C	
B	Short time	250°C	
5	Conductor		
A	Material and Grade	As per Cl. 3.1	
B	Size (mm^2)	.....mm^2	
C	Min no. of wires in each conductor (Nos.)	As per Manufacturer Standard	
D	Min Dia. of wires in each conductor before compaction (mm)	As per Manufacturer Standard	
E	Shape of conductor	Compacted Circular	
F	Diameter over conductor (mm)	……	
G	Maximum Conductor resistance at 20 ° C(Ohm/Km)	As per Table 2 of IS 8130	
H	Make of Al	Ref Annexure D	
6	Insulation	As per Table 3 of IS7098 Part-1	
A	Insulation Material	As per Cl. 3.2	

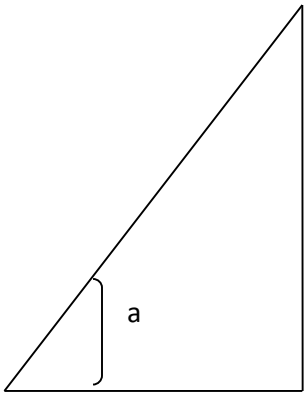
S.No.	Description	Buyer's Requirement	Seller's data
B	Nominal thickness (mm)		
(i)	For 1Cx300 mm^2	1.8 mm	
(ii)	For 1Cx500 mm^2	2.2 mm	
(iii)	For 1Cx630 mm^2	2.4 mm	
iv)	For 1Cx1000 mm^2	2.8 mm	
C	Diameter over Insulation (mm) Approx.	……	
D	Make of insulation compound	Ref: Annexure D	
7	Inner Sheath	Not applicable	
8	Armour	Not applicable	
9	FRLS Outer Sheath		
A	Material and Type	As per Cl. 3.6	
B	Minimum Thickness	As per Table 8 of IS 7098 Part-1	
C	Colour	Orange	
D	Embossing Details	As per Cl.3.6 (e)	
10	Approx. overall dia. (mm)	……	
11	Overall order tolerance	-2 % for the total cable length for the entire order	
12	Cable Drum		
A	Type of Drum	Wooden	
B	Drum Length & tolerance	As per Spec. Cl. 4.3 & 4.4	
C	Marking on Drum	As per Spec. Cl. 4.7	
D	Drums provide with MS Spindle plate & nut bolts arrangement (as per IS:10418)	Required	
13	End Cap	Required	
14	Weights	……	
a)	Net Weight of cable (Kg/Km.) – Approx		
b)	Weight of empty drum	Kg	

S.No.	Description	Buyer's Requirement	Seller's data
c)	Weight of cable with drum	Kg	
15	Continuous current rating for standard I.S condition laid direct		
a)	In ground 30° C	Amps	
b)	In duct 30° C	Amps	
c)	In Air 40° C	Amps	
16	Short circuit current for 1 sec of Conductor (kAmp)	……	
17	Electrical Parameters at Maximum operating temperature:		
A	AC Resistance	Ohm/Km	
B	Reactance at 50 C/s	Ohm/Km	
C	Impedance	Ohm/Km	
D	Capacitance	Micro farad / Km	
18	Recommended minimum bending radius	..... x O/D	
19	Derating factor for following Ambient temperature in	Ground / Air	
a)	At 30° C		
b)	At 35° C		
c)	At 40° C		
d)	At 45° C		
e)	At 50° C		
20	Group factor for following Nos. of cables laid	Touching / Trefoil	
a)	3 Nos.		
b)	4 Nos.		
c)	5 Nos.		
d)	6 Nos.		
21	Process of Cross linking of Polyethylene	Dry/ Sioplas Cure	
22	Type test	Is copy of latest valid TTR for respective Sizes enclosed?	

S.No.	Description	Buyer's Requirement	Seller's data
		Yes /No	
23	FRLS Properties		
	Oxygen Index	As per IS 1554, Part	
	Temperature Index	As per IS 1554, Part	
	Max Acid Gas Generation	As per IS 1554, Part	
	Light Transmission / Smoke Density	As per IS 1554, Part	

12.0 ANNEXTURE – C

ARMOUR COVERAGE PERCENTAGE



Percent coverage = $\frac{N \times d}{W} \times 100$

Where,
N = number of parallel wires / Strips
d = diameter of wire / width of formed wires
W = π x D x Cos a,
D = diameter under armour
a = angle between armouring wire / formed wires and axis of cable
tan a = π x D/C, and
C = lay length of armouring wires / formed wires.

Min 90% armour coverage shall be provided both in case of wires and strips.

The gap between armour wires / formed wires shall not exceed one armour wire / Formed wire space and there shall be no cross over / over-riding of armour wire / Formed wire so, the minimum area of coverage of armouring shall be 90%.

13.0 ANNEXTURE – D

LIST OF SUB-VENDORS

Sr. No.	Description of Material	Sub-Vendors
1	E.C Grade Aluminium Rod	Bharat Aluminium Co. Ltd. (BALCO) Hindustan Aluminium Co. Ltd. (HINDALCO) National Aluminium Co. Ltd. (NALCO)
2	XLPE Compound	Kkalpana Industries Ltd. KLJ Polymers and Chemicals Ltd. Dow Chemical, U.S.A Borealis, Sweden Hanwha, Seoul, South Korea
3	PVC Compound	Kkalpana Industries Ltd. KLJ Polymers and Chemicals Ltd. Universal SCJ Plastic Sriram Polytech Shri Ram Vinyl, Kota
4	GI Strip	Tata Balaji Systematic Mica Wires Pvt Ltd. Bansal Industries

BSES

TECHNICAL SPECIFICATION

FOR

FRLS CONTROL CABLE

SPECIFICATION NO. – BSES-TS-57-CCAB-R0

Rev:		0
Pages:		11
Date:		20 April 2022
Prepared by	Abhishek Vashistha	
	Rohit Patil	
Reviewed by	Puneet Duggal	
	Amit Tomar	
Approved by	Gaurav Sharma	
	Gopal Nariya	

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 upto 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	As per IS 1554 Part 1
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: i. The voltage designation ii. Type of construction / cable code (for e.g. AYWY) iii. Manufacturers Name or Trade mark iv. Number of Cores and nominal cross sectional area of conductors v. The drum progressive length of cable and individual drum number at every meter. (By Printing) vi. Name of buyer i.e. BSES vii. Month & Year of Manufacturing viii. 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: 250°C at Oxygen Index 21 (when tested as per ASTM D 2863) c) Max Acid Gas Generation – Not more than 20% as per IEC -60754-1 d) Light Transmission - Minimum 40% when tested as per ASTMD 2843 (Smoke Density rating shall be max 60%) e) Flammability Test – As per IEC 60332-III, Cat – B, IEC 60332- I, IS- 10810 – Part 53, IS:10810 – Part 61 & 62 (Category A)
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	Cables must be of type tested as per relevant IS/IEC/ASTM. Type test conducted either from CPRI/ERDA/NABL third party accredited lab will be treated as valid. 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 routine 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. 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.
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. BSES 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/Drawing submission shall be as per the matrix given below. All documents/drawings shall be provided in soft copy only in returnable Pen drives. Language of the documents shall be English only. Incomplete submission shall be liable for rejection.

S No.	Description	Bid	Approval	Pre Dispatch
8.1	Guaranteed Technical Particulars (GTP)	required	required	
8.2	Deviation Sheet, if any	required	required	
8.3	Detailed cross sectional drawing of cable	required	required	
8.4	Dimensional drawing of Cable Drum		required	
8.5	Type test reports for the offered type and rating of cable	required	required	
8.6	BIS Certificate	required		
8.7	Make of Raw Materials	required	required	
8.8	Cable de-rating factors	required	required	
8.9	Manufacturer's Quality Assurance Plan		required	
8.10	Detailed installation & commissioning instructions		required	
8.11	Test certificates of all raw materials			required
8.12	Inspection and routine test reports, carried out in manufacturer's works			required

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

(Standard Cable sizes are 2Cx2.5, 4Cx2.5, 6C X 2.5, 8Cx2.5, 10Cx2.5, 12C 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°C	
b)	Short time (° C)	160°C	
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 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 of specification & Table 2 of IS 1554(Part-1)	
b)	Minimum thickness (mm)		
c)	Core Identification	As per IS 1554 Part 1	
d)	Approx. dia. over Insulation (mm)	To be specified by	

Sr.	Description	Buyer's requirement	Vendor's Data
		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 of specification	
12.0	End Cap	Required	
13.0	Drums provide with MS Spindle plate & Nut bolts arrangement	Required	
14.0	Net Weight of cable (Kg/Km.) – approx.	To be specified by vendor	

Sr.	Description	Buyer's requirement	Vendor's Data
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

Of

Cable Sealing System

Specification no – BSES-TS-69-CSS-R0

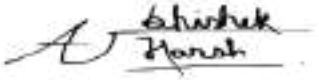
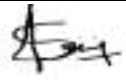
Rev:		0
Page:		1 of 8
Date:		29 Apr 2022
Prepared by	Abhishek Harsh	 3267d7c3-82b5-46cb-b5a6-867ee7820a34
Reviewed by	Srinivas Gopu	 5d32525e-ed3a-4f41-b1c7-b8a5e77d1519
Approved by	Gaurav Sharma	 23dc2de2-95de-4472-99a7-dea873f472b6

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

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		

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

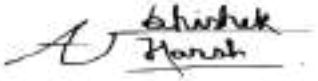
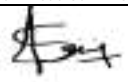
Rev:		0
Page		1 of 8
Date:		06 May 2022
Prepared by	Abhishek Harsh	 3267d7c3-82b5-46cb-b5a6-867ee7820a34
Reviewed by	Srinivas Gopu	 5d32525e-ed3a-4f41-b1c7-b8a5e77d1519
Approved by	Gaurav Sharma	 23dc2de2-95de-4472-99a7-dea873f472b6

TABLE OF CONTENT

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		

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.

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

DocUUID : 418842ef-48e6-4373-8932-04bd42bceccc

		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	

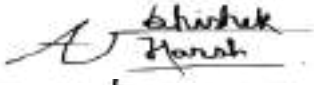
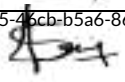
S. No.	Description	Specification requirement	Vendor Data
3.12	Bus joints	Silver	
3.13	Bus bar support insulator	Required	
3.13.1	Spacing (mm)		
3.13.2	Make		
3.13.3	Type		
3.13.4	Reference standard		
3.13.5	Voltage class (kV)		
3.13.6	Minimum creepage distance (mm)		
3.13.7	Cantilever strength (Kg/sq.cm.)		
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

SPECIFICATION
FOR
400/630/1000/1600/2000KVA,11/0.433 KV
OIL FILLED DISTRIBUTION TRANSFORMER

Specification No – SP-TRDU-01-R7

Revision		07
Date		19.03.2021
Pages		Page 1 of 77
Prepared by	Abhishek Harsh	
Reviewed by	Srinivas Gopu	3267d7c3-82b5-46cb-b5a6-867ee7820a34 
Approved by	Gaurav Sharma	 23dc2de2-95de-4472-99a7-dea873f472b6

INDEX

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

Record of Revision

Sl No.	Revision No	Item/Clause No.	Nature of change	Approved by
1	R1	2.0	Codes & standards updated.	DG/KR
2	R1	4.2.7.1	Transformer oil indicated as per annexure C and sample test included	DG/KR
3	R1	5.21	MOG and terminal box included	DG/KR
4	R1	5.22	Metering box included	DG/KR
5	R1	10.2	Additional description indicated for IR and PI measurement. Temperature rise test included for any lot	DG/KR
6	R1		Annexure C1 included for transformer oil specification	DG/KR
7	R1		Annexure C2 included for additional requirement for hermetically sealed transformer	DG/KR
8	R1		Annexure D updated	DG/KR
9	R1		Annexure D1 data for transformer oil included	DG/KR
10	R2	5.23	Steel support structure for cables added	MDB/KKA
11	R2	Cl 25.3 of Annexure C	Length reduced to 2100	MDB/KKA
12	R2	Cl 33.0 of Annexure C	Capitalization figure revised	MDB/KKA
13	R2	1.1.5 of Annexure A	Steel support for cables added	MDB/KKA
14	R2	10.5	Customer Hold Points added	MDB/KKA
15	R3	6.0	List of make Approved make updated	MDB/KKA
16	R3	6.2	Current density at all taps included	MDB/KKA
17	R4	2.0	BIS certification required	SR/KKA
18	R4	3.25 &3.26	Losses revised	SR/KKA
19	R4	10.4	Special tests revised	SR/KKA

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

20	R4	4.2.5.2&4.2.5.3	Core grade & thickness revised	SR/KKA
21	R4	3.37	Noise level specified	SR/KKA
22	R4	4.2.2.4	Silica gel type changed.	SR/KKA
23	R4	4.2.10.5	CT burden revised	SR/KKA
24	R4	10.1.1	Vacuum & pressure test shall be as per IS	SR/KKA
25	R4	10.2	Routine test revised	SR/KKA
26	R5	3.23	990kVA Transformer rating revised to 1000kV	DS
27	R5	3.24.1	400 & 630kVA percentage impedance changed to 4.5%	DS
28	R5	3.41 & 4.2.11.1	Tapping range revised	DS
29	R5	4.2.5.5	Flux density at over fluxing changed	DS
30	R6	3.23, 3.24, 3.27, 3.30, 3.31& 3.41	1600 & 2000 kVA ratings included	AA
31	R6	3.32	Transformer dimensions	AA
32	R6	3.25 & 3.26	Losses revised	AA
33	R7	3.29, 3.31	Busbar material and Size changed	GS
34	R7	3.41	Tapping range changed	GS
35	R7	4.2.10.8.1	CT box size is changed	GS
36	R7	4.2.12	PRV included	GS
37	R7	4.2.13	OTI/WTI scanner included	GS
38	R7	4.2.14	Auxiliary relays (hand reset type) included	GS
39	R7	Annexure D	Quality Assurance Plan	GS

1.0 Scope of Supply

For scope of supply, refer annexure – A.

2.0 Codes & standards

a) Materials, equipment and methods used in the manufacture of Transformer shall conform to the latest edition of below mentioned standards.

b) Vendor shall possess valid BIS Certification.

IEC Standards

IEC 60034	Rotating Electrical Machines. (e.g. For Cooler Fan Motors.)
IEC 60071	Co-ordination of Insulation.
IEC 60076	Power transformers.
IEC 60156	Method for Determination of the Electric Strength for Insulating Oils.
IEC 60044	Current Transformers.
IEC 60214	On Load Tap Changers
IEC 60296	Specification for Unused Mineral Insulating Oils for Transformers and Switchgear.
IEC 60354	Loading Guide for Oil-Immersed Power Transformers.
IEC 60445	Basic& Safety principles for man-machine interface, marking and identification, Identification of Equipment Terminals and conductor terminals
IEC 60529	Degrees of Protection Provided by Enclosures (IP Code).
IEC 60551	Determination of Transformer and Reactor Sound Levels.
IEC 60606	Application Guide for Power Transformers.
IEC 60616	Terminal and Tapping Markings for Power Transformers.
IEC 60947	Low-Voltage Switchgear and Control gear.
IEC 60947	Bushing for alternating voltage above 1000V

British Standard

BS 148	Determination of Transformer and Reactor Sound Levels.
BS 223	Application Guide for Power Transformers.
BS 2562	Terminal and Tapping Markings for Power Transformers.

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

Indian Standards

IS:335	Insulating oil
IS:1271	Thermal evaluation and classification of electrical insulation
IS:2099	Bushing for Alternating voltage above 1000V
IS:16227	Current Transformers
IS:3347	Dimensions for Porcelain Transformer bushing
IS:3637	Gas operated relays
IS:3639	Fitting & Accessories for power transformers
IS:4201	Application guide for CT's
IS:2027 pt 7	Guide for loading of oil immersed transformers
IS:8478	Application guide for On-load tap changer
IS:8468	On-load tap changer
IS:10028	Code of practice for selection, installation & maintenance of transformers
IS:13947	LV switchgear and Controlgear-Part1
IS 2026	Power Transformers
IS 1180	Outdoor type oil immersed distribution transformer upto and including 2.5MVA,33kV
IS 5561	Electrical Power Connectors
IS 5	Colors for ready mix paints
IS 6272	Industrial cooling fans
IS 325	Three phase induction motors
	Indian Electricity Rules
	Indian Electricity Act
	CBIP manual

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

i. Guaranteed Technical Particulars (GTP)

ii. This Specification

iii Indian Standards / IEC standards

iv Approved Vendor Drawings

iv. Other documents

3.0 Major Design Criteria & Parameters of the Transformer

Sr No	Description	Data by purchaser
3.1	Voltage variation on supply side	+ / - 10 %
3.2	Frequency variation on supply side	+/ - 5 %
3.3	Transient condition	- 20 % or + 10 % combined variation of voltage and frequency
3.4	Service Condition	Refer Annexure B
3.5	Insulation level	Class A
3.6	Location of equipment	Generally Outdoor but may be located indoor also with poor ventilation
3.7	Reference design ambient temperature	50 deg C
3.8	Type	Oil immersed, core type, step down
3.9	Type of cooling	ONAN
3.10	Reference standard	IS 2026/IS 1180
3.11	No. of phases	3
3.12	No. of windings per phase	2
3.13	Rated frequency (Hz)	50 Hz
3.14	Highest system voltage HV side	12 kV
3.15	Highest system voltage LV side	460 volt
3.16	Lightning Impulse withstand voltage , kV peak	
3.16.1	For nominal system voltage of 11 kV	75
3.17	Power Frequency Withstand Voltage kV rms	
3.17.1	For nominal system voltage of 11 kV	28
3.17.2	For nominal system voltage of 415 V	3
3.18	Clearances Phase to Phase , mm	
3.18.1	For nominal system voltage of 11 kV	180
3.18.2	For nominal system voltage of 415 V	25
3.19	Clearances Phase to Earth , mm	
3.19.1	For nominal system voltage of 11 kV	120
3.19.2	For nominal system voltage of 415 V	25

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

3.20	System Fault Level , HV side	350 MVA
3.21	System Fault Level , LV side	35 MVA
3.22	System earthing	
3.22.1	HV	Solidly earthed
3.22.2	LV	Solidly earthed
3.23	Ratings	400/630/1000/1600/2000 kVA
3.24	Percentage Impedance at 75 deg C	
3.24.1	400/630 kVA	4.5 % with IS tolerance
3.24.2	1000 kVA	5.0 % with IS tolerance
3.24.3	1600/2000 kVA	6.25% with IS tolerance
3.25	Max Total losses(No Load+ Load Losses at 75ºC) at 50% of the rated load , kW	
3.25.2	400 kVA	1.225
3.25.3	630 kVA	1.86
3.25.4	1000 kVA	2.79
3.25.5	1600 kVA	4.2
3.25.6	2000 kVA	5.05
3.26	Max Total losses(No Load+ Load Losses at 75ºC) at 100% of the rated load , kW	
3.26.1	400 kVA	3.45
3.26.2	630 kVA	5.3
3.26.3	1000 kVA	7.7
3.26.4	1600 kVA	11.8
3.26.5	2000 kVA	15
3.27	Phase CT Ratio , Amp	
3.27.1	400 kVA	600/5
3.27.2	630 kVA	1000/5
3.27.3	1000 kVA	1500/5
3.27.4	1600 kVA	2500/5
3.27.5	2000 kVA	3000/5

3.28	HV cable size for all sizes / Conductor size	11 kV (E) grade , A2XCEWY 3C x 150 sqmm
3.29	Aluminum Busbar size on HV side for cable termination, mm x mm	50x10
3.30	LV cable size, 650 /1100 V grade , A2XY cable single core 630 sqmm unarmoured (approx cable dia 40 mm)	Cable
3.30.1	400 kVA	2 runs per phase + 2 runs in Neutral
3.30.2	630 kVA	3 runs per phase + 2 runs in Neutral
3.30.3	1000 kVA	4 runs per phase + 3 runs in Neutral
3.30.4	1600 KVA	6 runs per phase + 3 runs in Neutral
3.30.5	2000 kVA	7 runs per phase + 4 runs in Neutral
3.31	Aluminum Busbar size on LV side for cable termination, mm x mm	
3.31.1	400/630 kVA	
3.31.1.1	Phase	100 x 12
3.31.1.2	Neutral	100 x 12
3.31.2	1000kVA	
3.31.2.1	Phase	2 runs 100 x 12
3.31.2.2	Neutral	2 runs 100 x 12
3.31.3	1600/2000kVA	
3.31.3.1	Phase	2 runs 160 x 12
3.31.3.2	Neutral	2 runs 160 x 12
3.32	Maximum Overall Dimension Acceptable (length x width x height), mm x mm x mm	
3.32.1	400 kVA	1500X1500X2000
3.32.2	630 kVA	1700X1700X2200
3.32.3	1000 kVA	1900X1900X2500
3.32.4	1600 kVA	2300X2000X2600
3.32.5	2000 kVA	2500X2000X2600
3.33	Short Circuit withstand Capacity of the transformer	

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

3.34	Three phase dead short circuit at secondary terminal with rated voltage maintained on the other side	For 3 secs.
3.35	Single phase short circuit at secondary terminal with rated voltage maintained on other side	For 3 secs.
3.36	Overload Capability	As per IS 2026/IEC 60905
3.37	Noise Level	400/630/1000/1600/2000 KVA-56/57/58/60/61 Db respectively
3.38	Radio Influence Voltage	Maximum 250 microvolt
3.39	Harmonic suppression	Transformer to be designed for suppression of 3rd, 5th, 7th harmonic voltages and high frequency disturbances.
3.40	Partial Discharge	Transformer to be free from partial discharge upto 120 % of rated voltage as the voltage is reduced from 150 % of rated voltage i.e. there shall be no significant rise above background level
3.41	Tappings	Off Circuit taps on HV winding , +10% to - 10% in steps of 2.5 % , change of taps by externally operated switch
3.41.1	Rotary tap switch operating voltage	11 kV
3.41.2	Rotary tap switch current rating, Amp.	
3.41.2.1	400 kVA	60 Amp
3.41.2.2	630 / 1000 kVA	100 Amp
3.41.2.3	1600/2000 kVA	150 Amp

4.0 Construction & Design

4.1	Type	Double Copper wound, three phase, oil immersed, with ONAN cooling, with off

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

		circuit tap changer
4.2	**Major Parts**	
4.2.1	**Tank**	
4.2.1.1	Type	Non sealed type with conservator as per manufacturer's standard.
4.2.1.2	Material of Construction	Robust mild steel plate without pitting and low carbon content
4.2.1.3	Plate Thickness	Adequate for meeting the requirements of pressure and vacuum type tests as per IS
4.2.1.4	Welding features	i) All seams and joints shall be double welded ii) All welding shall be stress relieved for sheet thickness greater than 35 mm iii) All pipes, radiators, stiffeners, welded to the tank shall be welded externally
4.2.1.5	Tank features	i) Adequate space at bottom for collection of sediments ii) Stiffeners provided for rigidity and designed to prevent accumulation of water iii) No internal pockets in which gas/air can accumulate iv) No external pocket in which water can lodge v) Tank bottom with welded skid base vi) Tank cover sloped to prevent retention of rain water vii) Minimum disconnection of pipe work and accessories for cover lifting viii) Tanks shall be of a strength to

		prevent permanent deformation during lifting , jacking, transportation with oil filled. ix) Tank to be designed for oil filling under vacuum x) Tank cover fitted with lifting lug xi) Tank cover bent at all the ends xii) Minimum disconnection of pipe work and accessories for cover lifting
4.2.1.5	Flanged type adequately sized inspection cover rectangular in shape required for	i) HV line bushing ii) LV line bushing iii) LV neutral bushing iv) Core / Winding
4.2.1.6	Fittings and accessories on main tank	See under fittings and accessories.
4.2.2	**Conservator for the main tank**	
4.2.2.1	Capacity	Adequate between highest and lowest visible levels to meet the requirement of expansion of oil volume in the transformer and cooling equipment from minimum ambient temperature to maximum operating temperatures.
4.2.2.2	Conservator oil preservation system	Conventional
4.2.2.3	Conservator features	i) Conservator shall be bolted into position so that it can be removed for cleaning / other maintenance purposes ii) Main pipe from tank shall project about 20 mm above conservator bottom for creating a sump for collection of impurities iii) Conservator minimum oil level corresponding to minimum temperature shall be well above

		the sump level. iv) Conservator to main tank piping shall be supported at minimum two points.
4.2.2.4	Fittings and accessories on main tank conservator	i) Prismatic oil gauge with MINIMUM, NORMAL and MAXIMUM marking ii) End Cover iii) Oil Filling Hole with cap iv) Silica Gel Dehydrating Breather with oil seal and dust filter with clear acrylic single piece clearly transparent cover resistant to UV rays(1kg). Breather shall be of Flanged type in circular shape with 4 no.holes of ½ inches with hardware of M10 bolts. Silica gel shall be of round ball type of 2.5mm dia. v) Drain Plug vi) Air release plug as required vii) Pressure/ Vacuum gauge viii) Magnetic Oil Gauge with LOW LEVEL ALARM
4.2.3	**Radiators**	Detachable type
4.2.3.1	Thickness	Minimum 1.2 mm
4.2.4.2	Features	With lifting lugs, air release plug, drain plug
4.2.5	**Core**	
4.2.5.1	Material	High grade , non ageing, low loss, high permeability, grain oriented, cold rolled silicon steel lamination
4.2.5.2	Grade	Premium Grade minimum M3 or better

4.2.5.3	Lamination thickness	0.23 mm Max.
4.2.5.4	Design Flux Density at rated conditions at principal tap	As per Manufacturer design.
4.2.5.5	Maximum Flux Density at 12.5 % over excitation / over fluxing	1.9 T
4.2.5.6	Core Design Features	i) Magnetic circuit designed to avoid short circuit paths within core or to the earthed clamping structures ii) Magnetic circuit shall not produce flux components at right angles to the plane of lamination to avoid local heating iii) Least possible air gap and rigid clamping for minimum core loss and noise generation iv) Adequately braced to withstand bolted faults on secondary terminals without mechanical damage and damage/ displacement during transportation and positioning. v) Percentage harmonic potential with the maximum flux density under any condition limited to avoid capacitor overloading in the system vi) All steel sections used for supporting the core shall be thoroughly sand blasted after cutting , drilling, welding vii) Provision of lifting lugs for core coil assembly viii) Supporting framework designed not to obstruct complete drainage of oil from transformer

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

4.2.6	**Winding**	
4.2.6.1	Material	Electrolytic Copper
4.2.6.2	Maximum Current Density allowed	3 Amp per sq mm at all taps.
4.2.6.3	Winding Insulating material	Class A , non catalytic, inert to transformer oil, free from compounds liable to ooze out, shrink or collapse.
4.2.6.4	Winding Insulation	Uniform
4.2.6.5	Design features	i) Type of winding a. LV: Sprial/Helical b. HV: Crossover/Disc ii) Stacks of winding to receive adequate shrinkage treatment iii) Connections braced to withstand shock during transport, switching, short circuit, or other transients. iv) Minimum out of balance force in the transformer winding at all voltage ratios. v) Conductor width on edge exceeding six times its thickness vi) Transposed at sufficient intervals. vii) Coil assembly shall be suitably supported between adjacent sections by insulating spacers + barriers viii) Winding leads rigidly supported , using guide tubes if practicable ix) Winding structure and major insulation not to obstruct free flow of oil through ducts x) Provision of taps as per clause 3.41
4.2.7	**Transformer Oil**	
4.2.7.1	Type	Should be in accordance with

		specification as per Annex C of this document One sample of oil drawn from every lot of transformer offered for inspection should be tested at CPRI/ERDA for tests as listed under Table-1 of IS:1866 (2000). The cost of this testing should be included within the cost of transformer. The results shall be confirming to BSES specification Annex C
4.2.8	**Bushings and Terminations**	
4.2.8.1	Type of HV side bushing	HV bushing should be top mounted. Outdoor, Epoxy Resin cast, rated voltage and creepage as per 31mm/kV with voltage class of 12kV respectively
4.2.8.2	Type of LV side bushing	LV bushing should be top mounted. Outdoor, Epoxy resin cast, rated voltage and creepage as per 31mm/kV with voltage class of 1.1 kV respectively Additional neutral bushing shall be provided of porcelain.
4.2.8.2.1	Essential provision for LV side line bushing	It shall be complete with copper palm complete with tinned copper busbar of size shall be as per clause 3.31.
4.2.8.2.2	Essential provision for LV side neutral bushing	In case of neutral bushing the stem and busbar shall be integral without bolted, threaded, brazed joints. Busbar size shall be as per clause 3.31
4.2.8.3	Arcing Horns	Not required
4.2.8.4	Support insulators inside HV cable box if provided	Epoxy resin cast, rated voltage 12 kV
4.2.8.5	Termination on HV side bushing	By bimetallic terminal connectors suitable for ACSR/AAAC conductor /

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

		Cable connection through cable box with disconnecting link suitable for 11kV(E) grade,A2XFY 3Cx 150sqmm
4.2.8.6	Termination of LV side bushing	By bimetallic terminal connectors suitable for LV Cable size of 650/1100VGrade, A2XY Cable single core 630sqmm (Approx dia 40mm)
4.2.8.7	Minimum creepage distance of all bushings and support insulators.	31mm/KV
4.2.8.8	Protected creepage distance	At least 50 % of total creepage distance
4.2.8.9	Continuous Current rating	Minimum 20 % higher than the current corresponding to the minimum tap of the transformer
4.2.8.10	Rated thermal short time current	25 times the rated current for 2 sec
4.2.8.11	Atmospheric protection for clamp and fitting of iron and steel	Hot dip galvanizing as per IS 2633
4.2.8.12	Bushing terminal lugs in oil and air	Tinned copper
4.2.8.13	Sealing washers /Gasket ring	Nitrile cork rubber(RC70C)/ Expanded TEFLON(PTFE) as applicable.
4.2.9	**HV & LV cable box**	Required
4.2.9.1	Material of Construction	Sheet Steel min. 2.5 mm thick
4.2.9.2	Cable entry	At bottom through detachable gland plate with cable clamps of non magnetic material
4.2.9.3	Cable size for HV	11 kV (E) grade , A2XFY 3C x 150 sqmm
4.2.9.4	Cable size for LV	LV cable size, 650 /1100 V grade, A2XY cable single core 630 sqmm unarmoured (approx cable dia 40 mm)
4.2.9.5	Cable size for LV Neutral	LV cable size, 650 /1100 V grade, A2XY cable single core 630 sqmm unarmoured (approx cable dia 40 mm)

4.2.9.6	Detachable Gland Plate material for HV, LV, LV Neutral box	i) MS for HV cable box ii) Al for LV cable box.
4.2.9.7	Gland plate thickness for HV, LV, LV Neutral box	i) 3 mm for HV side cable box ii) 5 mm for LV cable box.
4.2.9.8	Cable gland for HV cables	Nickel plated brass double compression weatherproof cable gland
4.2.9.9	Cable lug for HV, LV, LV Neutral cables	Double hole Aluminium lugs
4.2.9.10	Essential parts	i) Flange type removable front cover with handles min two nos. ii) Tinned Copper Busbar of adequate size for Purchaser's cable termination with busbar supports iii) Earthing boss for the cable box iv) Earthing link for the gasketted joints at two point for each joint v) Earthing provision for cable Armour/ Screen vi) Flanged type inspection cover on top for bushing inspection and maintenance with handle vii) Drain plug viii) Rainhood on gasketted vertical joint ix) Danger / caution plate
4.2.9.11	Terminal Clearances	700mm, Minimum
4.2.9.12	Termination height required for cable termination	1000mm, Minimum
4.2.10	**Current Transformers**	
4.2.10.1	Provision	On all three phases on LV side
4.2.10.2	Mounting	On LV side bushings on all three phases with the help of fibre glass mounting plate affixed to main tank by nut bolt arrangement

4.2.10.3	Maintenance requirements	Replacement should be possible by removing fixing nut of mounting plate after removal of LT cable without disturbing LT bushing
4.2.10.4	Accuracy Class	0.5
4.2.10.5	Burden	10VA
4.2.10.6	Type	Resin Cast Ring type suitable for outdoor use.
4.2.10.7	CT ratio	
	400kVA	600/5
	630kVA	1000/5
	1000kVA	1500/5
	1600kVA	2500/5
	2000kVA	3000/5
4.2.10.8	**CT terminal Box**	
4.2.10.8.1	Size	650 mm height x 750 mm width x 275 mm depth.
4.2.10.8.2	Fixing of instrument / meters within box	On slotted channel 40 x 12 mm size, channel fixed on vertical slotted angle 40 x 40 mm size at two ends
4.2.10.8.3	No of horizontal channels to be provided	Four
4.2.10.8.4	Fixing of terminals within the box	On horizontal slotted channel with the help of C channel available with the terminals
4.2.10.8.5	Location	On tank wall
4.2.10.8.6	Box door design	Openable from outside with antitheft hinge, padlock facility, door fixed by stainless steel allen screw M6 size , door shall have canopy for rain protection
4.2.10.8.7	Terminal strip	Nylon 66 material, minimum 4 sq mm, screw type for control wiring and

		potential circuit.
4.2.10.8.8	Cables and wires	PVC insulated, extruded PVC inner sheathed, armoured, extruded PVC outer sheathed 1100 V grade control cable as per latest edition of IS 1554 part 1 minimum 2.5 sq mm for signals and 4 sq mm for CT with multi strand copper conductor
4.2.10.8.9	Cable Glands	Nickel plated brass double compression weatherproof cable gland
4.2.10.8.10	Lugs on wires	Tinned copper pre insulated Pin, Ring, Fork type as applicable
4.2.10.8.11	Potential signal in CT box	i) Tapped from main LV busbar ii) Neutral Link and Fuse to be provided by bidder for PT
4.2.10.8.12	Essential provision	Wiring diagram to be fixed on the back of door along with CT spec. on Aluminum engraved plate fixed by rivet.
4.2.11	**Off Circuit tap Switch**	
4.2.11.1	Range /Step	Off circuit taps on HV winding, +10% to -10% in steps of 2.5%, change of taps by externally operated switch.
4.2.11.2	Type	Rotary type, 3 pole gang operated, draw out type
4.2.11.3	Operating Voltage	11kV
4.2.11.4	Rated Current for tap Switch	i) 400 kVA - 60 Amps ii) 630/1000 kVA - 100 Amps iii) 1600/2000kVA-150 Amps
4.2.11.5	Operating Handle	External at suitable height to be operated from ground level.
4.2.11.6	Essential provision	Tap position indicator, direction changing facility, locking arrangement, and caution plate metallic fixed by

		rivet.
4.2.12	**Pressure Relief Device**	
4.2.12.1	Type	Pressure Relief Valve (PRV)
4.2.12.2	Auxiliary contacts	2 NO
4.2.13	Winding and Oil Temperature scanner	Required
4.2.13.1	PT 100 sensor	For measurement of Oil temperature LV winding temperature.
4.2.13.2	No of potential free trip contacts	2NO
4.2.13.3	No of potential free alarm contacts	2NO
4.2.13.4	Auxiliary Supply	240 AC, Single phase, 50Hz. Tapped from LV side busbar through a MCB located inside box.
4.2.13.5	Communication port	RS 485 port for interfacing with FRTU on Modbus protocol. Battery/Super capacitor for data transmission to SCADA in the event of Auxiliary supply fail
4.2.14	Auxiliary Relay (hand reset type)	Required to identify the type of fault/indication.
4.2.14.1	quantity	4 no's Separate auxiliary relay to be provided for PRV, MOG,WTI/OTI, Buchholz relay.
4.2.14.2	Potential free contacts	2 NO
4.2.14.3	Auxiliary supply	240V AC
4.3	**Hardware**	
4.3.1	External	Hot dip galvanized bolts
4.3.2	Internal	Cadmium plated except special hardware for frame parts and core assembly as per manufacturer's design
4.4	**Gasket**	
4.4.1	For Transformer , surfaces interfacing with oil like inspection cover etc.	Nitrile cork rubber RC70C grade
4.4.2	For Cable boxes, Marshalling box, etc.	Neoprene rubber based/ cork nitrile

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

4.5	**Valves**	
4.5.1	Material of construction	Brass / gun metal
4.5.2	Type	Both end flanged gate valve / butterfly valve depending on application
4.5.3	Size	As per manufacturer's standard
4.5.4	Essential provision	Position indicator, locking rod, padlocking facility, valve guard, cover plate.
4.6	**Cable routing on Transformer**	Control cables for accessories on transformer tank shall be routed through perforated GI trays
4.6.1	Control cable specification	PVC insulated, extruded PVC inner sheathed, armoured, extruded PVC outer sheathed 1100 V grade control cable as per latest edition of IS 1554 part 1 minimum 2.5 sq mm for signals and 4 sq mm for CT with multi strand copper conductor
4.6.2	Specification of wires to be used inside marshalling box.	PVC insulated multi-strand flexible copper wires of minimum 2.5 sq mm size, 1100 V grade as per latest edition of relevant IS
4.7	**Terminal Blocks to be used by the vendor**	Nylon 66 material, minimum 4 sq mm, Stud type screw driver operated type for control wiring and potential circuit.
4.7.1	Essential provision for CT terminals	Sliding link type disconnecting terminal block Stud type screwdriver operated with facility for CT terminal shorting material of housing melamine/ Nylon66
4.8	**Cable glands to be used by the vendor**	Nickel plated brass double compression weatherproof cable gland
4.9	**Cable lugs to be used by the vendor**	

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

4.9.1	For power cables	Long barrel medium duty Aluminium lug with knurling on inside surface.
4.9.2	For Control Cable	Tinned copper pre insulated Pin, Ring, Fork type as applicable
4.10	**Painting of transformer, Radiator, marshalling box for CT, cable boxes etc.**	
4.10.1	Surface preparation	By 7 tank pretreatment process or shot blasting method
4.10.2	Finish on internal surfaces of the transformer	Bright Yellow heat resistant and oil resistant paint two coats. Paint shall neither react nor dissolve in hot transformer insulating oil.
4.10.3	Finish on inner surface of the CT terminal box, HV/LV/LVN cable box	White Polyurethane paint anti condensation type two coats , minimum dry film thickness 80 microns
4.10.4	Finish on outer surface of the transformer, radiator, CT terminal box, HV/LV/LVN cable box	Battle ship Grey shade 632 Polyurethane paint two coats, minimum dry film thickness 80 microns
4.10.5	Frame parts	Battle ship grey shade 632 IS 5, 80 micron minimum insulating oil resistant paint. Paint shall neither react nor dissolve in hot transformer insulating oil.

5.0 Fittings and Accessories on Transformer

5.1	Rating and Diagram Plate	Required
5.1.1	Material	Anodized aluminum 16SWG
5.1.2	Background	SATIN SILVER
5.1.3	Letters, diagram & border	Black
5.1.4	Process	Etching
5.1.5	Rating and Diagram Plate details	Following details shall be provided on rating and diagram plate as a minimum i) type/kind of transformer with

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

		winding material ii) standard to which it is manufactured iii) manufacturer's name; iv) transformer serial number; v) month and year of manufacture vi) rated frequency in Hz vii) rated voltages in kV viii) number of phases ix) rated power in kVA x) type of cooling (ONAN) xi) rated currents in A xii) vector group connection symbol xiii) 1.2/50µs wave impulse voltage withstand level in kV xiv) power frequency withstand voltage in kV xv) impedance voltage at rated current and frequency in percentage at principal, minimum and maximum tap xvi) Max. Total losses at 50 % rated load xvii) Max. Total losses at 100 % rated load xviii) Load loss at 50% & 100% rated load xix) No-load loss at rated voltage and frequency xx) Energy efficiency level. xxi) continuous ambient temperature at which ratings apply in deg C xxii) top oil and winding temperature rise at rated load in deg C; xxiii) winding connection diagram with

		taps and table of tapping voltage, current and power xxiv) transport weight of transformer xxv) weight of core and windings xxvi) total weight xxvii) volume of oil xxviii) weight of oil xxix) name of the purchaser xxx) PO no and date xxxi) Guarantee period
5.2	Terminal marking Plate for Bushing, anodized aluminium black lettering on satin silver background both inside cable boxes near termination and on cable box cover (all fixed by rivet)	Required
5.3	Company Monogram Plate fixed by rivet	Required
5.4	Lifting Lug to lift complete transformer with oil	Required
5.5	Lifting lug for top cover	Required
5.6	Lashing Lug	Required
5.7	Jacking Pad with Haulage hole to raise or lower complete transformer with oil	Required
5.8	Detachable Bidirectional flat roller Assembly	Required
5.8.1	Roller center to center distance	Minimum 900 mm on the side of HV and LV cable box Maximum 800 mm on the other side (perpendicular to HV, LV cable box).
5.8.2	Essential provision	Roller dia 150 mm min., roller to be fixed in such a way so that the lowermost part of the skid is above

		ground by at least 100 mm when the transformer is installed on roller.
5.9	Pockets for ordinary thermometer on tank cover with metallic identification plate fixed by rivet.	Required
5.10	Drain valve (gate valve) for the main tank with cork above ground by 150mm minimum with padlocking and valve guard with metallic identification plate fixed by rivet.	Required
5.11	Filter valve (gate valve) at top with padlocking and valve guard with metallic identification plate fixed by rivet.	Required
5.12	Air Release Plug on tank cover with metallic identification plate fixed by rivet.	Required
5.13	Earthing pad on tank for transformer earthing complete with non ferrous nut ., bolt, washers, spring washers etc. with metallic identification plate fixed by rivet	Required
5.14	Rainhood for vertical gasketted joints , in cable boxes, Conservator	Required Not required as per Annexure A Scope of supply
5.15	Earthing bridge by copper strip jumpers on all gasket joints at at least two points for electrical continuity	Required
5.16	Skid base welded type with haulage hole	Required
5.17	Core , Frame to tank Earthing	Required
5.18	Danger plate made of Anodized aluminum with white letters on red	Required

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

	background on Transformer, cable boxes (all fixed by rivet)	
5.19	Caution plate for Off Circuit tap changer fixed by rivet.	Required
5.20	MOG with auxiliary contact wired upto Terminal Box	Required
5.21	Buchholz relay for transformer above 1000kVA	Required
5.22	Pressure relief valve	Required
5.23	WTI & OTI Temperature Scanner	Required
5.24	Auxiliary relays (4 no's)	Required

6.0 Approved make of components

6.1	CT	Pragati / ECS / Kappa/Mehru
6.2	Bushings	Baroda Bushing/Jaipur glass/CJI
6.3	Tap Changer	Alwaye /Paragon
6.4	MOG	Sukrut/Atvus
6.5	Valves	Newman/ATAM
6.6	CRGO	Nippon/JFE/Posco
6.7	Copper	Birla copper/Sterlite
6.8	Pre compressed Pressboard	Raman Board, Mysore/ Senapathy Whiteley
6.9	Laminated Wood	Permalli Wallance / Rochling Engineers
6.10	Oil	Apar/Savita/Raj
6.11	Steel	TATA/Jindal/SAIL
6.12	Lugs/Glands	Jainson/Dowells/Comet
6.13	Radiators	CTR/Hi-Tech Radiators /Tarang Engineers
6.14	WTI/OTI	Precimeasure/ Pecon

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

7.0 Quality assurance

7.1	Quality Assurance program	To be submitted before contract award.

		Program shall contain following i) The structure of the organization ii) The duties and responsibilities assigned to staff ensuring quality of work. iii) The bidder should have qualified technical & dedicated QA personnel at various stages of manufacture & testing. iv) Factory inspection of bidder may be carried out to ascertain the quality system and process in place at manufacturing facility. The same is applicable to bidders not approved with BSES. v) The system for purchasing, taking delivery and verification of materials vi) The system for ensuring quality of workmanship vii) The system for control of documentation viii) The system for the retention of records ix) The arrangements for the Supplier's internal auditing x) A list of the administration and work procedures required to achieve and verify Contract's quality requirements. These procedures shall be made readily available to the Purchaser for inspection on request
7.2	Quality Plan	To be submitted by the successful bidder for approval. Plan shall contain following as a minimum i) An outline of the proposed work and programme sequence ii) The structure of the Supplier's organisation for the contract iii) The duties and responsibilities assigned to staff ensuring quality of work for the contract iv) Inspection Hold and notification

		points mutually agreed. v) Submission of engineering documents required by the specification vi) The inspection of materials and components on receipt vii) Reference to the Supplier's work procedures appropriate to each activity viii) Inspection during fabrication/ construction ix) Final inspection and test x) Successful bidder shall include submittal of Mills invoice, Bill of lading, Mill's test certificate for grade, physical tests, dimension, specific watt loss per kG for the core material to the purchaser for verification in the quality plan suitably
7.3	Manufacturing Quality Assurance Plan	Refer Annexure D

8.0 Progress Reporting

8.1	Outline Document	To be submitted for purchaser approval for outline of production, inspection, testing, packing, dispatch, documentation programme
8.2	Detailed Progress report	To be submitted to Purchaser once a month containing i) Progress on material procurement ii) Progress on fabrication iii) Progress on assembly iv) Progress on internal stage inspection v) Reason for any delay in total programme vi) Details of test failures if any in manufacturing stages vii) Progress on final box up viii) Constraints ix) Forward path

9.0 Inspection & testing

9.1	Inspection and Testing during manufacture	Only type tested equipment shall be acceptable
9.1.1	Tank and Conservator	i) Check correct dimensions between wheels demonstrate turning of wheels through 90 deg and further dimensional check. ii) Check for physical properties of materials for lifting lugs, jacking pads etc. All load bearing welds, including lifting lug welds shall be subjected to iii) required load tests. iv) Leakage test of the conservator. v) Certification of all test results. vi) Oil leakage test . vii) Vacuum and Pressure test on tank as type test as per IS
9.1.2	Core	i) Sample testing of core material for checking specific loss, bend properties, magnetization characteristics and thickness. ii) Check on the quality of varnish if used on the stampings. a) Measurement of thickness and hardness of varnish on stampings. b) Solvent resistance test to check that varnish does not react in hot oil. c) Check over all quality of varnish by sampling to ensure uniform hipping colour, no bare spots. No ever burnt varnish layer and no bubbles on varnished surface. iii) Check on the amount of burns. iv) Bow check on stampings. v) Check for the overlapping of stampings. Corners of the sheet are to be apart. vi) Visual and dimensional check during assembly stage. vii) Check on complete core for measurements of iron-loss and check for any hot spot by exciting the core so as to induce the designed value of

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

		flux density in the core. viii) Check for inter laminar insulation between core sectors before and after pressing. ix) Visual and dimensional checks for straightness and roundness of core, thickness of limbs and suitability of clamps. x) High voltage test (2 KV for one minute) between core and clamps. xi) Certification of all test results. xii) One sample of CRGO to be sealed for testing at ERDA/CPRI. The following tests shall be conducted on the sample xiii) Specific core loss measurement xiv) Magnetic polarization xv) Magnetic permeability xvi) Specific core loss measurement after accelerated ageing test xvii) Surface insulation resistivity measurement xviii) Stacking factor xix) Ductility (Bend test) xx) Lamination thickness xxi) Magnetization characteristics (B-H curve)
9.1.3	Insulating Materials	i) Sample check for physical properties of materials. ii) Check for dielectric strength. iii) Visual and dimensional checks. iv) Check for the reaction of hot oil on insulating materials. v) Certification of all test results.
9.1.4	Windings	i) Sample check on winding conductor for mechanical properties and electrical conductivity. ii) Visual and dimensional check on conductor for scratches, dept. mark etc. iii) Sample check on insulating paper for PE value, Bursting strength, Electric strength. iv) Check for the reaction of hot oil on

		insulating paper. v) Check for the bending of the insulating paper on conductor. vi) Check and ensure that physical condition of all materials taken for winding is satisfactory and free of dust. vii) Check for absence of short circuit between parallel strands. viii) Check for Brazed joints wherever applicable. ix) Measurement of voltage ratio to be carried out when core/ yoke is x) completely restocked and all connections are ready. xi) Certification of all test results.
9.1.4.1	Checks before drying process	i) Check conditions of insulation on the conductor and between the windings. ii) Check insulation distance between high voltage connection distance between high voltage connection cables and earthed and other live parts. iii) Check insulation distance between low voltage connection and earthed and other parts. iv) Insulation test of core earthing. v) Check for proper cleanliness vi) Check tightness of coils i.e. no free movement. vii) Certification of all test results.
9.1.4.2	Checks during drying process	i) Measurement and recording of temperature and drying time during vacuum treatment. ii) Check for completeness of drying. iii) Certification of all test results.
9.1.5	Oil	As per IS 335
9.1.6	Test on fittings and accessories	As per manufacturer's standard
9.2	Routine tests	The sequence of routine testing shall be as follows i) Visual and dimension check for completely assembled transformer ii) Measurements of voltage ratio iii) Measurements of winding resistance

		at principal tap and two extreme taps. iv) Vector Group and polarity test v) Measurements of insulation resistance* vi) Separate sources voltage withstand test. vii) Measurement of iron losses and exciting current at rated frequency and 90%, 100% and 110% rated voltage. viii) Induced voltage withstand test. ix) Load losses measurement at 50 % & 100 % of load. x) Impedance measurement of principal tap (HV and LV) of the transformer. xi) Routine test of tanks xii) Induced voltage withstand test (to be repeated if type tests are conducted). xiii) Measurement of Iron loss (to be repeated if type test are conducted). xiv) Measurement of capacitance and Tan Delta for transformer winding and Tan Delta for transformer oil (for all transformers). xv) Ratio of CT xvi) Oil leakage test on completely assembled transformer xvii) Magnetic balance test xviii) Power frequency voltage withstand test on all auxiliary circuits xix) Certification of all test results. xx) Temperature Rise Test # a) *Insulation resistance measurement shall be carried out at 5kV for HV and 1kV for LV. Value of IR should not be less than 1000 Mohms. Polarization Index (PI = IR_{10min}/IR_{1min}) should not be less than 1.5 (If one minute IR value is above 5000 Mohms and it is not be possible to obtain an accurate 10 minutes reading, in such cases polarization index can be disregarded as a measure of winding condition.) b) #Temperature rise test may be

		necessary to be carried one unit/lot. Purchaser's engineer, will at its discretion, select transformer for temp. rise test from any lot offered for inspection at manufacturer's works and witness the same for comparison with ERDA/CPRI type test results
9.3	Type Tests	On one transformer of each rating and type at CPRI/ERDA. i) Impulse withstand test on all three HV limbs of the transformers for chopped wave as per standard ii) Temperature rise test as per IS iii) Dissolved gas analysis before and after Temperature Rise Test iv) Air pressure test for sealed transformers v) Pressure and Vacuum test on tank vi) CRGO testing for specific core loss, accelerated ageing test, surface insulation resistivity, AC permeability and magnetization, stacking factor, ductility etc vii) Oil testing to be tested at CPRI/ERDA labs, whose samples shall be selected & sealed by customer. Note – Purchaser may choose to carry out short circuit, impulse & temperature rise test on one unit from a lot offered from inspection at CPRI/ERDA
9.3.2	Notification to bidders	The product offered must be of type tested quality. In case the product offered is never type tested the same as per above list to be conducted by bidder at his own cost at CPRI/ERDA. The test report shall not be more 5 years old
9.4	Special Tests	On one transformer of each rating and type i) Dynamic & Thermal (3 sec) Short Circuit Test as per IS 2026 ii) Measure of zero seq. impedance (Cl. 16.10 IS 2026 Part I).

		iii) Measurement of acoustic noise level (Cl. 16.12 of IS 2026 Part I). iv) Measurement of harmonic level on no load current. v) Paint adhesion test. vi) High voltage withstand test shall be performed on the auxiliary equipment and wiring after complete assembly. Cost of such tests, if extra, shall be quoted separately by the Bidder.
9.4.1	Note for special test	In case the product offered is never tested for short circuit (Dynamic & Thermal), same to be conducted by bidder at his own cost at CPRI/ERDA. The test report shall not be more 5 years old.
9.5	Customer Hold Point	i) GTP & Drawings approval ii) Core Inspection(See Cl No 9.1.2) Sample to be tested at CPRI/ERDA for each lot. iii) Tank Pressure & vacuum Test iv) Core & Coil Stage inspection of each lot to be offered for final testing.

10.0 Packing , Shipping, Handling and Storage

10.1	Packing	
10.1.1	Packing protection	Against corrosion, dampness, heavy rains, breakage and vibration
10.1.2	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection
10.1.3	Packing details	On each packing case details required as follows i) Individual serial number; ii) Purchaser's name; iii) PO number; iv) Destination; v) Supplier's name; vi) Name and address of supplier's agent vii) Description and quantity viii) Manufacturer’s name ix) Country of origin x) Case measurements

		xi) Gross and net weights in kilograms xii) All necessary slinging and stacking instructions.
10.2	Shipping	i) The bidder shall ascertain at an early date and definitely before the commencementof 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. ii) Any modifications required in the infrastructure and cost thereof in this connection shall be brought to the notice of the Purchaser
10.3	Handling and Storage	As per manufacturer's instruction

11.0 Deviations

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

12.0 Drawings& Data Submission Matrix

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

S.no	Documents to be submitted	With the bid	After Award	
			For Approval	Prior to dispatch
1	Copy of specification along with company seal & signature on each page.	✓	✓	
2	Guaranteed technical particulars	✓	✓	
3	Outline dimension drawing for each	✓	✓	

S.no	Documents to be submitted	With the bid	After Award	
			For Approval	Prior to dispatch
	major component, general arrangement drawing showing component layout an general schematic diagrams.			
4	Type test certificates, where available, and sample routine test reports	✓	✓	
5	Detailed reference list of customers already using equipment offered during the last 5 years with particular emphasis on units of similar design and rating	✓		
6	Details of manufacturers quality assurance standard and programme and ISO 9000 series or equivalent national certification.	✓		
7	Deviations from this specification. Only deviations approved in writing before award of contract shall be accepted.	✓		
8	Recommended spare parts and consumable items for the five years of operation with prices and spare parts catalogue with price list for future requirements.	✓		
9	Transport / shipping dimension and weights, space required for handling parts for maintenance	✓		
10	Write up on oil preservation system.	✓	✓	
11	Quality assurance program.	✓	✓	
12	Programme for production and testing		✓	
13	General description of the equipment and all components, including brochures		✓	
14	Detailed dimension drawing for all components ,general arrangement drawing showing detailed component layout and detailed schematic and wiring drawings for all components like marshalling box and OTI/WTI scanner, PRV, Buchhloz relay. Auxiliary relays		✓	
15	Calculations to substantiate choice of electrical, structural, mechanical component size, ratings		✓	

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

S.no	Documents to be submitted	With the bid	After Award	
			For Approval	Prior to dispatch
16	Detailed loading drawing to enable the purchaser to design and construct foundations for the transformer.		✓	
17	Transport /shipping dimension with weights ,wheel base details, untanking height etc.		✓	
18	Terminal arrangements and cable box details		✓	
19	Flow diagram of cooling system showing no. of cooling banks		✓	
20	Drawings of major components like bushing,CT, OTI/WTI Scanner, PRV, Buchholz relay, Auxiliary relays, Valves, radiators etc		✓	
21	Lists of makes of all fittings and accessories		✓	
22	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		✓	
23	Detailed installation and commissioning instructions		✓	
24	Inspection and test reports carried out in manufacturers works			✓
25	Test certificates of all bought out items.			✓
26	Operation and maintenance instructions as well as trouble shooting charts.			✓

Annexure A Scope of supply

1.0 The scope of supply shall include following

1.1 Design, manufacture, assembly, testing at stages of manufacture as per Cl. 9 of this specification, final testing at manufacturer works on completely assembled transformer before dispatch, packing, transportation, delivery and submission of all documentation for the Power transformer with all accessories as below

Sr. No	Description	Scope of Supply
1.1.1	Fully assembled transformer with all major parts like conservator, Radiators, CT box, Fittings and accessories as per Clause 5.0 of this specification	YES
1.1.2	Off circuit tap changer as per this specification	YES
1.1.3	HV, LV, cable boxes	YES
1.1.4	Support steel material for support of cable boxes from ground	YES
1.1.5	Foundation Bolts for complete transformer	YES
1.1.6	Support structure to support of cable from the transformer tank	YES
1.1.7	Nickel Plated brass double compression glands for HV and LV, LVN cables (in case of termination by cable)	YES
1.1.8	Long barrel medium duty Aluminium lugs for power cables (in case of termination by cable)	YES
1.1.9	Nickel Plated brass double compression glands and tinned copper lugs for control cable termination in CT box for vendor's cables	YES
1.1.10	Cables and wires for transformer accessories and internal wiring of CT box	YES
1.1.11	Touch up paint, minimum 2 litres	YES
1.1.12	Extra Transformer oil 10 % in non returnable drums	YES
1.1.13	One spare complete set of gaskets	YES
1.1.14	Routine testing as per Cl. 9.2 of this specification	YES
1.1.15	Type testing as per Cl. 9.3 of this specification	YES
1.1.16	Special testing as per Cl. 9.4 of this specification	YES
1.1.17	Submission of Documentation as detailed below	YES

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

Annexure B Service Conditions

1.0.0	Delhi Atmospheric conditions	
a)	Average grade atmosphere :	Heavily polluted, dry
	Maximum altitude above sea level	1000 M
b)	Ambient Air temperature	Highest 50 deg C, Average 40 deg C
	Design ambient temperature	50 deg C
c)	Relative Humidity	90 % Max
d)	Seismic Zone	4
e)	Rainfall	750 mm concentrated in four months

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

Annexure C Technical Particulars of transformer oil

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

1.0 Codes & standards

Latest revision of following codes & standards with all amendments –

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

2.0 Properties

The insulating material shall have following features

Sr No	Item description	Specification requirement
2.1	**Function**	
2.1.1	Viscosity	
2.1.1.1	Viscosity at 40^0C	15 mm^2/s, Max
2.1.1.2	Viscosity at 0^0C	1800 mm^2/s, Max
2.1.2	Pour Point	- 10^0C, Max
2.1.3	Water content	30 mg/Kg, Max
2.1.4	Breakdown voltage	
2.1.4.1	New unfiltered oil	30 kV, Min
2.1.4.2	After filtration	70 kV, Min
2.1.5	Density at 20^0C	0.895 g/ml, Max
2.1.6	Dielectric dissipation factor at 90^0C	0.005, Max
2.1.7	Particle Content	Manufacturer to specify the data
2.2	**Refining/Stability**	
2.2.1	Appearance of oil	Clear, free from sediment and suspended matter
2.2.2	Acidity	0.01 mg KOH/g, Max
2.2.3	Interfacial tension at 27^0C	0.04 N/m, Min
2.2.4	Total sulphur content	Manufacturer to specify the data
2.2.5	Corrosive sulfur	Not-corrosive
2.2.6	Potentially Corrosive sulfur	Not-corrosive
2.2.7	DBDS	Not detectable (<5 mg/kg)
2.2.8	Inhibitor	Not detectable (<0.01%)
2.2.9	Metal Passivator	Not detectable (<5 mg/kg)
2.2.10	Other additives	Manufacturer to specify the data
2.2.11	2-furfural and related Compounds content	Not detectable (<0.05 mg/kg) for each individual compound
2.3	**Performance**	
2.3.1	Oxidation stability, test duration 164 h	
2.3.1.1	Total acidity	1.2 mg KOH/g, Max
2.3.1.2	Sludge	0.8%, Max
2.3.1.3	DDF at 90^0C	0.5, Max

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

Sr No	Item description	Specification requirement
2.3.2	Gassing Tendency	Manufacturer to specify the data
2.3.3	ECT	Manufacturer to specify the data
2.4	**Health,safety and Environment**	
2.4.1	Flash point	135^0C, Min
2.4.2	PCA content Max	3%, Max
2.4.3	PCB content	Not detectable (<2 mg/Kg)

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

Annexure D Manufacturing Quality Assurance Plan

SL NO	CHARACTRISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
A	**RAW Material**										
1	**Winding Conductor (PICC)**										
1.1	Bare Dimensions & Finish of Conductor	Major	Measurement	1 sample per size per lot	MFR. STD / IS 13730 Part 27	MFR. STD / IS 13730 Part 27	Supplier's TC	P	V	R	
1.2	Increase in dimensions due to Paper covering	Major	Measurement	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.3	Resistivity @ 20°C	Major	Electrical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.4	No of Layers	Critical	Measurement	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.5	Conductor Tensile strength	Critical	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.6	Conductor Elongation	Critical	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.7	% Overlap of Paper	Critical	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.8	Corner Radius	Critical	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.9	**Kraft Paper Insulation**										
1.9.1	Thickness	Major	Measurement	1 sample per size per lot	MFR. STD/ IEC 60554	MFR. STD/ IEC 60554	Supplier's TC	P	V	R	

SL NO	CHARACTRISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
1.9.2	Apparent Density	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.9.3	Air Permeability	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.9.4	Tensile Index (Longitudinal and Transverse)	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.9.5	Electrical Strength in Air	Major	Electrical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.9.6	Ash Content	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.9.7	pH of 5% Aqueous Extract	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.9.8	Conductivity of 5% Aqueous Extract	Critical	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.9.9	Moisture Content	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.9.10	Heat Stability	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.9.11	Degree of Polymerization	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.9.12	Elongation (MD & CMD)	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
1.9.13	Tear index	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
2.0	**CRGO Laminations (Watt absorption)**										

SL NO	CHARACTRISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
2.1	Specific Core Loss	Major	Electrical	Random	MFR. STD/IS 3024	MFR. STD/IS 3024	Supplier's TC	P	V	R	
2.2	Surface Insulation resistance	Major	Electrical	-DO-	-DO-	-DO-	-DO-	P	V	R	
2.3	Ageing Test	Major	Measurement	-DO-	-DO-	-DO-	-DO-	P	V	R	
2.4	Stacking Factor	Major	Measurement	-DO-	-DO-	-DO-	-DO-	P	V	R	
2.5	Waviness	Major	Measurement	-DO-	-DO-	-DO-	-DO-	P	V	R	
2.6	Edge Burr	Major	Visual	-DO-	-DO-	-DO-	-DO-	P	V	R	
2.7	Sample testing for Checking Specific Core loss, accelerated ageing test, Surface insulation resistivity, AC permeability and magnetization, stacking factor, Ductility	Major	Electrical	100%	MFR. STD/IS 3024	MFR. STD/IS 3024	--	--	P	W	Sample will be randomly selected by BSES & will be send for testing at CPRI/ERDA lab.
3.0	**Un-impregnated Laminated Wood**										
3.1	Thickness	Major	Visual	1 sample size / LOT	MFR.D STD/ IEC 61061	MFR.D STD/IEC 61061	Supplier's TC	P	V	R	

SL NO	CHARACTRISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
3.2	Density	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
3.3	Moisture Content	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
3.4	Oil Absorption	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
3.5	Cross breaking strength	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
3.6	Compressive Strength	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
3.7	Electric Strength in Oil	Major	Electrical	-DO-	-DO-	-DO-	-DO-	P	V	R	
3.8	Shrinkage in oil	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
3.9	Tensile Strength	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
4.0	**Press Boards (Pre-compressed)**										
4.1	Thickness	Major	Measurement	1 sample/Size/LOT	MFR. STD/ IEC 60641	MFR. STD/ IEC 60641	Supplier's TC	P	V	R	
4.2	Tensile Strength (MD & CMD)	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
4.3	Shrinkage in Air (MD & CMD)	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
4.4	Moisture Content	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

SL NO	CHARACTRISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
4.5	Oil Absorption	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
4.6	Electrical Strength in Oil and air	Major	Electrical	-DO-	-DO-	-DO-	-DO-	P	V	R	
4.7	pH of 5% aqueous extract	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
4.8	Conductivity of 5% aqueous extract	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
4.9	Compressibility	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
4.10	Ash Content	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
4.11	Apparent density	Major	Chemical	-DO-	-DO-	-DO-	-DO-	P	V	R	
4.12	Elongation (MD & CMD)	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
5.0	**Tank and its accessories**										
5.1	Structural steel										
5.1.1	Thickness	Major	Measurement	Random	MFR. STD / IS 2062	MFR. STD / IS 2062	Suppliers TC	P	V	R	
5.1.2	Yield Strength	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
5.1.3	Tensile Strength	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
5.1.4	Elongation	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	

SL NO	CHARACTRISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
5.1.5	Bend test	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
5.2	**Manufacturing of Tank and accessories**										
5.2.1	Dimension check	Major	Measurement	100%	MFR. Spec/ DRG	MFR. Spec/ DRG	MFR. Fabrication report	P	W	R	
5.2.2	Joint preparation	Major	Measurement	100%	-DO-	-DO-	-DO-	P	V	R	
5.2.3	Assembly and alignment	Major	Visual and measurement	100%	MFR. Spec/ DRG	MFR. Spec/ DRG	MFR. Fabrication report	P	V	R	
5.2.4	DP Test on Welds on Load bearing members eg. Jack Pads	Major	DP Test	100%	-DO-	-DO-	-DO-	P	W	R	
5.2.5	Pressure test	Major	Mechanical	On One unit	CBIP	CBIP	Test Report	--	P	W	**STAGE INSPECTION**
5.2.6	Vacuum test	Major	Mechanical	On One unit	CBIP	CBIP	Test Report	--	P	W	**STAGE INSPECTION**
5.2.7	Leakage test										

SL NO	CHARACTRISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
5.2.7.1	Main Unit	Major	Mechanical	100%	MFR. STD	MFR. STD	Test report	P	W	R	
5.2.7.2	Conservator	Major	Mechanical	100%	MFR. STD	MFR. STD	Test report	P	W	R	
5.2.7.3	Pipes	Major	Mechanical	100%	MFR. STD	MFR. STD	Test report	P	W	R	
5.2.8	Surface preparation	Major	Visual	100%	MFR. STD	MFR. STD	MFR. Fabrication report	P	V	R	
5.2.9	Final Paint Coat (including Primer), Thickness & Shade	Major	Measurement	100%	MFR. STD	MFR. STD	Test report	P	V	R	
5.2.10	Paint Peel off test	Major	Visual	100%	MFR. STD	MFR. STD	Test report	--	P	R	
6.0	**Bushing**										
6.1	Make and rating	Critical	Visual	100%	IS 8603/IS 2099/App.Drg.	IS 8603/IS 2099/App.Drg.	Supplier's TC	P	V	R	
6.2	Visual inspection for surface smoothness, any damage, etc.	Critical	Visual	100%	-DO-	-DO-	-DO-	P	V	R	
6.3	Important dimension including Creepage distance	Major	Measurement	One sample /size / lot	-DO-	-DO-	-DO-	P	V	R	
6.4	Dry Power Frequency	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	

SL NO	CHARACTRISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
	voltage withstabd test										
6.5	Air pressure test in water	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
6.6	Electro -Tinning	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
7.0	**Magnetic Oil Gauge**										
7.1	Make and dimensions	Major	Physical	100%	App.Drg./ Supplier Catalogue	App.Drg./ Supplier Catalogue	Supplier's TC	P	V	R	
7.2	Test for level (eg at 30° Max)	Major	Mechanical	100%	-DO-	-DO-	-DO-	P	V	R	
7.3	Switch contact test	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
7.4	Leakage test	Major	Mechanical	100%	-DO-	-DO-	-DO-	P	V	R	
7.5	Switch operating and setting	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
7.6	Di-electric test at 2 KV AC between live terminal and body	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
8.	**Buchholz relay**										
8.1	Make and type	Critical	Visual	100%	App.Drg./ Supplier Catalogue /IS	App.Drg./ Supplier Catalogue /IS	Supplier's TC	P	V	R	

SL NO	CHARACTRISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
					3637	3637					
8.2	Bore size	Major	Measurement	One/size	-DO-	-DO-	-DO-	P	V	R	
8.3	Porosity and element test	Major	Critical	100%	-DO-	-DO-	-DO-	P	V	R	
8.4	Gas volume and surge test	Major	Mechanical	One/Size	-DO-	-DO-	-DO-	P	V	R	
8.5	HV test at 2 KV AC & IR test	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
8.6	Continuity for alarm/Trip	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
9.0	**Radiator**										
9.1	Dimension, number of sections	Major	Measurement	100%	MFR. DRG	VTD DRG	Supplier's TC	P	V	R	
9.2	Leakage Test with Air	Major	Visual	100%	As per CBIP	As per CBIP	Supplier's TC	P	V	R	
9.3	Paint shade	Major	Visual & Measurement	Random	MFR. Specs /Drg	MFR. Specs /Drg	Supplier's TC	P	V	R	
9.4	Surface Preparation	Major	Measurement	100%	SA 2.5 of ISO 8503/2	SA 2.5 of ISO 8503/2	Supplier's TC	P	V	R	
10	**Off Circuit Tap Changer**										
10.1	Make, Rating and model	Major	Visual	100%	MFR. Spec/ IS	MFR. Spec/ IS	Supplier's	P	V	R	

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

SL NO	CHARACTRISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
					8468 /IEC 214-1989	8468 /IEC 214-1989	TC				
10.2	Contact Resistance test	Major	Visual	100%	Supplier's STD	Supplier's STD	Supplier's TC	P	V	R	
10.3	Electrical Routine test	Major	Electrical	100%	IS 8468/ IEC 214	IS 8468/ IEC 214	Supplier's TC	P	V	R	
10.4	Mechanical test on diverter switch including pressure test	Major	Mechanical	100%	-DO-	-DO-	-DO-	P	V	R	
10.5	HV test for Auxiliary circuit	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
10.6	Mechanical test on Tap selector switch with motor drive	Major	Mechanical	100%	-DO-	-DO-	-DO-	P	V	R	
10.7	Pressure test for Oil Compartment	Major	Mechanical test	100%	-DO-	-DO-	-DO-	P	V	R	
11.0	**Transformer Oil**	Major	Testing	One Sample from each lot	Annexure D of BSES spec.	Annexure D of BSES spec.	STC	P	V	R	One sample of oil shall be drawn from **each lot of Transforme**

SL NO	CHARACTRISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
											r offered for final inspection by BSES representative and same shall be tested at CPRI/ERDA lab as per relevant std.
12.0	**OTI / WTI Scanner**										
12.1	Make and Model	Critical	Visual	100%	MFR. STD/App. Drg.	MFR. STD/App. Drg.	Suppliers TC	P	P	R	
12.2	Calibration	Major	Electrical	100%	-DO-	-DO-	-DO-	P	P	R	
12.3	Check for alarm & trip signal operation against set value	Major	Electrical	100%	-DO-	-DO-	-DO-	P	P	R	
12.4	HV test	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
12.5	Switch Setting	Major	Mechanical	100%	-DO-	-DO-	-DO-	P	P	R	
13.0	**Bushing Metal parts**										

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

SL NO	CHARACTRISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
13.1	Dimension Checks	Major	Mechanical	100%	MFR. STD /IS 3347	MFR. STD /IS 3347	Supplier's TC	P	V	R	
13.2	Surface Finish	Major	Visual	100%	-DO-	-DO-	-DO-	P	V	R	
14.0	**Current Transformers**										
14.1	Dimensions, make	Major	Measurement	100%	MFR. STD /App. DRG. / IS 2705	MFR. STD /App. DRG. / IS 2705	Supplier's TC	P	P	R	
14.2	Rating and terminal marking	Major	Physical	100%	MFR. APPD. DRG	MFR. APPD. DRG	Supplier's TC	P	P	R	
14.3	Measurement of ratio and phase angle error	Major	Electrical	100%	IS 2705	IS 2705	Supplier's TC	P	V	R	
14.4	High Voltage test	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
14.5	Inter-Turn insulation test	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
14.6	Polarity	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
15.0	**Valves/ Butterfly valves**										
15.1	Make & operation	Critical	Visual	100%	APP.drg./MFR. STD	APP.drg./MFR. STD	Supplier's TC	P	P	R	
15.2	Leakage test for body	Major	Mechanical	100%	-DO-	-DO-	-DO-	P	P	R	
15.3	Leakage test for top	Major	Mechanical	100%	-DO-	-DO-	-DO-	P	P	R	

SL NO	CHARACTRISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
	spindle										
15.4	Mounting dimensions	Major	Measurement	100%	-DO-	-DO-	-DO-	P	P	R	
15.5	Material of Body & Seat	Major	Chemical & measurement	1 sample per lot	-DO-	-DO-	-DO-	P	V	R	
16.0	**Pressure relief Valve**										
16.1	Make	Critical	Visual	100%	MFR. STD/ App. Drg.	MFR. STD/ App. Drg.	-DO-	P	P	R	
16.2	Operating pressure	Major	Mechanical	100%	-DO-	-DO-	-DO-	P	P	R	
16.3	Switch Contact test	Major	Electrical	100%	-DO-	-DO-	-DO-	P	P	R	
16.4	Mounting dimensions	Major	Measurement	100%	-DO-	-DO-	-DO-	P	V	R	
16.5	HV test between body & terminal	Major	Electrical	100%	-DO-	-DO-	-DO-	P	V	R	
17.0	**Gasket**										
17.1	Appearance & Finish	Major	Mechanical	1 sample per size per lot	IS 4253-II, 1980	IS 4253-II, 1980	Supplier's TC	P	V	R	
17.2	Hardness, IRHD	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
17.3	Tensile Strength	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
17.4	Compressibility	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	

SL NO	CHARACTRISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
17.5	Compression set	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
17.6	Flexibility	Major	Mechanical	-DO-	-DO-	-DO-	-DO-	P	V	R	
18.0	**Silica gel Breather**										
18.1	Type / model	Major	Visual	100%	MFR. STD /DRG	MFR. STD /DRG	Supplier's TC	P	V	R	
18.2	Color of Gel	Major	Visual	100%	-DO-	-DO-	-DO-	P	V	R	
B	**In Process**										
1	**Winding**										
1.1	Check for Visual, physical and dimensional Parameters and no. of parallel conductors.										
1.1.1	Measurement of axial height, OD & ID& current density calculation.	Major	Measurement	100%	MFR. Data/Drg	MFR. Data/Drg	QC report	--	P	W	
1.1.2	Copper Conductor size (Bare & covered)	Major	Measurement	100%	-DO-	-DO-	-DO-	--	P	W	
1.1.3	No. of Turns / Disc	Major	Measurement	100%	-DO-	-DO-	-DO-	--	P	R	

SL NO	CHARACTRISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
1.2	Winding height	Major	Measurement	100%	-DO-	-DO-	-DO-	--	P	W	
1.3	Visual inspection of Brazed joints as applicable	Major	Visual	100%	-DO-	-DO-	-DO-	--	P	R	
1.4	Tap Leads termination in case of tap winding	Major	Visual	100%	-DO-	-DO-	-DO-	--	P	R	
1.5	Current density calculation	--	--	--	--	--	--	--	P	W	
2.0	**Core Assembly**										
2.1	Visual & Key Dimensional check										
2.1.1	Diagonal distance	Major	Measurement	100%	MFR.Drg	MFR.Drg	QC report	--	P	W	
2.1.2	Window centre distance	Major	Measurement	100%	-DO-	-DO-	-DO-	--	P	W	
2.1.3	Window height	Major	Measurement	100%	-DO-	-DO-	-DO-	--	P	W	
2.2	Stack Thickness	Major	Measurement	100%	-DO-	-DO-	-DO-	--	P	W	
2.3	High Voltage test at 2 KV AC for I min between core & core clamp, Yoke bolt	Major	Electrical	100%	-DO-	-DO-	-DO-	--	P	W	

SL NO	CHARACTRISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
2.4	Pre-Core loss measurement	Major	Electrical	100%	-DO-	-DO-	-DO-	--	P	W	
3.0	**Core-Coil Assembly**										
3.1	Top & Bottom insulation arrangement	Major	Visual	100%	MFR.Data /DRG	MFR.Data /DRG	QC report	--	P	R	
3.2	Lead arrangement	Critical	Visual	100%	-DO-	-DO-	-DO-	--	P	R	
3.3	Tap & Lead End Brazing & Insulation	Critical	Visual	100%	-DO-	-DO-	-DO-	--	P	R	
3.4	Dimension of Coil After Shrinkage	Major	Measurement	100%	-DO-	-DO-	-DO-	--	P	R	
3.5	Verification of Major electrical clearances	Major	Visual & Measurement	100%	-DO-	-DO-	-DO-	--	P	R	
3.6	HV/LV Connection	Major	Visual	100%	-DO-	-DO-	-DO-	--	P	R	
4.0	**Core-Coil Assembly Before Ovening**										
4.1	Initial Ratio test	Major	Measurement	100%	-DO-	-DO-	-DO-	--	P	R	
5.0	**Core-coil assembly during drying**										
5.1	Measurement & recording	Major	Visual	100%	MFR.Data	MFR.Data	QC report	--	P	R	

SL NO	CHARACTRISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
	of temperature & drying time during vacuum treatment.				/DRG	/DRG					
5.2	Check for completeness of drying	Major	Visual	100%	MFR.Data /DRG	MFR.Data /DRG	QC report	--	P	R	
5.3	Certification of all test	Major	Visual	100%	MFR.Data /DRG	MFR.Data /DRG	QC report	--	P	R	
6.0	**Core-Coil Assembly After Ovening**										
6.1	Ratio Test & Magnetic Balance test	Major	Electrical	100%	-DO-	-DO-	-DO-	--	P	W	
6.2	Recording of time/Temp, Vacuum	Major	Measurement	100%	-DO-	-DO-	-DO-	--	P	R	
6.3	Record of Moisture extract	Major	Measurement	100%	MFR. STD	MFR. STD	QC report	--	P	R	
6.4	Verification of completeness & Drying	Major	Verify	100%	MFR. STD	MFR. STD	QC report	--	P	R	
6.5	Insulation resistance measurement by Megger	Major	Electrical	100%	MFR. STD	MFR. STD	Test report	--	P	R	
6.6	Earthing connection	Major	Visual	-DO-	MFR. STD	MFR. STD	QC Report	--	P	R	

SL NO	CHARACTRISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
7.0	**Tanking**										
7.1	Electrical clearance arrangement	Major	Measurement	100%	MFR. DRG	MFR. DRG	QC report	--	P	R	
7.2	Verification of Core-Frame Clamping arrangement	Major	Visual	100%	-DO-	-DO-	-DO-	--	P	R	
7.3	Core to frame insulation resistance test & HV test at 2 KV for min	Major	Electrical	100%	-DO-	-DO-	-DO-	--	P	R	
8.0	**Final Assembly for testing**										
8.1	Fittings of external accessories	Major	Visual	100%	MFR. STD /DRG	MFR. STD /DRG	Job Card	--	P	R	
8.2	Internal Oil leakage test on main unit	Major	Visual	100%	CBIP	CBIP	QC report	--	P	R	
C	**Final testing**										
1	**Routine Test**										
1.1	Voltage Ratio test	Major	Electrical	100%	IS 2026	IS 2026	Test Report	--	P	W	

SL NO	CHARACTRISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
1.2	Winding Resistance at all tap corrected to 75°C	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.3	No Load Loss & Current @90%,100%&112.5% of rated voltage	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	To be repeated after type test.
1.4	Impedance Voltage/Short Circuit Impedance(Principal Tap)	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.5	Load Loss measurement at 50% and 100% of load @Principal, Max, Mini Tap	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.6	Induced over voltage	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	To be repeated after type test
1.7	Separate Source Voltage Test	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.8	Insulation Resistance &PI(10 min / 1 min)	Major	Electrical	100%	--	--	Test report	--	P	W	PI Shall be more than1.5

SL NO	CHARACTRISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
1.9	Voltage Vector Relationship & Polarity	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.10	Magnetic Balance Test	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.11	Oil leakage test	Major	Visual	100%	CBIP	CBIP	Test report	--	P	W	
1.12	Polarity check & Ratio Test of LVWTI CT/ Metering CT	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.13	BDV test on Transformer Oil	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.14	Power frequency withstand on auxiliary circuit	Major	Electrical	100%	IS 2026	IS 2026	Test report	--	P	W	
1.15	Heat Run Test (Temp. Rise Test)	Major	Testing	One Unit (each lot)	IS 2026	IS 2026	Test Report	--	P	W	
1.16	Pressure relief device test	Major	Testing	One Unit (each lot)	MFR. STD	MFR. STD	Test Report	--	P	W	
1.17	Visual and dimensional check	Major	Visual	100%	Approved drawings	Approved drawings	Test Report	--	P	W	
1.18	Measurement of Cap & tandelta of Wdg, Oil and	Major	Electrical	One unit	--	--	Test report	--	P	W	

SL NO	CHARACTRISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
	HV bushing										
2.0	**Type test (One unit of each type and rating of Transformer at CPRI/ERDA)**										
2.1	Heat Run Test (Temp. Rise Test)	Major	Testing	One Unit	IS 2026	IS 2026	Test Report	**CPRI/ERDA**			
2.2	Dynamic & Thermal (3 sec) Short Circuit Test	Major	Testing	One Unit	IS 2026	IS 2026	Test Report	**CPRI/ERDA**			
2.3	Impulse withstand Test on all HV & LV Limb for Chopped wave.	Major	Testing	One Unit	IS 2026	IS 2026	Test Report	**CPRI/ERDA**			
2.4	DGA Test Before & After temperature rise	Major	Testing	One Unit	Relevant std.	Relevant std.	Test Report	**CPRI/ERDA**			
3.0	**Special Test (One unit of each type and rating of Transformer)**										
3.1	Zero Phase Sequence Test	Major	Testing	One Unit	IS 2026	IS 2026	Test Report	--			
3.2	Noise Level Test	Major	Testing	One Unit	NEMA TR-1	NEMA TR-1	Test Report	--	P	W	
3.3	No Load Harmonic Test	Major	Testing	One Unit	IS 2026	IS 2026	Test Report	--	P	W	
3.4	HV Test on all auxiliary equipment and wiring after complete assembly	Major	Testing	One Unit	--	--	Test Report	--	P	W	

SL NO	CHARACTRISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
								S	M	O	
1	2	3	4	5	6	7	8	9			10
D	**Dispatch & Packing**										
1.1	Identification & packing	Major	Visual	100%	As per packing list	As per packing list	Packing List	--	P	--	
1.2	Check for proper Packing	Major	Visual	100%	As per packing list	As per packing list	Packing List	--	P	--	
1.3	Visual check before dispatch	Major	Visual	100%	As per packing list	As per packing list	Packing List	--	P	--	

LEGEND:

S: Supplier
M: Main Contractor (Manufacturer)
O: Owner (BYPL)

P - Perform
V - Verify
R – Review
W- Witness

Schedule A Guaranteed Technical Particulars (Data by Seller)

Sr.	Particulars	Specified / Required	Offered
1.0	General		
1.1	Make		
1.2	Type	Oil immersed, core type, step down located generally outdoor but may be located indoor also with poor ventilation. Bidder shall confirm full rating available in indoor location also	
2.0	Nominal Continuous Rating, KVA		
2.1	HV winding	400/630/1000/1600/2000kVA	
2.2	LV winding	400/630/1000/1600/2000kVA	
3.0	Rated voltage (kV)		
3.1	HV Winding	11 kV	
3.2	LV Winding	433 volt	
4.0	Rated current (Amps)	400/630/1000/1600/2000kVA	
4.1	HV Winding		
4.2	LV Winding		
5.0	Connections		
5.1	HV Winding	Delta	
5.2	LV Winding	Star with neutral	
5.3	Vector Group reference	Dyn11	
6.0	Impedance at principal tap rated current and frequency, ohm @75 deg C		
6.1	Impedance	4.5% / 4.5%/ 5.0/6.25/6.25 % with IS tolerance	
6.2	Reactance		
6.3	Resistance		
6.4	X/R ratio		
6.5	Impedance at lowest tap at rated		

	current and frequency		
6.6	Impedance at highest tap at rated current and frequency		
7.0	Resistance of the winding at 75^0 C in ohm		
7.1	a) HV		
7.2	b) LV		
8.0	Zero sequence impedance in ohm		
8.1	a) HV		
8.2	b) LV		
9.0	Guaranteed maximum Total losses at principal tap at 75°C, kW		
9.1	50 % of Load	as per Spec Cl 3.25	
9.2	100% of Load	as per Spec Cl 3.26	
9.3	No Load Loss (Max)		
9.4	Total I^2R losses of windings @ 75 deg C, KW		
9.5	Total stray loses @ 75 deg C, KW		
9.6	Total Load losses (Max.), KW		
9.7	No load loss at maximum permissible voltage and frequency (approx.),kW		
10.0	Temperature rise over reference ambient of 40 ^{0}C		
10.1	Top oil by thermometer ^{0} C	40 ^{0}C	
10.2	Winding by resistance^0 C	45 ^{0}C	
11.0	Efficiency		
11.1	Efficiency at 75^0C and unity power factor %		
11.1.1	at 110% load		
11.1.2	at 100% load		
11.1.3	at 80% load	Not Less than 99.5%	
11.1.4	at 60% load		
11.1.5	at 40% load		

11.1.6	at 20% load		
11.2	Efficiency at 75^0C and 0.8 power factor lag %		
11.2.1	at 110% load		
11.2.2	at 100% load		
11.2.3	at 80% load		
11.2.4	at 60% load		
11.2.5	at 40% load		
11.2.6	at 20% load		
11.3	Maximum efficiency at 75^0C %		
11.4	Load and power factor at which it occurs		
12.0	Regulation , (%)		
12.1	Regulation at full load at 75^0 C		
12.1.1	at unity power factor		
12.1.2	at 0.8 power factor lagging		
12.2	Regulation at 110% load at 75^0 C		
12.2.1	at unity power factor		
12.2.2	at 0.8 power factor lagging		
13.0	Tappings		
13.1	Type		
13.2	Capacity		
13.3	Range-steps x % variation		
13.4	Taps provided on HV winding (Yes / No)		
13.5	Rated current of rotary switch		
14.0	Cooling system		
14.1	Type of cooling	ONAN	
14.2	No. of cooling unit Groups		
14.3	Capacity of cooling units		
14.4	Mounting of radiators		
14.5	Number of Radiators		
14.8	Total radiating surface , sqmm		

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

14.9	Thickness of radiator tubes, mm	Minimum 1.2 mm	
15.0	Details of Tank		
15.1	Material	Robust mild steel plate without pitting and low carbon content	
15.2	Thickness of sides mm		
15.3	Thickness of bottom mm		
15.4	Thickness of cover mm		
15.5	Confirmation of Tank designed and tested for Vacuum, Pressure (Ref: CBIP Manual) , (Yes/ No)		
15.5.1	Vacuum mm of Hg. / (kN/m^2)	As per IS	
15.5.2	Pressure mm of Hg.		
15.6	Is the tank lid sloped?	Yes	
15.7	Inspection cover provided (Yes / No)	as per spec	
15.8	Location of inspection cover (Yes / No)		
15.9	Min. dimensions of inspection cover (provide list of all inspection cover with dimension), mm x mm		
16.0	Core		
16.1	Type:	Core	
16.2	Core material grade	Premium grade minimum M3 or better	
16.3	Core lamination thickness in mm		
16.4	Insulation of lamination	With insulation coating on both sides	
16.5	Design flux density at rated condition at principal tap, Tesla		
16.6	Maximum flux density at 12.5 % overexcitation /overfluxing, Tesla	1.9 Tesla Max allowed	
16.7	Equivalent cross section area		

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

	mm^2		
16.8	Guaranteed No Load current at 100% rated voltage , Amps		
16.8.1	HV		
16.8.2	LV		
16.9	Guaranteed No Load current At 110% rated voltage, Amps		
16.9.1	HV		
16.9.2	LV		
17.0	Type of Winding		
17.1	HV		
17.2	LV		
17.3	Conductor material	Electrolytic Copper	
17.4	Current density (HV/LV)	Maximum allowed 3.0 A per sq mm at all taps	
17.5	Gauge/area of cross section of conductor		
17.5.1	a) HV		
17.5.1	b) LV		
17.6	Insulating material		
17.6.1	HV Turn		
17.6.2	LV Turn		
17.6.3	LV Core		
17.6.4	HV - LV		
17.7	Insulating material thickness, mm		
17.7.1	HV Turn		
17.7.2	LV Turn	-	
17.7.3	LV to Core		
17.7.4	HV to LV		
18.0	Minimum design clearance, mm		
18.1	HV to earth in Air		
18.2	HV to earth in oil		
18.3	LV to earth in Air		

18.4	LV to earth in oil		
18.5	Between HV & LV in Air		
18.6	Between HV & LV in oil		
18.7	Top winding and yoke		
18.8	Bottom winding and yoke		
19.0	**Insulating oil**		
19.1	Quantity of oil Ltrs		
19.1.1	In the Transformer tank		
19.1.2	In each radiator		
19.1.4	Total quantity		
19.2	10% excess oil furnished?	Yes	
19.3	Type of Oil	As per cl 4.2.7	
20.0	**Bushing / Support Insulator**		
20.1	Make	-	
20.2	Type		
20.2.1	HV side	As per Cl. 4.2.8.1 of the spec	
20.2.2	LV side	As per Cl. 4.2.8.2 of the spec	
20.3	Reference Standard		
20.4	Voltage class, kV		
20.4.1	HV side Bushing/ Support Insulator	12 kV	
20.4.2	LV side line and neutral bushing/ Support Insulator	1.1 kV	
20.5	Creepage factor for all bushing / Support Insulator mm/KV	31 mm / kV	
20.6	Rated thermal short time current		
20.6.1	HV bushing	25 times rated current for 2 secs.	
20.6.2	LV line and neutral bushing	25 times rated current for 2 secs.	
20.7	Weight, Kg		
20.7.1	HV bushing		
20.7.2	LV line and neutral bushing		
20.8	Free space required for bushing removal, mm		

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

20.8.1	HV bushing		
20.8.2	LV line and neutral bushing		
21.0	**Terminal connections**		
21.1	HV	Cable size as per Cl no 3.28	
21.2	LV	Cable size as per Cl no 3.30	
21.3	LV Neutral	Cable size as per Cl no 3.30	
22.0	**HV cable box**	Required	
22.1	Suitable for cable type,size	Cable size as per Cl no 3.28	
22.2	Termination height	750 mm min.	
22.3	Gland plate dimension, mm x mm		
22.4	Gland plate Material	MS	
22.5	Gland plate thickness	3 mm min.	
22.6	Phase to phase clearance inside box,mm	180 mm	
22.7	Phase to earth inside box,mm	120 mm	
23.0	**LV Cable box**	Required	
23.1	Suitable for cable type , size	Cable size as per Cl no 3.30	
23.2	Termination height	1000 mm, min.	
23.3	Gland plate dimension, mmxmm		
23.4	Gland plate material	Aluminium	
23.5	Gland plate thickness	5 mm min.	
23.6	Phase to phase	25 mm	
23.7	Phase to earth	25 mm	
24.0	L.V neutral Cable termination arrangement	Separate cable box not required (LV-N to be provided in LV cable box.)	
25.0	Current Transformer on LV phases		
25.1	Type		
25.2	Make		
25.3	Reference Standard		
25.4	CT Ratio		

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

25.5	Burden, VA		
25.6	Class of Accuracy		
25.7	CT terminal box size		
26.0	Pressure release device		
26.1	Minimum pressure the device is set to rupture		
26.1.1	For Main Tank		
26.1.2	Alarm and trip contact ratings of protective devices		
27.0	Fittings Accessories Each Transformer furnished as per Clause No 5. (Bidder shall attach separate sheet giving details, make and bill of materials)		
27.1	OTI/WTI Scanner		
27.1.1	Make		
27.1.2	Model no		
27.1.3	Auxiliary supply		
27.1.4	Manual submitted (Yes/No)		
27.2	Buchholz Relay		
27.2.1	Make		
27.2.2	Model no		
27.2.3	Auxiliary supply		
27.2.4	Manual submitted (Yes/No)		
27.3	Auxiliary relays for Fault/indication identification (PRV, Buchholz relay, MOG)		
27.3.1	Make		
27.3.2	Model no		
27.3.3	Auxiliary supply		
27.3.4	Potential free contacts		
27.3.5	Manual submitted (Yes/No)		
28.0	Painting: as per clause for the transformer, cable boxes, radiator,		

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

	Marshalling box (Yes/No)		
29.0	Max over all transformer dimensions	**As per Clause 3.32**	
29.1	Length, mm		
29.2	Breadth, mm		
29.3	Height, mm		
30.0	Transformer Tank Dimensions		
30.1	Length, mm		
30.2	Breadth, mm		
30.3	Height, mm		
31.0	Weight data		
31.1	Core, kG		
31.2	Frame parts, kG		
31.3	Core and frame, kG		
31.4	Total Winding, kG		
31.5	Core , Frame, Winding, kG		
31.6	Tank, kG		
31.7	Tank lid, kG		
31.8	Empty conservator tank, kG		
31.9	Each radiator empty, kG		
31.10	Total weight of all radiators empty, kG		
31.11	Weight of oil in Tank, kG		
31.12	Weight of oil in Conservator, kG		
41.13	Weight of oil in each Radiators, kG		
31.14	Total weight of oil in Radiators, kG		
31.16	Total Transport weight of the transformer, kG		
32.0	Volume Data		
32.1	Volume of oil in main tank, litres		
32.2	Volume of oil between highest and lowest levels of main conservator, litres		

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

32.4	Volume of oil in each radiator, litres		
32.5	Total volume of oil in radiators, litres		
32.7	Transformer total oil volume, litres		
33.0	Shipping Data		
33.1	Weight of heaviest package, kG		
33.2	Dimensions of the largest package (L x B x H) mm		
34.3	Tests		
34.1	All in process tests confirmed as per Cl. (Yes/ No)		
34.2	All Type Tests confirmed as per Cl. (Yes / No)		
34.3	All Routine Tests confirmed as per Cl. (Yes/ No)		
34.4	All Special Tests confirmed as per Cl. (Yes/ No)		

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

Schedule B Guaranteed Technical Particulars of Transformer Oil

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

Sr No	Item description	Specification requirement	Data by Vendor
1.0	Manufacturer Name		
1.1		Address	
1.2		Contact person	
1.3		Contact telephone no	
2.0	**Function**		
2.1	Viscosity		
2.1.1	Viscosity at 40^0C	15 mm^2/s, Max	
2.1.2	Viscosity at 0^0C	1800 mm^2/s, Max	
2.2	Pour Point	- 10^0C, Max	
2.3	Water content	30 mg/Kg, Max	
2.4	Breakdown voltage		
2.4.1	New unfiltered oil	30 kV, Min	
2.4.2	After filtration	70 kV, Min	
2.5	Density at 20^0C	0.895 g/ml, Max	
2.6	Dielectric dissipation factor at 90^0C	0.005, Max	
2.7	Particle Content	Manufacturer to specify the data	
3.0	**Refining/Stability**		
3.1	Appearance of oil	Clear, free from sediment and suspended matter	
3.2	Acidity	0.01 mg KOH/g, Max	
3.3	Interfacial tension at 27^0C	0.04 N/m, Min	
3.4	Total sulphur content	Manufacturer to specify the data	
3.5	Corrosive sulfur	Not-corrosive	
3.6	Potentially Corrosive sulfur	Not-corrosive	
3.7	DBDS	Not detectable (<5 mg/kg)	
3.8	Inhibitor	Not detectable (<0.01%)	
3.9	Metal Passivator	Not detectable (<5 mg/kg)	
3.10	Other additives	Manufacturer to specify the data	
3.11	2-furfural and related Compounds content	Not detectable (<0.05 mg/kg) for each individual compound	
4.0	**Performance**		
4.1	Oxidation stability, test duration 164 h		
4.1.1	Total acidity	1.2 mg KOH/g, Max	
4.1.2	Sludge	0.8%, Max	
4.1.3	DDF at 90^0C	0.5, Max	
4.2	Gassing Tendency	Manufacturer to specify the data	

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

Sr No	Item description	Specification requirement	Data by Vendor
4.3	ECT	Manufacturer to specify the data	
5.0	**Health,safety and Environment**		
5.1	Flash point	135^0C, Min	
5.2	PCA content Max	3%, Max	
5.3	PCB content	Not detectable (<2 mg/Kg)	

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

Schedule C Recommended Spares (Data by Seller)

List of recommended spares as following –

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

DocUUID : 39215ff8-7035-4cde-96a3-b53c6d7aab92

BSES

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	
	Amar Singh	
Reviewed by	Srinivas Gopu	
	Abhinav Srivastava	
Approved by	Gaurav Sharma	
	Gopal Nariya	

INDEX

DocUUID : f95933cb-c64c-4d46-b917-21c1b07d42ba

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.

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

		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	

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	

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	

16.3.9	Losses-middle phase	w/m/ph	
16.3.10	Minimum clearance of bus bar and joints	Required	
16.3.11	Phase to phase (mm)		
16.3.12	Phase to earth (mm)		
16.3.13	Bus bar insulation	i. Heat shrinkable sleeves rated for maximum operating voltage	
		ii. Cast resin shrouds for joint	
16.3.14	Bus joints	Silver	
16.3.15	Bus bar support insulator	Required	
16.3.16	Spacing (mm)		
16.3.17	Make		
16.3.18	Type		
16.3.19	Reference standard		
16.3.20	Voltage class (kV)		
16.3.21	Minimum creepage distance (mm)		
16.3.22	Cantilever strength (Kg/sq.cm.)		
16.4	**Wiring and Terminals**		
16.4.1	**Wiring**		
a	Grade and type	1100 V grade, PVC insulated, FRLS type stranded flexible copper wire.	
b	Ferruling	Each wire shall bear an identifying ferrule or tag at each end or connecting point.	
c	Spare	20% Spare Wiring	
16.4.2	**Terminals**		
a	Grade	1100 V grade, moulded piece terminals complete with insulated barriers, washers, nuts and lock nuts.	
b	Power Terminals type	Stud type, nut driver operated	
c	Control terminals type	Stud type, screw driver operated	
d	Spare terminals	20% spare	

e	Accessibility	Placement of terminals shall enable proper cable termination. Terminals shall be readily accessible for inspection and maintenance.	
f	Marking	The terminals shall be serially numbered to facilitate installation and maintenance.	
16.5	**METERS, INDICATIONS, PUSH BUTTONS & HEATERS**		
16.5.1	Ammeter	DC Moving coil ammeter of size 96 sq.mm. with external shunt. Rating of Ammeter shall be 0-100A DC.	
a	Model No Ammeter		
b	Make of Ammeter		
16.5.2	Voltmeter	DC Moving coil voltmeter of size 96.sq.mm to read the DC Bus voltage. Rating of Voltmeter shall be 0-300VDC	
a	Model No Voltmeter		
b	Make of Voltmeter	Rishabh/Schneider/AE	
c	Type	Digital type	
16.5.3	Indicating lamps	Cluster LED type.	
a	Make of Indicating lamps	Vaishno/Binay/Teknic/Siemens/Mimic/C &S	
b	Incomer/ Outgoing On	Red	
c	Incomer/ Outgoing Off	Green	
d	Incomer/ Outgoing Trip	Amber	
e	Push buttons Make	L&T/Siemens/Vaishno/Schneider	
16.5.4	Heaters	Cubicle space heater having rating of 100W. Thermostat for space heater shall be provided with temperature range $0\text{-}90^0$	
16.5.5	CFL	Cubicle lamp shall be provided in DCDB having rating of 11 W.	
16.6	**NAME PLATES & MARKINGS**		

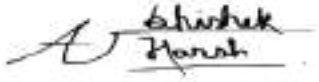
a	Panel nameplate	Panel Serial No.-	
b		Customer Name - BSES Yamuna/Rajdhani Power Ltd	
c		PO No. & date -	
d		Type of Panel -	
e		Current rating -	
f		Guarantee period -	
16.6.1	Feeder nameplate	As per Spec	
a	Equipment nameplate	As per Spec	
b	Material	As per Spec	
c	Fixing	As per Spec	
d	Markings	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)	

Technical Specification

of

Illumination and Lighting System

Specification no – BSES-TS-98-ILS-R0

Rev		0
Page		1 of 12
Date		06 May 2022
Prepared by	Abhishek Harsh	 3267d7c3-82b5-46cb-b5a6-867ee7820a34
Reviewed by	Srinivas Gopu	 5d22525e-ed3a-4f41-b1c7-b8a5e77d1519
Approved by	Gaurav Sharma	 23dc2de2-95de-4472-99a7-dea873f472b6

NDEX

DocUUID : 0dc069dd-c771-4bdb-a40c-e5b068994399

1. SCOPE

The specification covers the design, engineering, manufacture, assembly and testing at manufacturer's work, supply and installation of Illumination system for substation including normal distribution pillars, normal lighting board, emergency distribution pillar, emergency lighting board, Junction boxes, Illumination lamps with required lux level.

2. STANDARDS AND CODES

Standard Code	Standard Description
IS 16101 : 2012	General Lighting -LEDs and LED modules – Terms and Definitions
IS16102(Part 1) 2012	Self-Ballasted LED Lamps for General Lighting Services, Part 1 Safety Requirements
IS16102(Part 2) 2012	Self-Ballasted LED Lamps for General Lighting Services, Part 2 Performance Requirements
IS16103(Part 1) 2012	Led Modules for General Lighting, Part 1Safety Requirements
IS16103(Part 2) 2012	Led Modules for General Lighting, Part 2 Performance Requirements
IS15885(Part2/Sec13)	Safety of Lamp Control Gear , Part 2 Particular Requirements , Section 13 dc. or ac. Supplied Electronic Control gear for Led Modules
IS16104 : 2012	d.c. or a.c. Supplied Electronic Control Gear for LED Modules - Performance Requirements
IS16105 : 2012	Method of Measurement of Lumen Maintenance of Solid State Light (LED) Sources
IS16106 : 2012	Method of Electrical and Photometric Measurements of Solid-State Lighting (LED) Products
IS 16107(Part 1)2012	Luminaires Performance ,Part 1 General Requirements
IS 16107(Part 2)2012	Luminaires Performance, Part 2 Particular Requirements ,Section 1 LED Luminaire
IS 16108 : 2012	Photo biological Safety of Lamps and Lamp Systems
IS 10322 : 2012	Luminaires: Part 5 Particular requirements, Section 3 Luminaires for road and street lighting
IS 5	Colours for Ready Mixed Paints and Enamels
IS 613	Copper Rods and Bars for electrical purposes
IS 694	PVC Insulated cables for working voltages up to and including 1100 V
IS 2551	Danger notice plates
IS 5082	Wrought Aluminium and Aluminium alloy bars, rods, tubes and sections for electrical purpose
IS 6665	Code of practice for industrial lighting
IS 13703	LV Fuses for voltage not exceeding 1000V ac or 1500V dc
IS 10118	Code of Practice for Selection, Installation and Maintenance of Switchgear and Controlgear
International Standard	

IEC 62612	Self-ballasted LED lamps for general lighting services for voltage above 50 V — Performance requirements
IEC : 60598-2-3	Particular requirements - Luminaries for road and street lighting
IEC 62471	Photo biological safety of lamps and lamp systems
IEC 62778	Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaries
IEC 61000-4-5	Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test
IEC 60439	Low Voltage Switchgear and Controlgear assemblies - Type tested and partially type tested assemblies
IEC 60529	Degrees of protection provided by enclosures (IP Code)
IEC 60947-1	Low Voltage Switchgear and Controlgear - General Rules
IEC 60947-2	Low Voltage Switchgear and Controlgear - Circuit breakers
IEC 61643	Low-voltage surge protective devices

3. ILLUMINATION SYSTEM

3.1.	Lux level requirement	3.1.1. The design of the illumination system shall ensure availability of the average illumination levels as specified below with the maximum possible uniformity in the entire substation. The illumination system shall consist of the normal lighting system and emergency lighting system. The minimum illumination levels shall be as specified below(Reference IS3646(Part II)). 3.1.1.1. Outdoor Substation : 20 lux 3.1.1.2. Roads within substation : 20 lux 3.1.1.3. Boundary wall of the substation : 10 lux 3.1.1.4. Control room : 300 lux 3.1.1.5. Switchgear Room : 200 lux 3.1.1.6. Battery room : 100 lux 3.1.1.7. Stair case : 100 lux 3.1.1.8. Transformers : 100 lux 3.1.2. The illumination level of specific spots such as operating mechanisms of Capacitor bank isolator, oil level and temperature gauges of transformer etc. shall be minimum 50 Lux. Contractor shall design the lighting system with the help of desired software. Owner shall verify the same post commissioning with lux meter to check the levels. In case desired lux levels are not met contractor has to install addition fitting in outdoor and indoor location as per requirement. 3.1.3. Complete design calculation sheets for arriving at the number of luminaires required for the normal and emergency requirements shall be furnished by the bidder. Design calculation sheets for the selection of cables, MCB, HRC fuses, bus bars, etc. are also required to be furnished for Owner's approval.

DocUUID : 0dc069dd-c771-4bdb-a40c-e5b068994399

3.2.	Illumination circuit	3.2.1.	The illumination system load and welding load in the substation area shall be supplied from 415/230 volt ACDBs to be provided in the substation control room. Requisite numbers of 3-phase, 4-wire, cable circuits for illumination system and welding socket outlets shall be extended from the above board. The laying of cables from the Board to the illumination system/welding socket outlets and their installation are included in the Bidder's scope.
		3.2.2.	Each outgoing cable circuit for illumination loads from the 415 volt switchboard shall terminate in the respective outdoor pillar boxes located in the substation. Outgoing feeders from the illumination shall be taken to the various illumination points in the substation. Necessary fuses shall be provided near light fixtures in the substation.
		3.2.3.	The emergency illumination load shall be supplied from the main emergency illumination board located in the control room. Necessary cable circuits with appropriate fuses shall be provided by the Contractor for the supply system for emergency illumination load of the substation.
		3.2.4.	Emergency DC lighting system shall be provided in the substation wherever required. The emergency lighting shall be adequate for safe movement by the operating personnel in the substation in the event of failure of normal lighting system. Number of lights shall be decided at the time of detailed engineering. A total of minimum 12 no's individually controllable 60 watt lamps shall be provided in the substation.
3.3.	Wiring	3.3.1.	All lighting fixtures and 5A convenience outlets shall be wired with 1.1 KV grade PVC insulated extra flexible, multistranded, copper conductor cables of size not less than 2.5 sq.mm.
		3.3.2.	For 15A heavy-duty outlets copper conductor cables of size not less than 6 sq. mm shall be used.
		3.3.3.	The wiring shall consist of phase, neutral and ground. For grounding the lighting fixtures/convenience outlets etc., GI wire of size not less than 14 SWG shall be used. The phase and neutral conductor shall be suitably colour coded.
		3.3.4.	Supply shall be looped between the lighting fixtures of the same circuit by using junction boxes. For this purpose one (1) 100 mm x 100 mm square junction box shall be provided for each lighting fixture. For recessed lighting fixtures, supply shall be extended from the junction boxes to the fixtures by means of flexible conduits. While for stem-mounted/wall-mounted lighting fixtures the junction box shall be mounted below one of the mounting stems.
		3.3.5.	For lighting branch circuits the nos. of lighting switches shall be decided keeping in mind the ease of control, as well as to limit the current to 2.5A per circuit.
		3.3.6.	For convenience outlets, the bidder shall design the wiring scheme so as to limit 6 nos. of 5A outlets per branch

		circuit and two nos. of 15A outlets per branch circuit. 3.3.7. All wiring materials such as terminals, crimping lugs, ferrules etc. shall also be provided by the Contractor. 3.3.8. No section of the conduit shall be filled with more than 70% of its area. Any consumable material that is required for pulling the wires through conduit shall also be provided by the Contractor. 3.3.9. Lighting fixtures coming in one area shall be evenly distributed between three phases so that tripping of one phase or two phases does not cause total loss of illumination in that area.
3.4.	Required documents to be submitted	Complete manufacturer's literature/catalogues, performance curves, illumination distribution curves, G.A. drawings, specification sheets, etc. as relevant in respect of all materials/equipment to be supplied shall be submitted by the Contractor.
3.5.	Illumination system check after installation	After completion of installation of the illumination system in the substation, the actual illumination level at different locations shall be measured by the Contractor in the presence of Owner's authorised representative. If the average value of the measured illumination levels is found to fall short of the specified levels, the Contractor shall have to provide additional lighting fixtures so as to achieve the specified levels of illumination at no additional cost to the Owner. While measuring the illumination levels due allowance shall be made on account of maintenance factor. The specified lux levels shall be suitably increased to cover maintenance factor of 0.6 for outdoor areas.

4. DISTRIBUTION PILLARS FOR NORMAL ILLUMINATION SYSTEM

4.1.	Construction	4.1.1. Distribution pillars of adequate dimensions shall be constructed from sheet steel having a thickness not less than 2 mm. 4.1.2. The pillars shall be totally enclosed weather-proof, dustproof, vermin-proof, having hinged doors with locking arrangement and shall be capable of being mounted in the substation. 4.1.3. The pillars suitable for cable entry at the bottom shall be designed for easy access of connections to terminals and inspection of equipment mounted therein. 4.1.4. The degree of protection of the board shall be IP55. 4.1.5. The enclosure shall be painted externally with Shade No., 692 of IS:5 and internally with brilliant white of semi-glossy finish of IS:5.
4.2.	Configuration	4.2.1. Each pillar shall accommodate the following: 4.2.2. One incoming, 4-pole (3 phase and neutral) isolating switch with MCB of appropriate current rating. 4.2.3. 3-phase and neutral bus bars of appropriate current rating. 4.2.4. Single-pole earth leakage circuit breakers of suitable current ratings on all outgoing circuits.

		4.2.5. Neutral links for all outgoing circuits. 4.2.6. Cable lugs, compression type cable glands, name plates, circuit numbers, earthing lugs, etc. to make the pillar complete in all respects. 4.2.7. 20% spare outlets shall be provided for outgoing feeders. 4.2.8. Three (3) indicating lamps with fuses to indicate that supply is 'ON'.

5. LIGHTING DISTRIBUTION BOARDS

5.1.	Construction	5.1.1. Metal-clad enclosure with minimum 2 mm CRCA sheets for load-bearing members and 1.6 mm for non load-bearing members suitably reinforced with structural. 5.1.2. 3-phase, 4-wire bus bar system with high conductivity aluminium busbars mounting on FRP insulators having anti-tractive property with minimum 25 mm phase-to-phase and minimum 19 mm phase-to-earth clearances. The busbars shall be uniform throughout the length of the LDB and busbar joints shall be silver plated and covered with shrouds. 5.1.3. All cables shall enter from the bottom. 5.1.4. The degree of protection for the LDB shall be IP-54. 5.1.5. The enclosure shall be painted externally with Shade No., 692 of IS:5 and internally with brilliant white of semi-glossy finish of IS:5.
5.2.	Configuration	Each LDB shall accommodate the following: 5.2.1. One incoming, 4-pole (3 phase and neutral) isolating switch with MCB of appropriate current rating. 5.2.2. 3-phase and neutral bus bars of appropriate current rating. 5.2.3. 4 Pole outgoing MCBs of appropriate rating 5.2.4. Cable lugs, compression type cable glands, name plates, circuit numbers, earthing lugs, etc. to make the pillar complete in all respects. 5.2.5. 20% spare outlets shall be provided for outgoing feeders. 5.2.6. Three (3) Nos. indication lamps (Red, Yellow, Blue) shall be provided to indicate that the incoming supply is available. Similarly, 3 Nos. indication lamps shall be provided to indicate that the busbar is energised.
5.3.	Busbar	5.3.1. The busbars shall be suitable for short-time current rating of 40KA for 1 Sec. 5.3.2. The busbar temperature rise shall not exceed 35 Deg C over an ambient of 50 Deg C. 5.3.3. The LDBs shall be provided with a continuous busbar of 25 x 6 sq.mm (electrolytic copper) with suitable hardware for connection to the main grounding grid

6. MAIN EMERGENCY LIGHTING BOARD

6.1.	Construction	6.1.1. Metal-clad enclosure with minimum 2 mm CRCA sheets for load-bearing members and 1.6 mm for non load-bearing members suitably reinforced with structural. 6.1.2. All cables shall enter from the bottom. 6.1.3. The degree of protection for the LDB shall be IP-54. 6.1.4. The enclosure shall be painted externally with Shade No., 692 to IS:5 and internally with brilliant white of semi-glossy finish to IS:5.
6.2.	Configuration	6.2.1. Each Board shall accommodate the followings: 6.2.2. Automatic changeover contactor. 6.2.3. Voltage sensing relays. 6.2.4. Time delay relay. 6.2.5. Bus Bars. 6.2.6. Two pole MCBs of adequate ratings for incoming and outgoing feeders. 6.2.7. Test switch, push button type. 6.2.8. Indicating lamps, ac - Green, dc - Red. 6.2.9. Terminals for remote indication 6.2.10. Cable lugs, compression type cable glands, name-plates, circuit numbers, earthing lugs and remote indication wiring upto substation 415V a.c. control board, to make the board complete in all respects.
6.3.	Changeover facility	The main emergency lighting board shall have an automatic changeover switch to energise the dc lighting system in the event of AC power failure. It shall have voltage-sensing relays to perform the changeover automatically when AC voltage of any one phase falls below 60 percent of 240 volts and continues at that low level for more than 10 seconds. These shall changeover from DC to AC again when 70 percent of 240 volt is restored and this continues for 10 seconds.
6.4.	Emergency Lighting Pillar	Local Emergency Lighting Pillar shall be identical in details to Lighting Distribution Pillar specified in clause 4 except that it shall have two pole isolating switch fuse unit on the incoming side and only two busbars and shall be without neutral links.

7. LUMINAIRES

7.1.	Luminaires type	Luminaires for use in normal and emergency illumination systems in the substation shall be suitable for LED lamps. All the luminaires shall be supplied complete with all accessories and lamps. The LED lamps ratings shall be adequate to achieve the required Lux level and calculation for number of luminaires shall be in the bidder's scope. Minimum rating shall be a follows - 7.1.1. Outdoor – 90W minimum 7.1.2. Indoor – 36W minimum

7.2.	Flood lights	The flood light luminaires in the substation shall be fixed at suitable height on the substation structures/ building, so as to provide the specified average illumination in the substation area without causing any glare to the operational/ maintenance staff working in the substation. While fixing the luminaires it shall be ensured that the stipulated electrical clearances are not violated. The Contractor shall supply and install suitable type of non-mettalic street light poles or octagonal galvanished poles required for installing the fittings for illuminating the roads, fence boundary wall etc.
7.3.	Reliability	Substation lighting circuits shall be divided into two or three sections and provided with time switches of suitable ratings.
7.4.	Design features for Outdoor Luminaires	
7.5.	Fixture	7.5.1. The luminaries housing shall be either extruded or pressure die casted aluminium of minimum 1.6 mm thickness. Body must be Corrosion Resistant Powder Coated and UV resistant. 7.5.2. The entire housing shall be dust and waterproof having Ingress protection of housing as IP65 or above as per IEC 60529. 7.5.3. Luminaire should be covered with suitable Glass or diffuser with high Transitivity. All luminaires shall be supplied with either clear toughened glass or clear polycarbonate cover for better IP retention and higher life.
7.6.	LED	7.6.1. The luminous efficacy of LED luminaire shall be atleast 85 lumen/watt. 7.6.2. LED module efficacy shall not be less than 90 percent of the rated LED module Efficacy. 7.6.3. Color Rendering Index (CRI) shall be at least 70 7.6.4. Color Temperature shall be 5500-6500K 7.6.5. Uniformity Emin/Eavg> 0.4, Emin/Emax>0.33
7.7.	LED Driver	LED driver shall have following features: 7.7.1. LED driver shall be applicable for Power supply 240V AC±10%, at 50Hz+3% / -5%. 7.7.2. Output voltage of the driver shall be designed to meet the Power Requirements of the system. 7.7.3. Power factor of complete fitting shall be more than 0.90 at full load. 7.7.4. Total Harmonic Distortion (THD) shall be < 10 %
7.8.	General Requirements	7.8.1. The connecting wires used inside the Luminaire, shall be low smoke halogen free, fire retardant e-beam cable and fuse protection shall be provided in input side. 7.8.2. The lumen maintenance of all the LED fixtures shall not be less than 70% after 50,000 hours. 7.8.3. Built in protection features for Short circuit, Surges (at least upto 5kV), and overvoltage shall be provided.

		7.8.4. High /Low voltage cut-off shall be provided. 7.8.5. The whole luminaire shall be eco-friendly green technology based i.e. mercury free. 7.8.6. No UV and IR radiations shall be produced. 7.8.7. Access of driver for maintenance shall be provided at the top/side of the luminaire fixture. 7.8.8. All fasteners must be of stainless steel.

8. JUNCTION BOXES/WALL BOXES

8.1.	Size	100 mm x 100 mm junction boxes and wall boxes of standard size shall be provided.
8.2.	Construction	Wall boxes and junction boxes shall be made of FRP with a thickness of 2.0mm. Necessary conduit termination fittings such as bushings, locknuts etc. also be provided.

9. AUTOMATIC LIGHTING CONTROLLER

9.1.	Size	Contractor shall provide microprocessor based automatic lighting controller for controlling switching arrangement of indoor and outdoor lighting. The controller shall have provision of setting 52 week ON / OFF time as per astronomical clock or as per user requirement. All abnormal events shall be recorded in the controller. Secure / Genus or equivalent are approved makes.

10. SOCKETS & SWITCHES

10.1.	Indoor	All sockets and switches shall be modular and universal type suitable for 5/15A
10.2.	Outdoor	Two nos transformer oil filtration sockets shall be provided, one at each transformer bay. These sockets shall be three phase industrial type and rated for 100A.

11. NAMEPLATE & MARKING

11.1.	Name plate details of LED housing	Followings shall be clearly engraved / embossed on the die cast housing of LED: Rated voltage or voltage range (marked 'V' or 'Volt'); 11.1.1. Rated current (marked A' or 'Ampere'); 11.1.2. Rated wattage (marked 'W' or 'Watts'); 11.1.3. Rated frequency (marked in 'Hz') 11.1.4. Rated lumen 11.1.5. Indian/International Standards to which it is manufactured 11.1.6. Month and year manufacture 11.1.7. Customer Name - BSES Yamuna / Rajdhani Power Ltd 11.1.8. Fitting serial number 11.1.9. PO no and date 11.1.10. Guarantee period
11.2.	Panel nameplate and marking details	
11.2.1.	Panel nameplate	Panel shall have a nameplate clearly indicating the following: 11.2.1.1. Panel Serial No.- 11.2.1.2. Customer Name - BSES Yamuna/Rajdhani Power Ltd 11.2.1.3. PO No. & date - 11.2.1.4. Panel Name - 11.2.1.5. Current rating - 11.2.1.6. Guarantee period -
11.2.2.	Feeder nameplate	Large and bold name plate carrying the feeder identification shall be provided on the top of each module.
11.2.3.	Danger plate	Panel shall have a danger plate of anodized Aluminium clearly indicating the danger logo and voltage details.
11.2.4.	Material	Anodized Aluminium 16SWG. Nameplates shall be satin silver in colour with black letters engraved on them. Stickers are not allowed.
11.2.5.	Fixing	All nameplates shall be riveted to the panels at all four corners. Bolting/screwing is not acceptable.

12. APPROVED MAKE OF COMPONENTS

12.1.	Relays	ABB/Jyoti/Omran
12.2.	HRC Fuse Links	GE/ Siemens/ L&T
12.3.	AC Contractors/ DC contactor	L&T/Siemens/Telemechanique/GE/ABB

12.4.	Terminals	Connectwell/Elmex/Wago/Phoenix
12.5.	Push buttons / Actuator	L&T/Siemens/Vaishno/Schneider
12.6.	MCB	Legrand/Hager/Schneider/ABB
12.7.	LED	NICHIA/ OSRAM/ CREE/ PHILIPS//EDISON
12.8.	Luminaire fittings	GE/Philips/Crompton/Bajaj
12.9.	Indicating lamps	Vaishno/Binay/Teknic/Siemens/Mimic/C&S

13. INSPECTION & TESTING

13.1.	Type test	All Equipment should be of type tested quality only, type test certificate to be submitted along with offer. If the manufacturer's lab is accredited by govt. / authorized body then it shall be acceptable for type testing.
13.2.	Acceptance & Routine tests	As per relevant Indian standard

14. DEVIATION

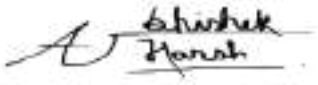
14.1.	Deviation	Deviations from this Specification shall be stated in writing with the tender by reference to the Specification clause/GTP/Drawing and a description of the alternative offer. In absence of such a statement, it will be assumed that the bidder complies fully with this specification. No deviation will be acceptable post order.

Technical Specification

For

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	 5d325f5e-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

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

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

	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

		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

	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

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

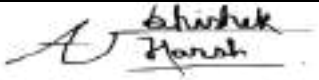
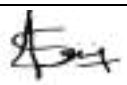
Rev:		0
Pages:		1 of 14
Date:		06 May 2022
Prepared by	Abhishek Harsh	 3267d7c3-82b5-46cb-b5a6-867ee7820a34
Reviewed by	Srinivas Gopu	 5d32525e-ed3a-4f41-b1c7-b8a5e77d1519
Approved by	Gaurav Sharma	 23dc2de2-95de-4472-99a7-dea873f472b6

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

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.

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.

		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	

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.

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

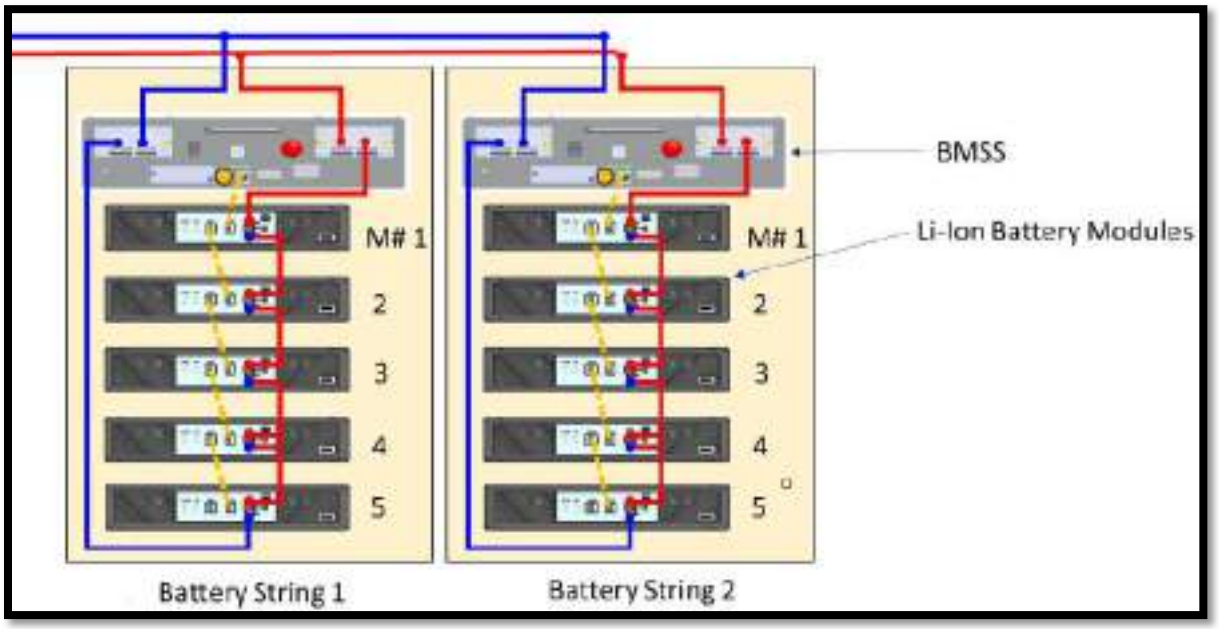
17.1	Vendor quality plan	To be submitted for purchaser approval
17.2	Inspection points	To be mutually identified & agreed in quality plan

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		

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

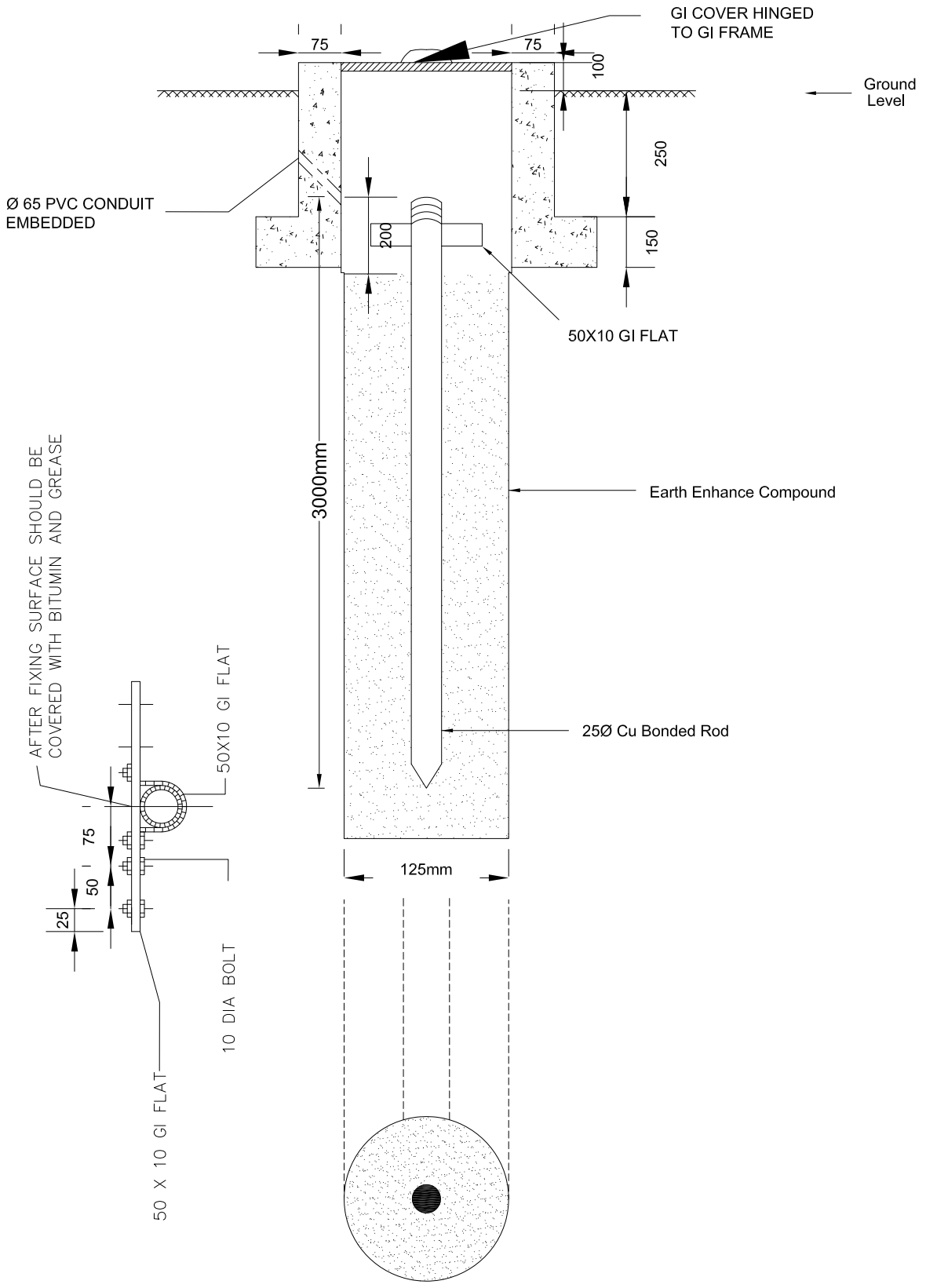
S. No	Parameter	BYPL Requirement	Vendor Data
9.1	Rod to rod welding	Exothermic	
9.2	Zinc deposition of GI earthing Strip	610gm/sqm	
9.3	Length of GI Strip	7m (Minimum)	
9.4	Diameter of Cu clad Rod	25 mm	
9.5	UL/CPRI/ERDA Certification of Cu Bonding	Test certificate to be provided	
9.6	Cu bonding	250 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

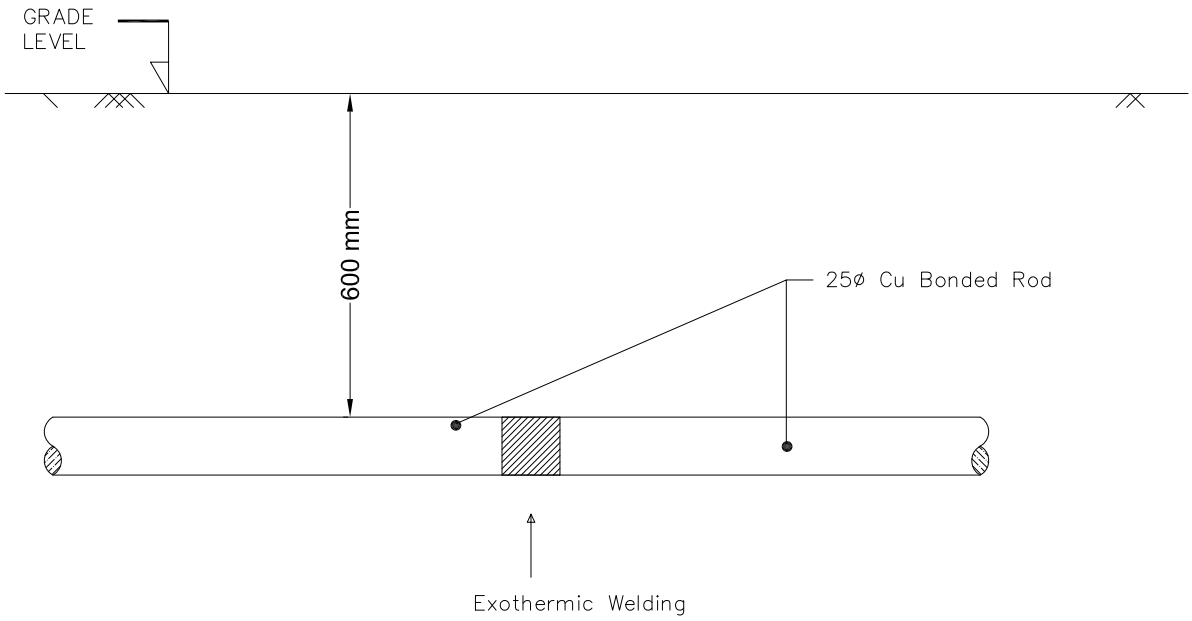
TITLE:–

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

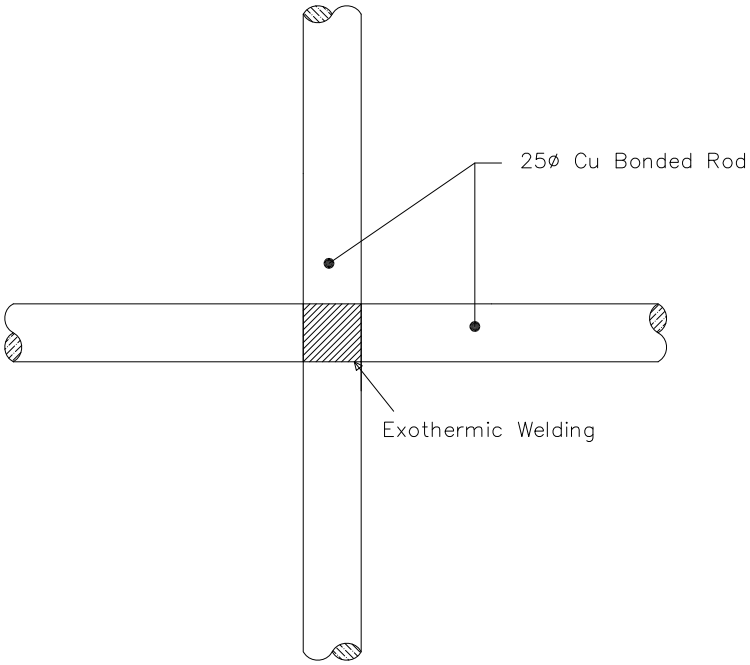
TITLE:-

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
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

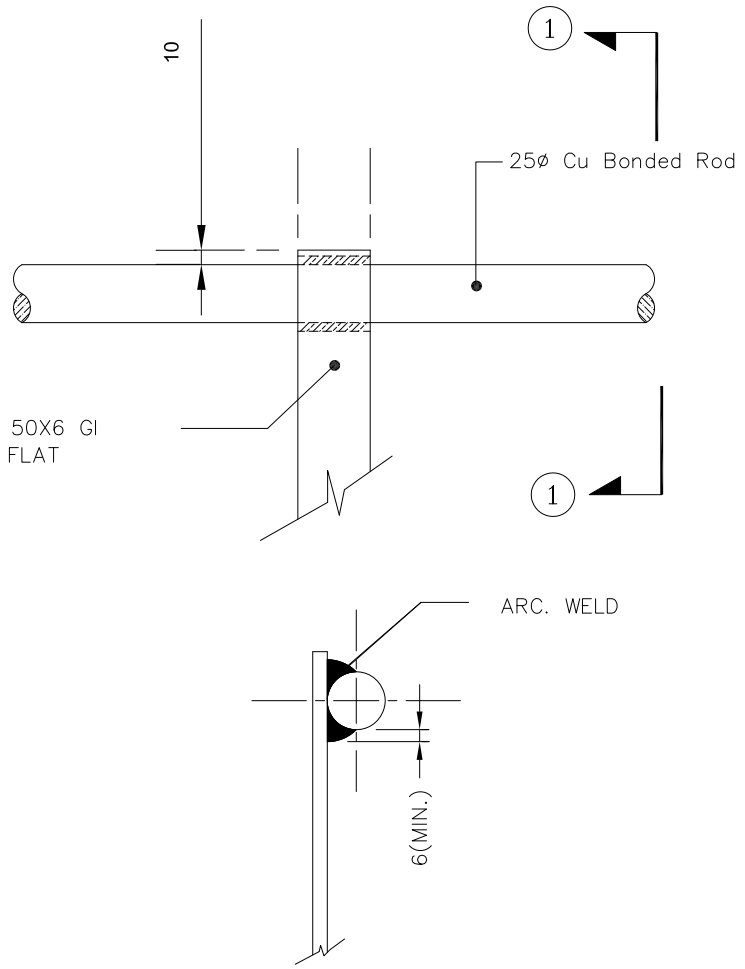
TITLE:–

CROSS JOINT BETWEEN RODS

BSES Yamuna Power Limited

FILE NAME: REL–COENG–NEE–E21–P–00085 DATE:–08.09.10

A4 [210x297]



SECTION – (1)

DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

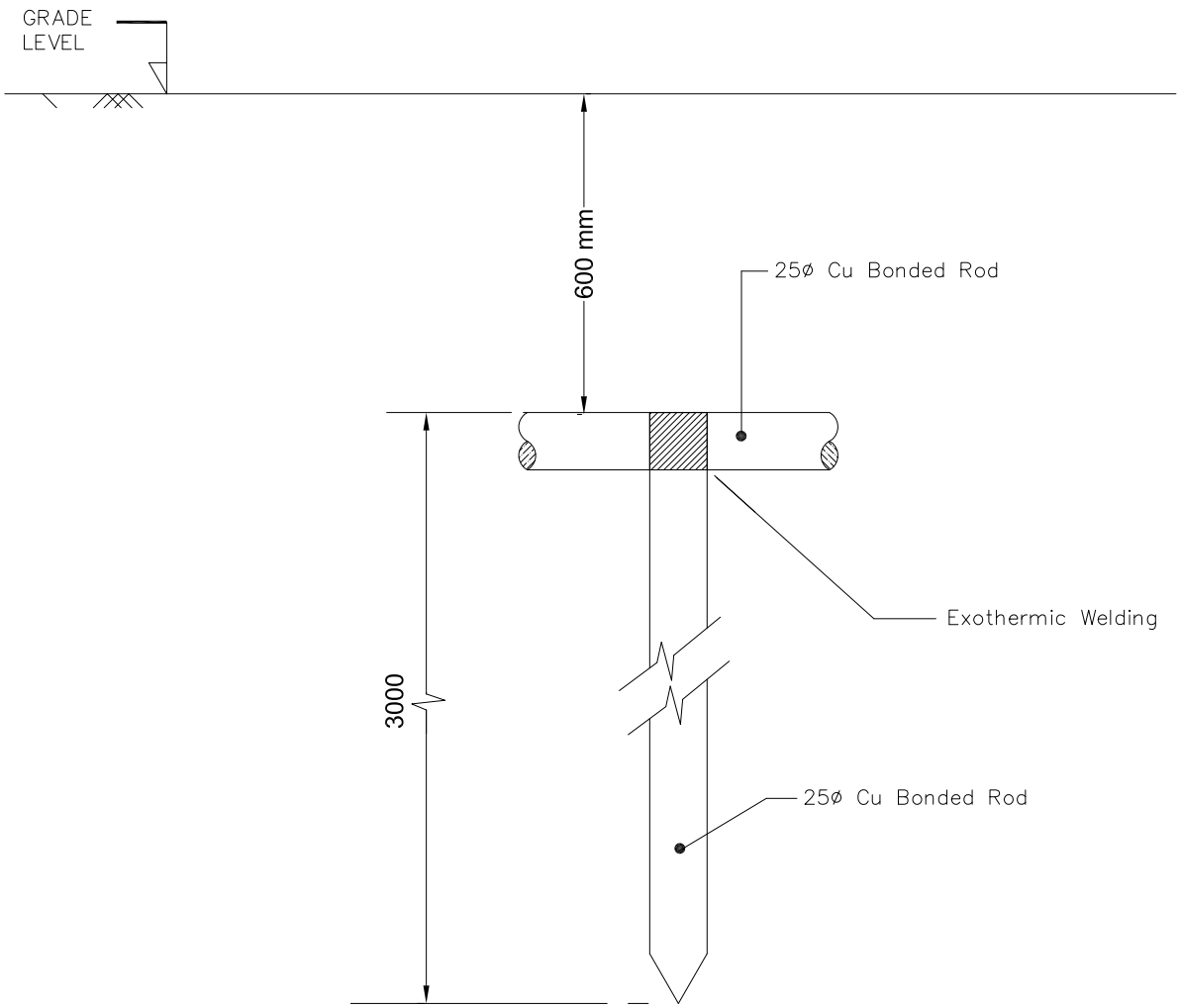
TITLE:–

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

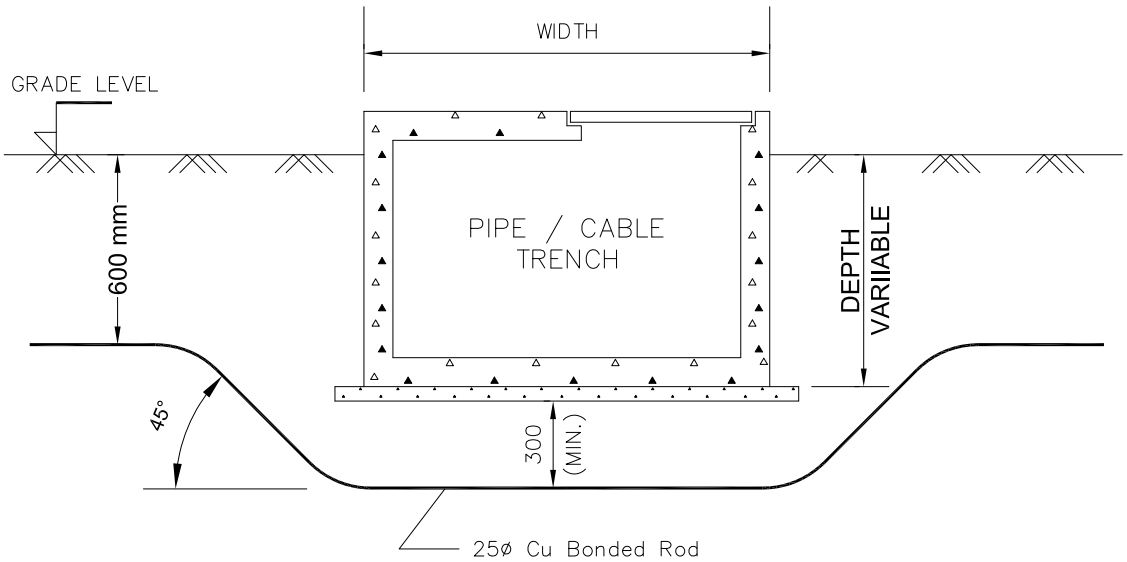
TITLE:–

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

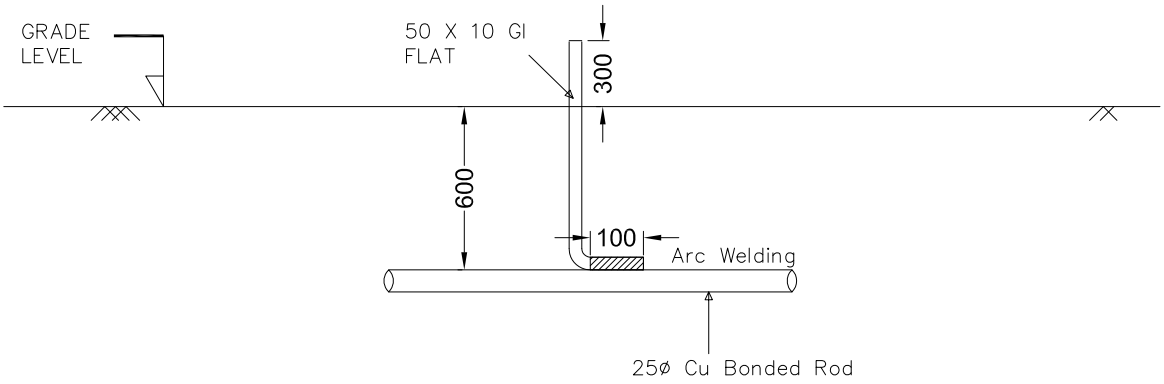
TITLE:–

TRENCH CROSSING OF
EARTHING CONDUCTOR

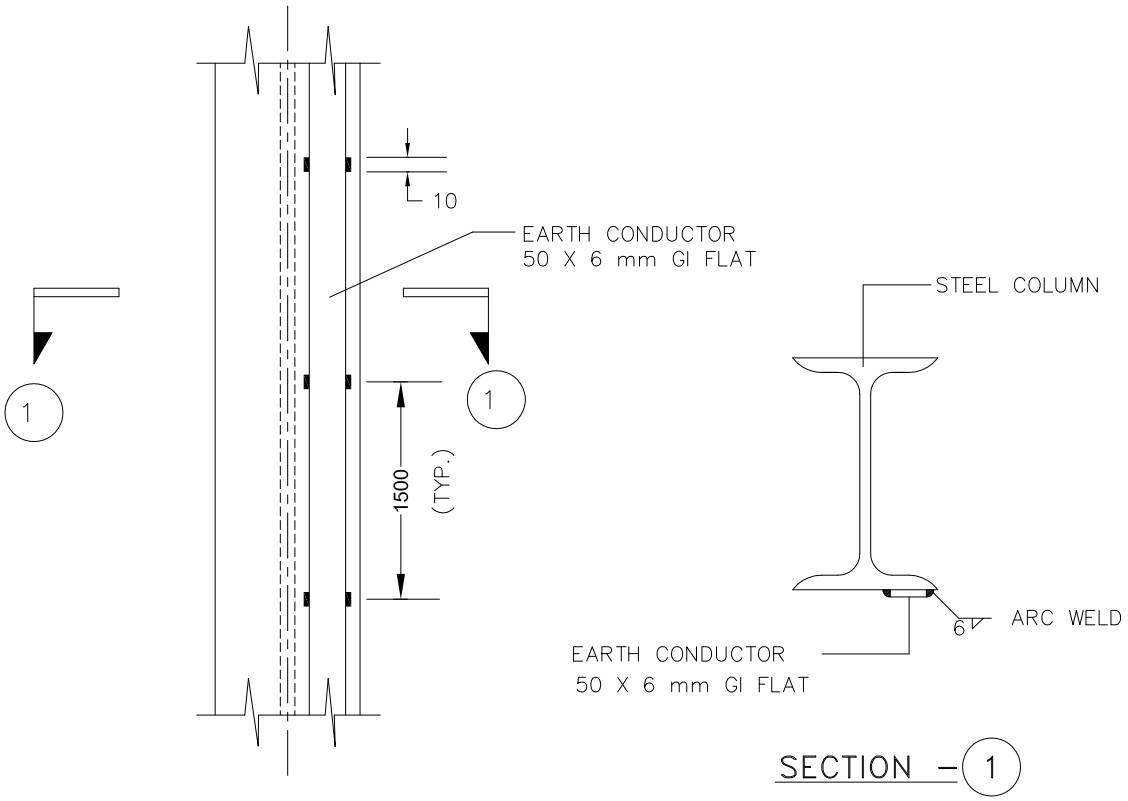
BSES Yamuna Power Limited

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

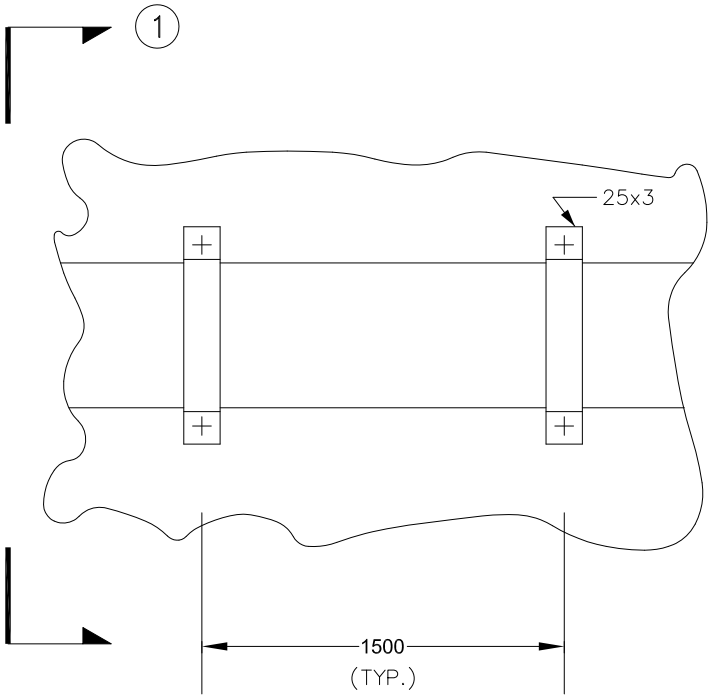
TITLE:–

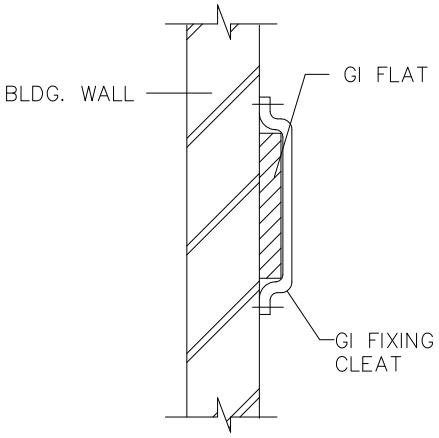
EARTHING CONDUCTOR ALONG STEEL COLUMN

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

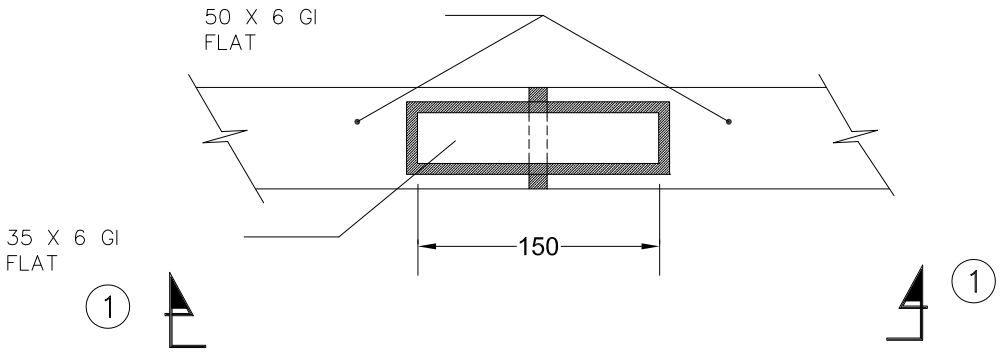
TITLE:–

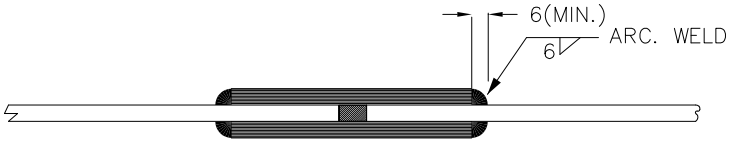
EARTHING CONDUCTOR ALONG BUILDING WALL

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

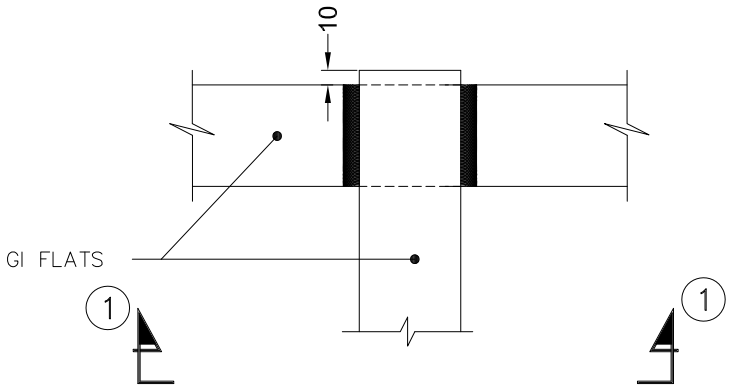
TITLE:–

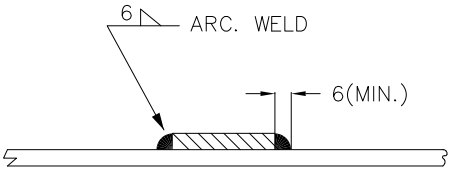
BUTT JOINT BETWEEN GI FLATS

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

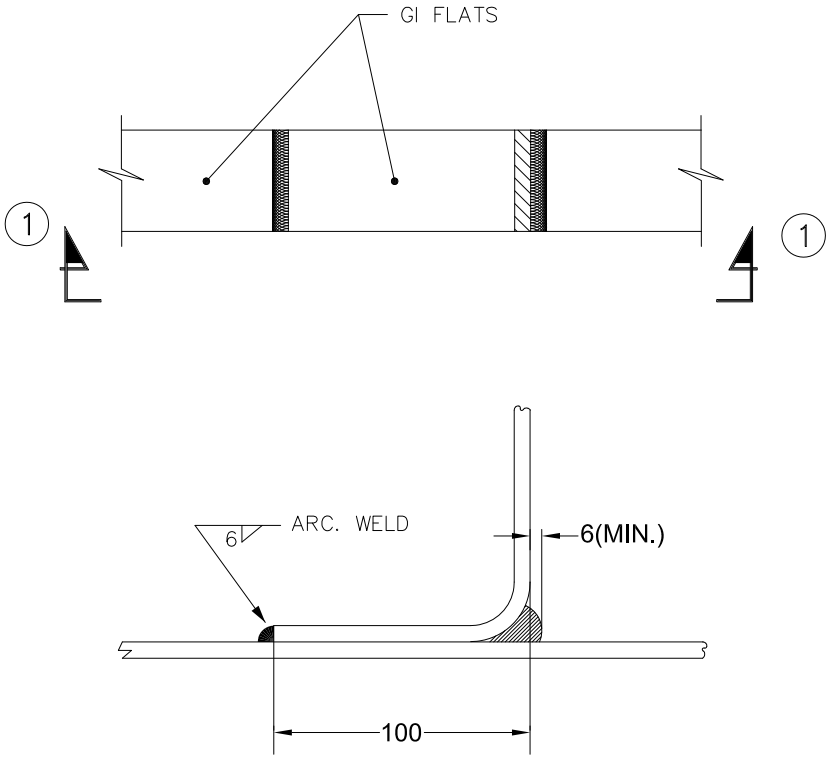
TITLE:–

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

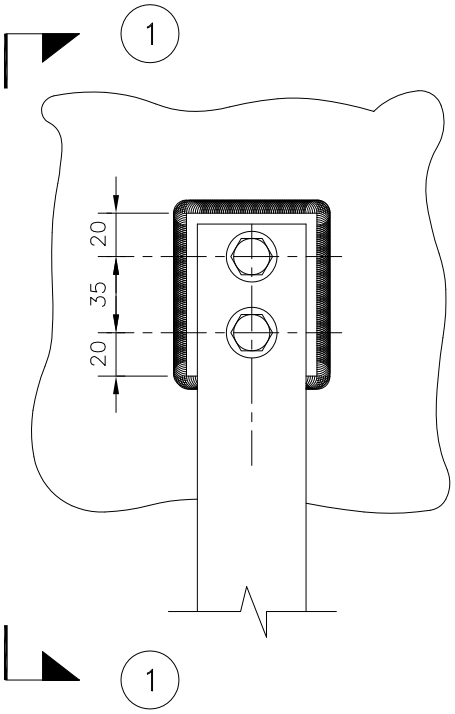
TITLE:–

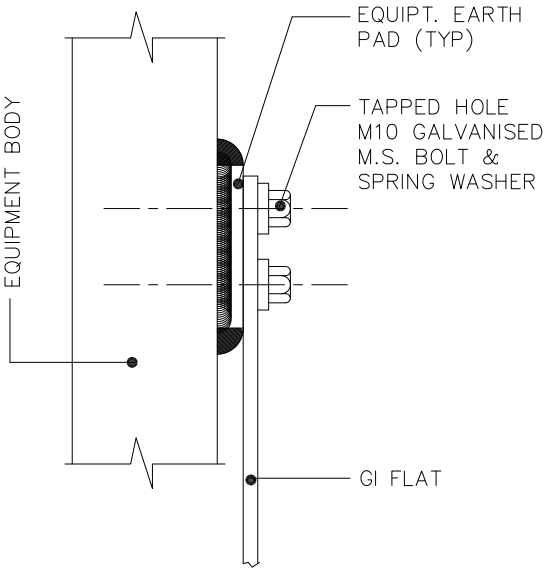
ANGULAR JOINT BETWEEN GI FLATS

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

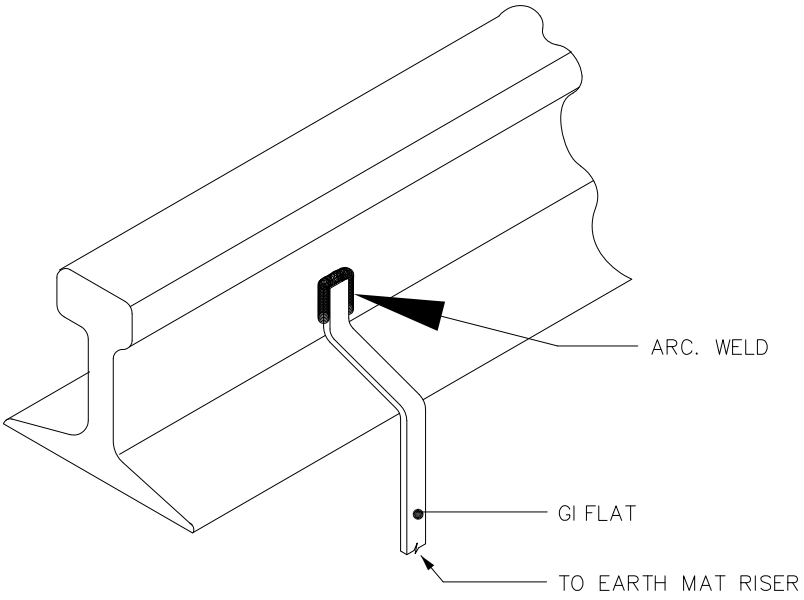
TITLE:–

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

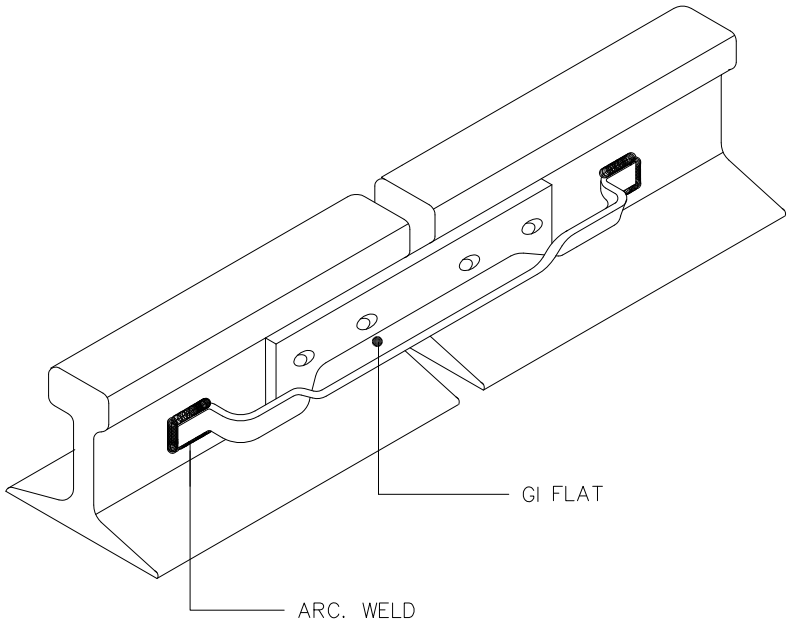
TITLE:-

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

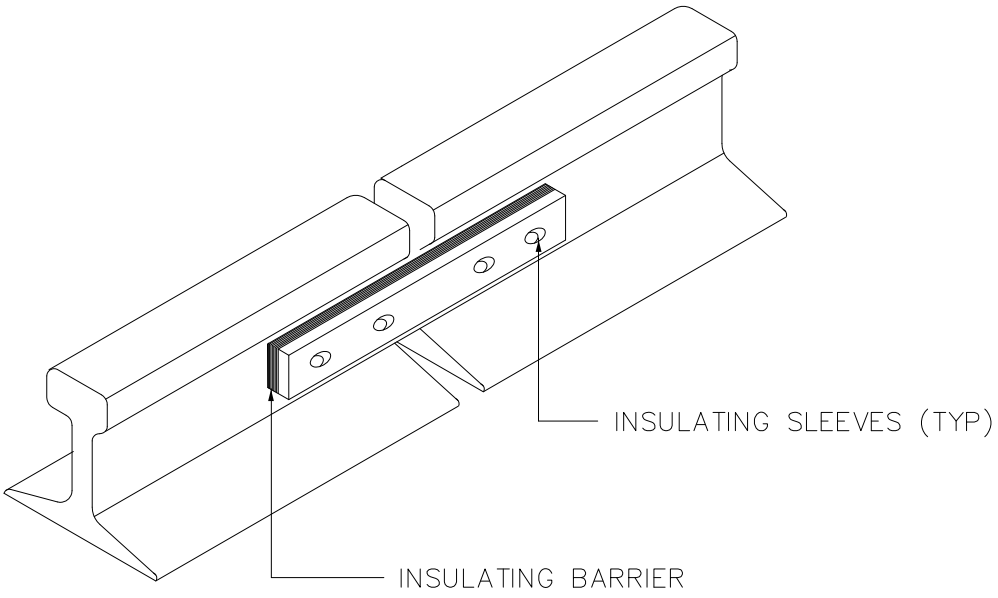
TITLE:–

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

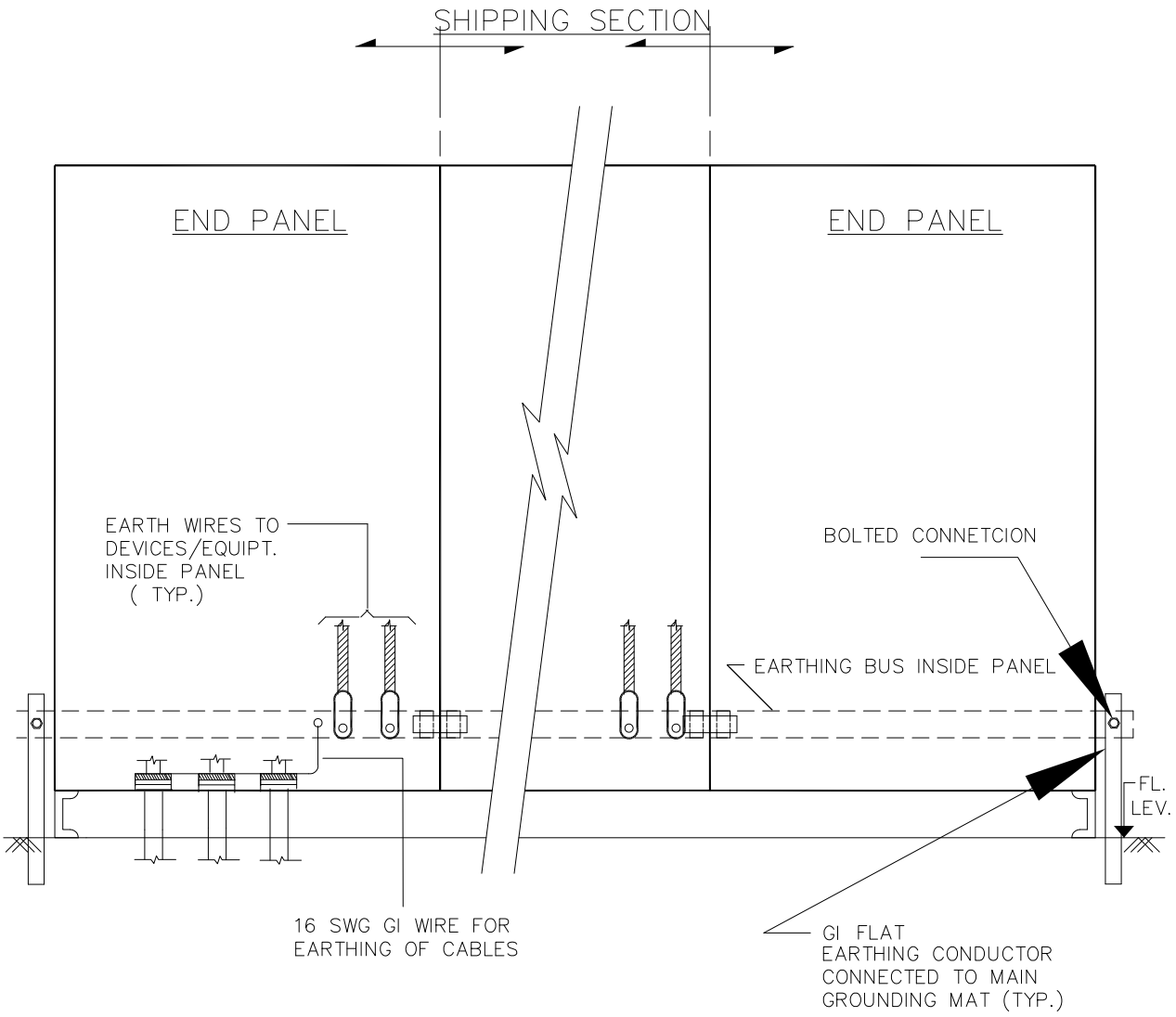
TITLE:–

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

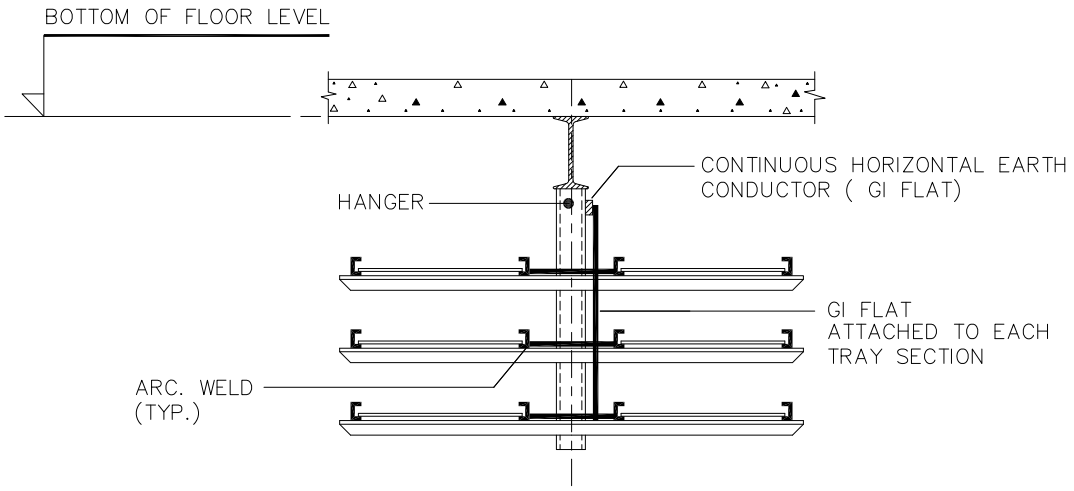
TITLE:-

EARTHING OF MCC, SWITCHGEAR

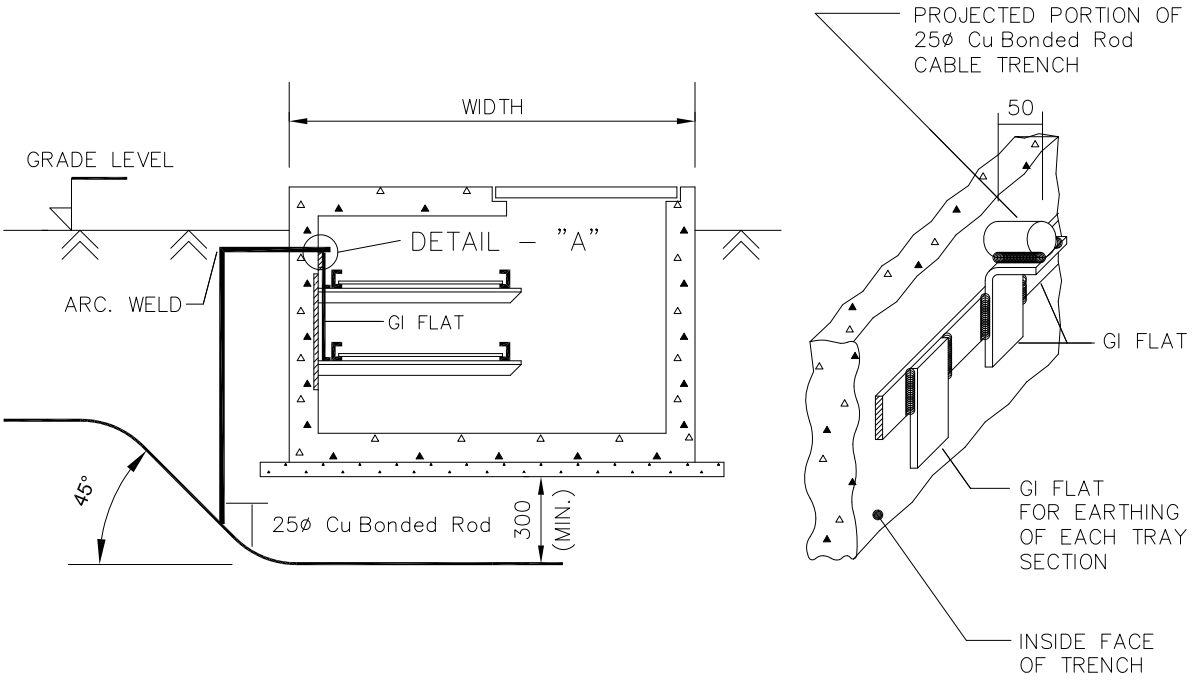
BSES Yamuna Power Limited

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

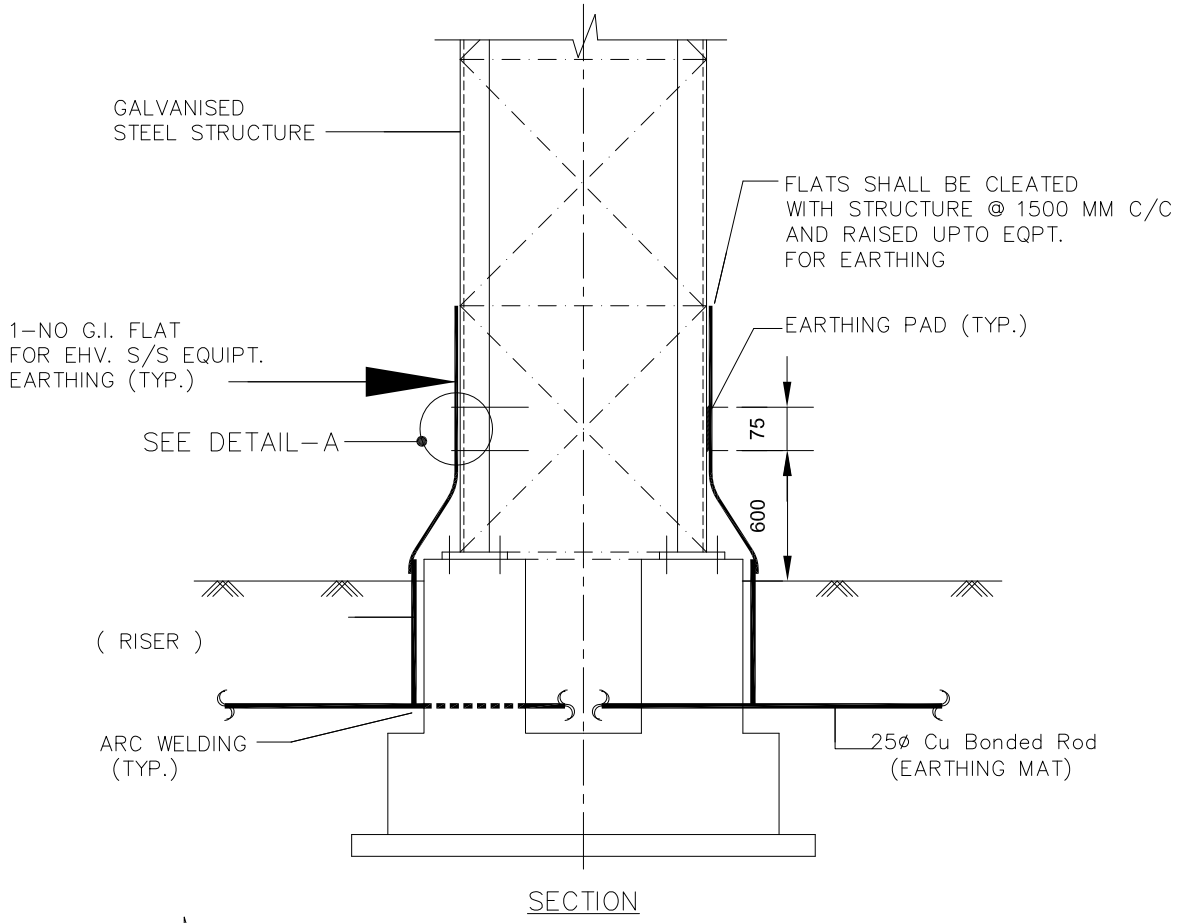
TITLE:–

CABLE TRANCH/TRAY EARTHING

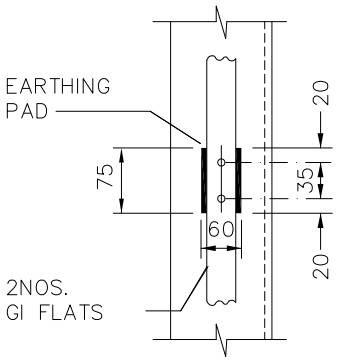
BSES Yamuna Power Limited

FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

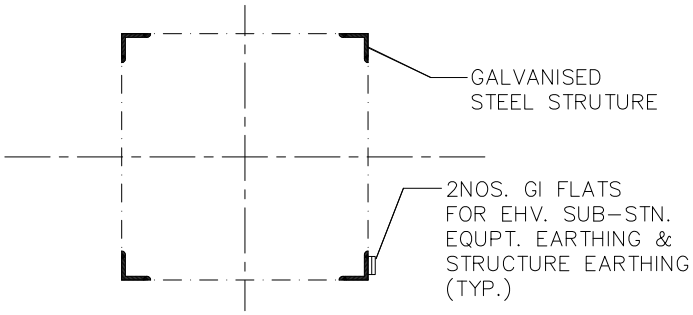
A4 [210x297]



SECTION



DETAIL – 'A'



PLAN

DRAWN	A.H
CHECKED	G.S
APPD.	A.A
DATE	17.10.17
SCALE	NTS

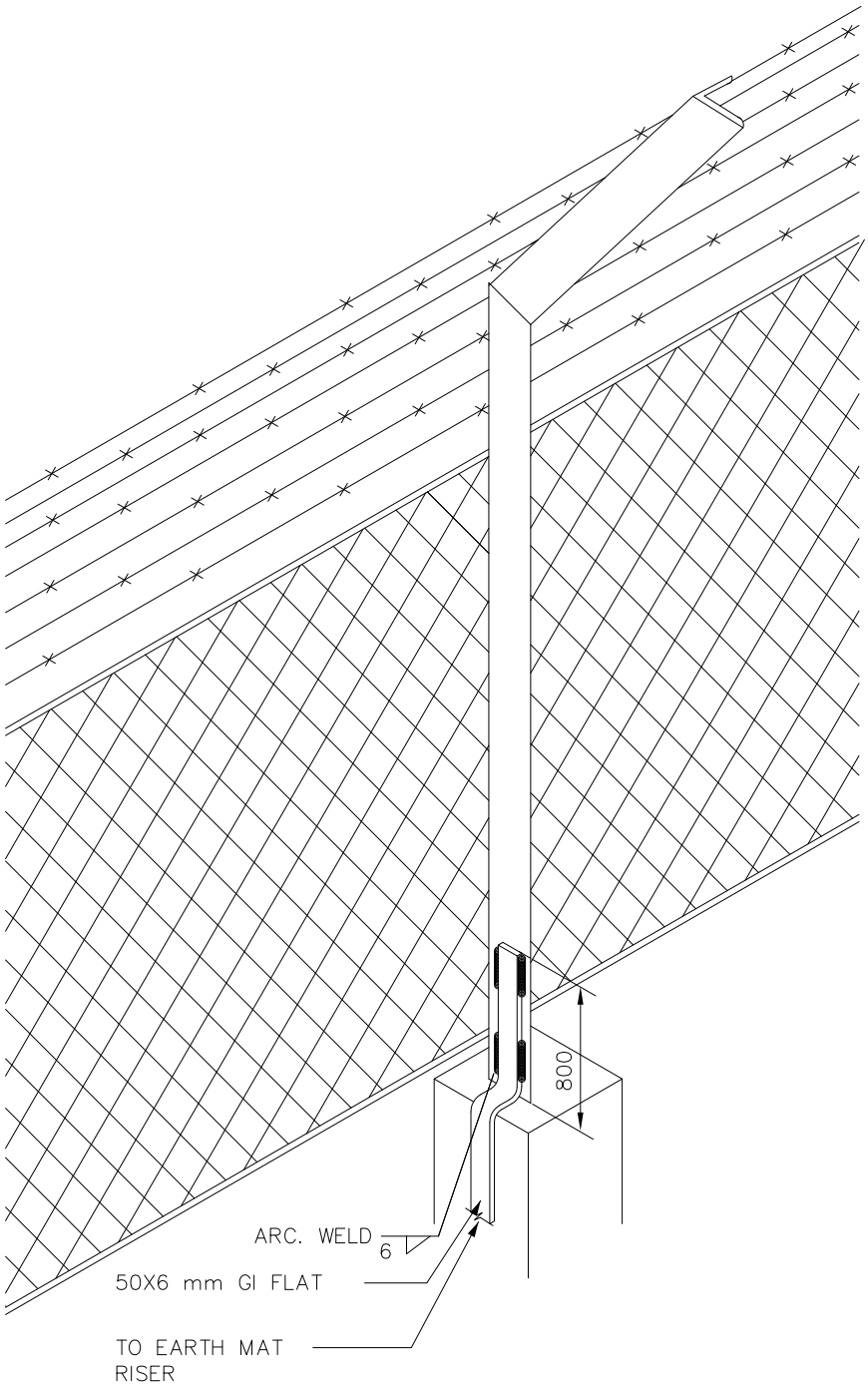
TITLE:–

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

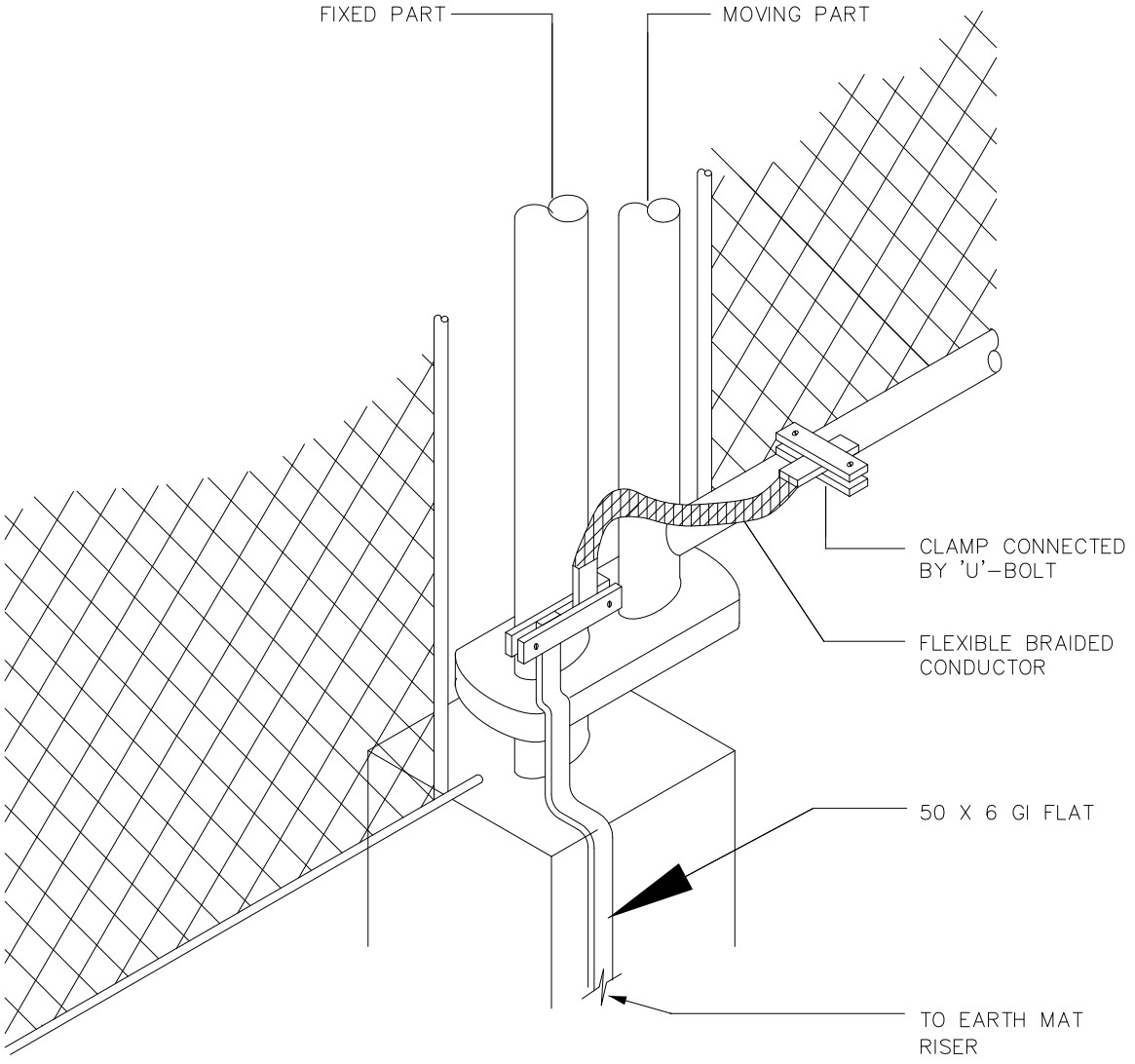
TITLE:–

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

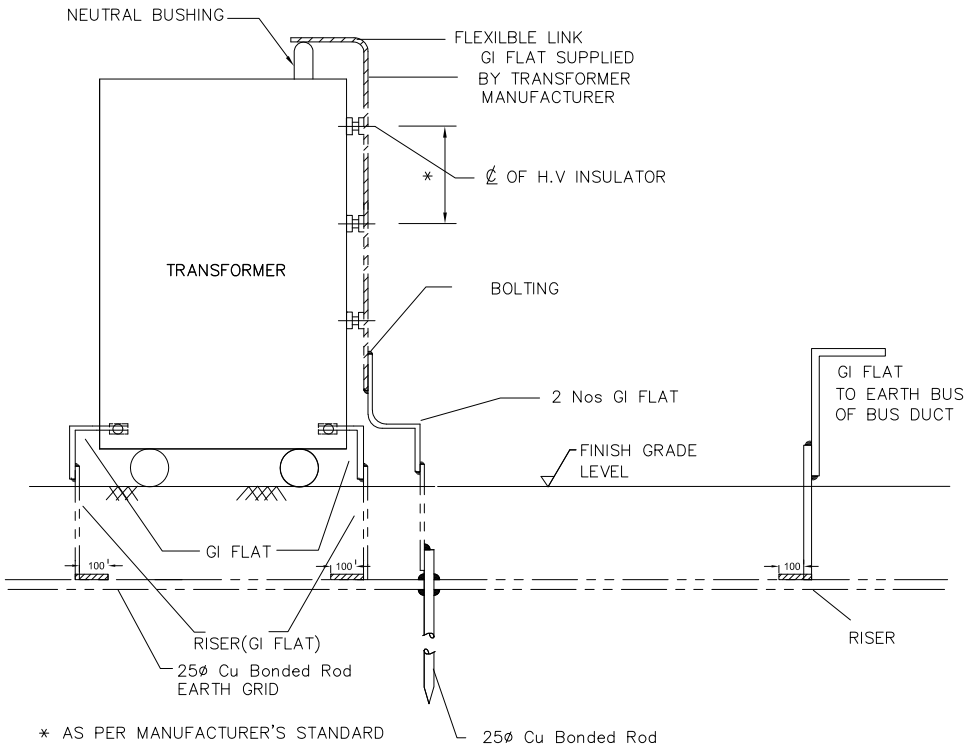
TITLE:-

FENCE GATE EARTHING

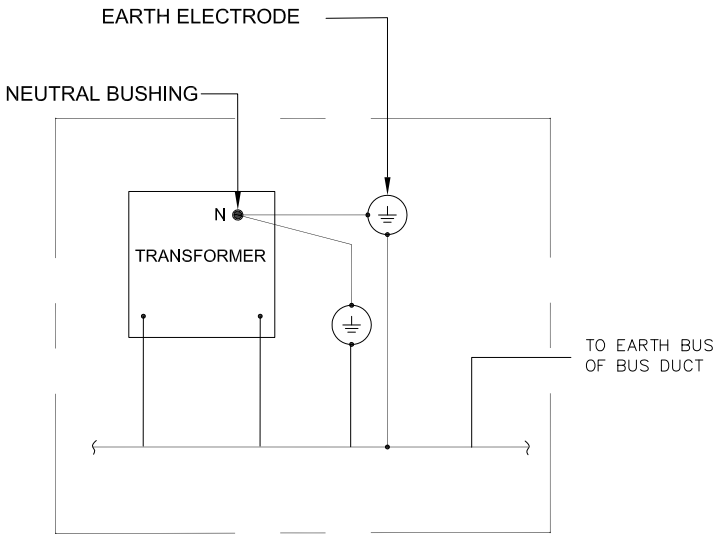
BSES Yamuna Power Limited

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

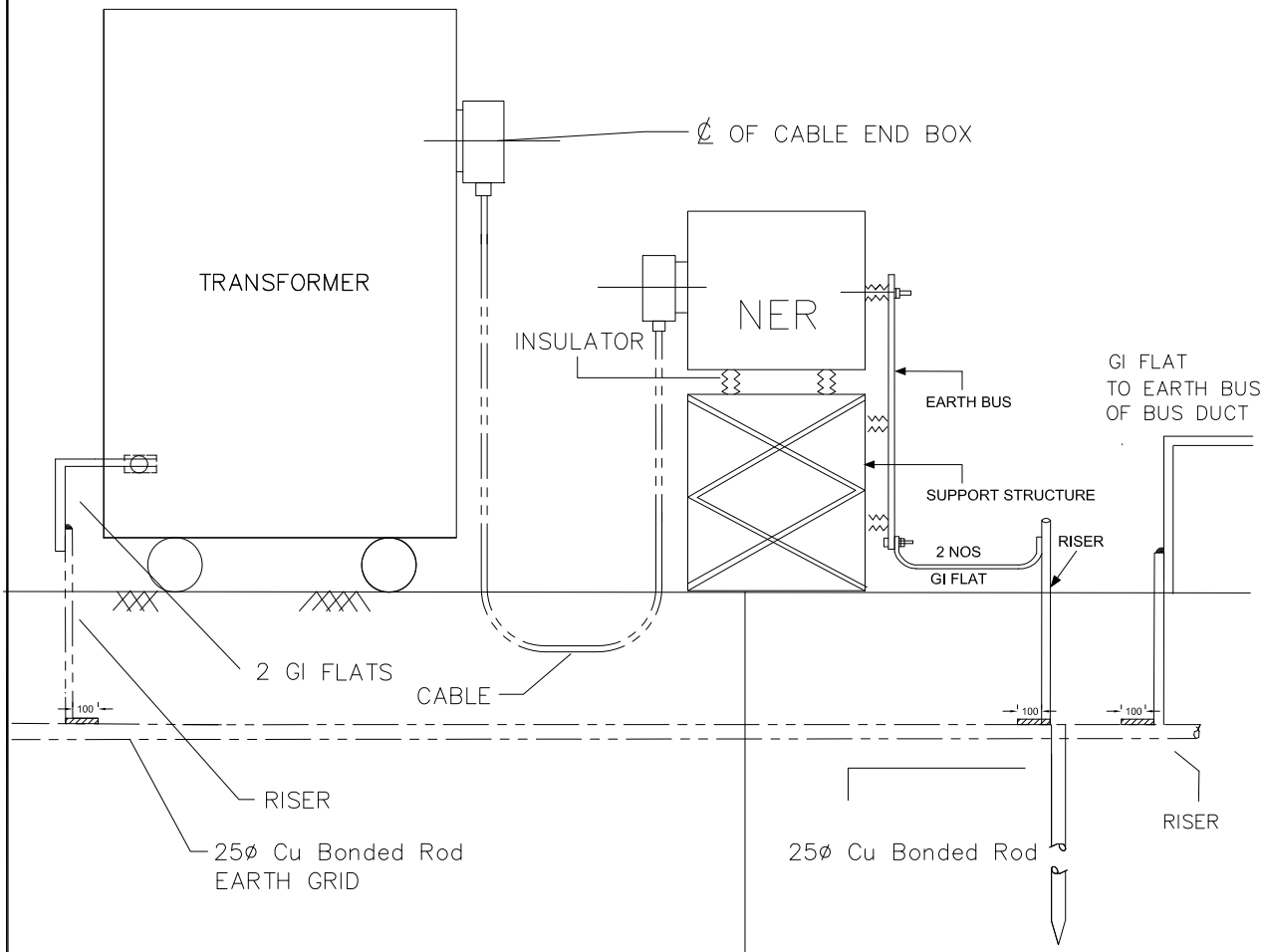
TITLE:-

TRANSFORMER NEUTRAL EARTHING (DIRECT)

BSES Yamuna Power Limited

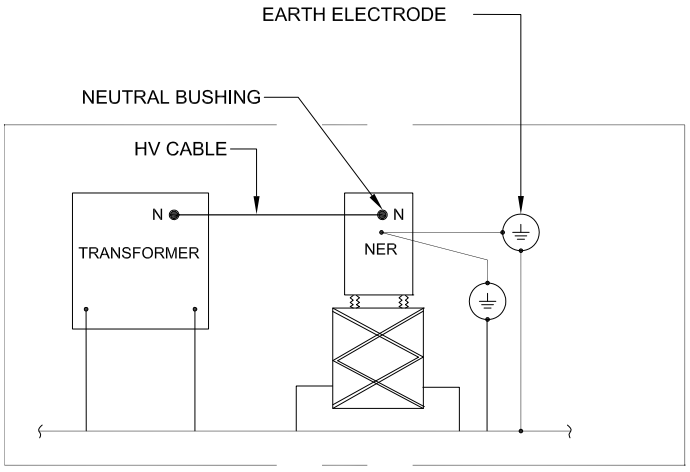
FILE NAME: REL-COENG-NEE-E21-P-00085 DATE:-08.09.10

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

FOR

11KV AUTO SWITCHED CAPACITOR BANK

INDEX

1.0 RECORD OF REVISION

S. No	Item/ Clause No	Change/ Addition	Reason of Change/Addition
1	5.13	Peek Hole in Enclosure doors	To see the status of Capacitor bank fuse
2	5.14	Exhaust Fan with Air filter And Canopy	For heat suppression in capacitor bank compartment
3	5.21	Cutout space for Power Cable Entry	For ease of Power Cable Entry
4	6.10	Inclusion of External Fuse	For Ease of O&M
5	7.1	Addition of Shreem make vacuum contactor	Vacuum contactor of Shreem complies the specification of BSES Yamuna Power Limited
6	8.10	Class of Insulation	For more clarity on Series Reactor Data
7	9.0	Updation of RVT data	For More clarity on RVT Data
8	10.4	Communication Protocol as Modbus	For Communication with SCADA
9	10.7	Supply of APFC has been changed to 48-220 VDC to 220 VAC	No vendor provides APFC with Auxilliary voltage 48-220 VDC
10	14.6	Inclusion of Warranty period, and Customer care Number in Name Plate rating	For ease of O&M
11	15.0	Approved Make Table	For Quality Products
12	17.0	Typical SLD	Upgradation of SLD due to stepped Capacitor Bank
13	20.0	Inclusion of Drawing and Data Submission Matrix	To streamline drawing/document submission

2.0 SCOPE OF SUPPLY

a. This specification covers the design, manufacturing, testing, supply, erection & commissioning of 7.2 MVAR (One fixed step of 1.8 MVAR and three steps of 1.8 MVAR), 12.65 KV three phase outdoor Auto Switched Capacitor Bank with bus bar arrangement at site in an enclosure including but not limited to 0.2% series reactors, capacitor switch/contactor, Isolator cum earth switch, HT fuses, RVT, APFC Panel and all necessary equipment for auto switching. No Equipment should lie outside the enclosure apart from APFC panel which shall be the part of VCB panel. Necessary space will be provided for APFC panel in switchboard. Fitting and wiring of this panel shall be in vendor's scope. (Although in case of unavailability of space in switchboard, separate wall mounted panel shall be provided by the vendor). Isolator, Earth Switch etc should be incorporated in enclosure only.NDR will not be the part of vendor's scope but wiring for NDR shall be in vendor's scope.

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

3.0 CODES & STANDARDS

Indian Electricity Rules	
Indian electricity act	
CBIP manual	
IS 13925 part 1,2 & 3	Shunt capacitors above rated voltage 1000v
IS 11298 part 3	Plastic films for capacitors
IS 9921-1985	Isolator
IS 5553	Series reactor
IS 2099	Bushings for voltages above 1000v
IS 12672	Internal fuses & disconnector for shunt capacitors
IS 2705	Current transformers
IS 13067	Imp regnant for power capacitors
IS5	Color of mixed paints
IS 3156	RVT
IS 15086	Surge arrestor
IS 3070 (Pt 3)	Surge arrestor
IS 2629	Recommended practice for Hot dip galvanizing of steel
IS 4759	Hot dip Zinc coating on Steel structures and other allied products
IEC 60871	Shunt capacitors for AC power Systems
IEC 61000	Automatic Power Factor Controller
IS 9920-2002	Vacuum Contactors/Capacitor Switch

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

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

4.0 SERVICE CONDITIONS

4.1	Max Ambient Temperature	50 deg C
4.2	Max Daily average ambient temp	40 deg C
4.3	Min Ambient Temp	0 deg C
4.4	Maximum Humidity	95%
4.5	Minimum Humidity	10%
4.6	Maximum annual rainfall	750 mm
4.7	Average no of rainy days per annum	60
4.8	Rainy months	June to Oct
4.9	Altitude above MSL	300 M
4.10	Seismic Zone	IV

5.0 GENERAL

5.1	Capacitor Scheme	3 Phase, 7.2 MVAR @ 12.65KV,Single Star with RVT protection.
5.2	Switching	Auto switched in three steps of 1.8 MVAR with one fixed step of 1.8 MVAR. Auto switching will be controlled by APFC.
5.3	Service location	Suitable for outdoor use
5.4	Connection	Single star for individual steps
5.5	HT capacitor bank assembly	a. Individual single phase capacitor units mounted on steel stand / rack & connected externally by sleeved flexible copper connectors b. Sleeves to be Red, Yellow, Blue, & Black in colour.
5.6	Interchangeability	Between various single phase capacitor units without disturbing other units
5.7	Capacitor bank enclosure	For enclosing complete capacitor bank including capacitor units, Reactors, flexible copper connectors, RVT & terminal bus bar. Enclosure's door shall be provided with limit switch having interlock with Isolator and Circuit breaker.
5.8	Enclosure size	Max 6m X 1.5m
5.9	Enclosure mounting	Panel mounted
5.10	Degree of Ingress Protection for Bank Enclosure	IP55

5.11	Enclosure side walls	CRCA metal may be used for enclosure with thickness of loaded parts-2mm and unloaded parts-1.5mm
5.12	Enclosure doors of width 1500mm	Hinged, center opening, double leaf type, two doors provided on adjacent side walls with bolting as well as padlocking and interlocking facility.
5.13	Peek hole	Peek hole shall be provided in each door to see the status of fuse of Capacitor Bank
5.14	Exhaust Fan with Air filter And Canopy	Exhaust fan shall be provided in each step for heat suppression in compartment. Exhaust fan must operate of that step when capacitor bank is in ON condition.
5.15	Enclosure top cover	CRCA sheet metal 2mm thick with stiffeners
5.16	Door Interlock	Doors shall be provided with solenoid type lock to avoid door opening (after tripping of breaker) for a minimum of 10 minutes.
5.17	Earth Connection	All wire CRCA Sheet metal side walls/, doors & top cover shall be connected to each other by metallic jumper links, two earth studs with hole size for M10 bolt to be provided on enclosure frame bottom
5.18	Bus bar for HV cable termination	One for each phase mounted on porcelain or epoxy insulators
5.19	Bus bar material	Tinned copper, sized for 150% of rated current and rated fault duty
5.20	Bus bar arrangement	Suitable for outdoor termination of HT cable size up to 2 x 3C x 300sqmm for each phase
5.21	Cutout space for Power Cable Entry	Suitable for outdoor termination of HT cable size up to 2 x 3C x 300sqmm for each phase. (Preferebly-400x400 mm^2)
5.22	External hardware for HT capacitor bank enclosure (nuts/bolts/handles)	Stainless steel
5.23	GA drawing	Manufacturer shall submit the G.A. Drawings for Capacitor Bank with mounting of series reactor inside the bank.
5.24	Power Frequency Withstand Voltage	28kVrms
5.25	Impulse Withstand Voltage	75kVp

6.0 SINGLE PHASE CAPACITOR UNIT

6.1	Single phase capacitor unit	Totally enclosed, leak proof, dust proof suitable for outdoor application, comprising individual capacitor elements connected in series & parallel groups. Continuous operating current shall be minimum 1.43 times to max. 1.65 times as per clause 6.2 of IS 13925.
6.2	Capacitor unit size	Preferred size is 200kVAR, however higher unit sizes may be considered if the space availability at site is scarce
6.3	Capacitor element	Developed from alternate layers of conducting metal foil & dielectric film
6.4	Conducting layer material	Aluminum foil
6.5	Dielectric material	Hazy Poly Propylene (APP), Double layer minimum
6.6	Cooling	Natural air
6.7	Impregnating liquid	Non PCB(Poly chlorinated Biphenyl), less toxic, with low bio-accumulation and bio-degradable liquid filled under vacuum
6.8	Capacitor unit enclosure	Fabricated from sheet metal CRCA steel of thickness 2mm minimum, hermetically sealed & hydraulically tested
6.9	Discharge device	For each single phase capacitor unit
6.10	Fuse	External HRC Fuse
6.11	Surge arrestor	Gap less metal oxide type
6.12	Rated voltage	9kV
6.13	Maximum continuous operating voltage	7.65kV
6.14	Discharge current	10 kA
6.15	Spare capacitor unit	One capacitor unit for each bank

7.0 VACUUM CONTACTOR FOR AUTO SWITCHING

7.1	Rated Voltages	12 KV
7.2	Rated Continuous Current	200% of full load current (minimum) of unit being switched
7.3	Rated Capacitor Switching Current	150% of full load current (minimum) of unit being switched
7.4	Frequency	50 Hz
7.5	Control supply	230 V Single phase AC supply
7.6	Type	Vacuum
7.7	Installation	Inside Enclosure
7.8	Mechanical Endurance	10000 operations (minimum)
7.9	Electrical Endurance	10000 electrical operations at rated capacitive switching current (minimum)
7.10	Indicator	To show number of operations

7.11	Trip lever	For emergency tripping operation
7.12	Closing lever	For capacitor bank discharging
7.13	Make	ABB/EPCOS/SHREEM

8.0 SERIES REACTOR

8.1	Series Reactor	Shall be provided fulfilling following requirement, a. Parallel switching of one bank with another two bank in service b. Suitable design calculation shall be submitted at the time of drawing approval c. Reactors shall be suitably designed to limit inrush current with proper calculation to be submitted to BYPL. d. The series reactor shall be designed to suit the final capacity of Capacitor Bank e. The manufacturer shall submit the G.A. Drawings for Capacitor Bank with mounting of series reactor inside the bank
8.2	Series reactor continuous rating	0.2% of capacitor bank rating
8.3	Series reactor rated voltage	Same as capacitor bank rated voltage
8.4	Series reactor rated frequency	50Hz
8.5	Series reactor single phase unit connections	Connected between single phase capacitor units and neutral star point
8.6	Series reactor type	Dry type with air natural cooling
8.7	Series reactor power frequency withstand voltage	28 KV
8.8	Series reactor lightening impulse withstand voltage	75 KV
8.9	Series reactor short time withstand current rating for 3 seconds	16 times capacitor rated current at 130% rated voltage
8.10	Class of Insulation	F

9.0 RVT

9.1	Type	Resin cast suitable for Panel Mounting
9.2	Application	Indoor inside the outdoor panel
9.3	Connection	Star/Star-Open delta winding(11KV/Sqrt 3:110 V/Sqrt 3: 190 V)
9.4	Winding	Three winding Star/Star –Open Delta. Secondary winding in Star shall be for Metering and

		secondary winding for open delta shall be for Residual/ Unbalance voltage Protection.
9.5	Protection	One RVT for All banks' protection. NDR (Neutral Displacement Relay) will not be in vendor's scope. Although its wiring shall be in vendor's scope.
9.6	Accuracy Class	0.5/ 3 PR
9.7	Nominal System Voltage	11 KV
9.8	Highest System Voltage	12 KV
9.9	Power frequency withstand voltage	28 kVrms(As per IS 13925 Part 1 Table 3A)
9.10	Lightning impulse withstand voltage	75 kV Peak(As per IS 13925 Part 1 Table 3A)

10.0 APFC

10.1	Installation	Indoor Type. To be fitted in VCB panel.
10.2	Power Factor Setting Range	0.7 Inductive to 0.7 Capacitive
10.3	DIs and DOs	DIs and DOs shall be as per control scheme suitable for auto switching of 3 phase, 7.2MVAR capacitor bank in three stages i.e steps of 1.8MVAR (0.6MVAR per phase). Automatic control has to be achieved by switching of vacuum contactors/switches provided in the capacitor bank to achieve the set power factor.Atleast 4 Dis and 4 Dos shall be spare for future use
10.4	Interface	Scada Compatible with RS-485 communication port and Modbus protocol. In case of any other port, suitable convertor shall be provided by the vendor) . Integration of APFC with RTU and Capacitor bank shall be in bidder's scope.
10.5	Operation	Both Automatic and Manual Mode. Shall switch ON and OFF the bank through vaccum contactor/switch as per the desired power factor value.Over riding provision shall also be made for electrical switching ON and OFF of the capacitor contactor/switch by operator from APFC panel.The switching ON operation should take place after period of 10 minutes. The switching OFF operation of relevant step shall be instantaneous.
10.6	Ingress Protection(Except for Terminals)	IP 42
10.7	Auxiliary Supply	220 VAC
10.8	Current Measuring	0 - 5A, suitable for CT x/1A and x/5A

10.9	Display	Power, Energy, Voltage, Current, Average PF, Missing Reactive Power, Supplied Reactive Power,Total no of switching of each vaccum contactor/isolator , ON and OFF indication of Vaccum contactor/switch, THD measurement with odd harmonics coefficient
10.10	Size	Maximum 150x150 mm^2
10.11	Logging	Recording of Electrical Data upto last 2 months in the form of Hourly Records, Fault Records and Daily Records
10.12	Protection	Over/Under Load, Over/Under Frequency, Load Unbalance, Over Current, Over Temperature
10.13	NDR Relay	Not Required
10.14	LED Required on APFC For ON and OFF Status of Each step	8

11.0 ISOLATOR

11.1	Installation	Outdoor
11.2	Rated Voltage	11 KV
11.3	Type	Single throw double break off, off load type , triple pole horizontal gang operated with earth switch. Mechanical interlock should be provided between isolator and Earth Switch.
11.4	Operation Type	Manual

12.0 LIGHTNING ARRESTOR

12.1	Voltage Rating	9 kV
12.2	Type	Gapless ZnO type
12.3	Discharge Class	III
12.4	Nominal Discharge Current	10 kA

13.0 PERFORMANCE

13.1	Over voltage operation	as per IS 13925 part1
13.2	Over current operation	as per IS 13925 part1
13.3	Operating temperature category	+5/C as per IS 13925 part1
13.4	Discharge characteristic as per IS 13925 part1	a. Each capacitor single phase unit residual voltage after disconnection from mains supply

		shall be 50V (maximum) within 10 minutes b. Capacitor bank residual voltage after disconnection from mains supply shall be 50V (maximum) within 10 minutes
13.5	Power loss and tangent of Loss angle (tan δ)	To be specified by manufacturer as per IS 13925 part1

14.0 LABELS & FINISH

14.1	Rating plate for HT Capacitor bank	
14.2	Material	Anodized aluminum 16SWG
14.3	Background	Satin silver
14.4	Letters, diagram & border	Black
14.5	Process	etching
14.6	Bank Name plate details	Mfg name, Mfg Sr. No., Month & year of Mfg, equipment type, total output rating, Bank Capacitance in µF, Bank watt losses, Owner name & order number, Temp. category, connection diagram, Warranty period, Customer care Number
14.7	Rating plate for each single phase capacitor unit	Anodized aluminum with white character on black background and details as per clause no 10.1 of IS 13925
14.8	Unit Name plate details	Mfg name, Mfg Sr. No., Month & year of Mfg, equipment type, total output rating, unit Capacitance in µF, unit watt losses, Temp. category, Discharge device rating, connection diagram, Owner name & order number, Guarantee period, unit wt. in kG,
14.9	Danger plate on front & rear side of wired mesh enclosure	Anodized aluminum with white letters on red background
14.10	Painting - Capacitor single phase unit	
14.11	Surface preparation	Shot blasting or chemical 7 tank process
14.12	External finish	Powder coated pure-polyester base Mat finish, shade– Siemens Gray RAL 7032, uniform thickness 50 microns minimum
14.13	Painting–frame enclosure	a. Chemical 7 tank process for surface b. Hot dipped Galvanized with uniform thickness 65 microns minimum as per IS 2629 and 4759.
14.14	SLD	SLD of Approved drawing must be engraved in inside the enclosure door

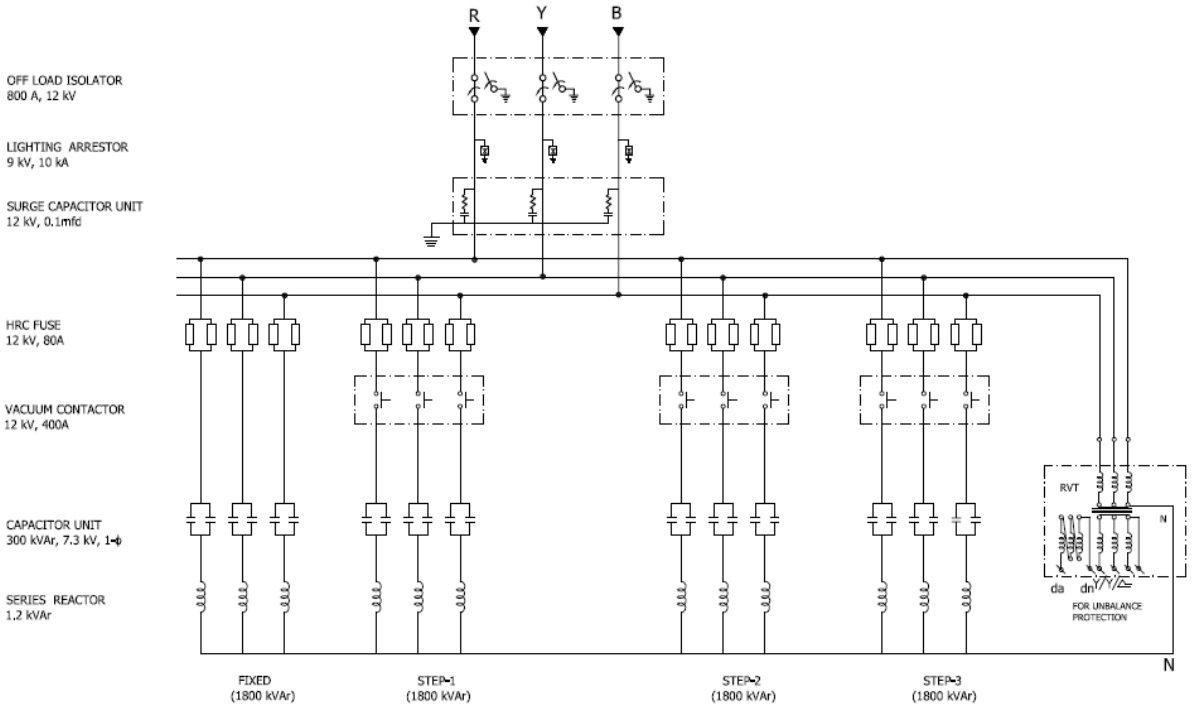
15.0 APPROVED MAKES OF COMPONENTS

15.1	APFC	Beluk/ABB/EPCOS/Shreem
15.2	Vacuum Contactor	ABB/ EPCOS/Shreem
15.3	RVT	Pragati/Kappa
15.4	Electromechanical Relays	Alstom/Schneider/Siemens/ABB/ER
15.5	Miniature Relays	ABB/Jyoti/Omran
15.6	Contactors	ABB/Siemens/Telemechanique
15.7	Instrument transformers	ECS/ Pragati/ Gemini/Schneider/CGL/Kappa/Narayan power tech
15.8	MCBs	Siemens/Schneider/Legrand/ABB
15.9	Control switches	Switron/Kaycee
15.10	Test terminal blocks	IMP/Schneider/Alstom
15.11	Terminal blocks	Elmex/Connectwell
15.12	Indicating lamps	Siemens/ Teknic/ Binay
15.13	Surge Suppressors	Oblum/Tyco
15.14	Meters	Rishabh/Conzerv

16.0 INSPECTION & TESTING

16.1	Type test	Equipment of type tested quality only, type test certificate to be submitted along with offer.
16.2	Routine test	As per relevant Indian standard
16.3	Acceptance test as per IS	To be performed in presence of Owner at manufacturer works, as per relevant Indian standard along with BOM.

17.0 TYPICAL SCHEME OF HT CAPACITOR BANK



18.0 MANDATORY SPARES

Following spares have to be provided for each capacitor bank set of 7.2 MVAR

a. Capacitor Units – 2 nos
b. Series Reactors – 2 nos
c. Vacuum Switch/ Contactor – 2 nos

19.0 DRAWING AND DATA SUBMISSION MATRIX

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

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
19.1	Contact Person Name, Email ID and Mobile Number	Required			
19.2	Consolidated Deviation Sheet	Required	Required		
19.3	GTP	Required	Required		

19.4	Relevant Type Test as per IS/IEC	Required			
19.5	Power Cable and control cable Philosophy and Schedule		Required		
19.6	Manufacturer's quality assurance plan and certification for quality standards		Required		
19.7	Sizing Calculation of Associated Equipment		Required		
19.8	Recommended Spares Apart from spares stated in Spec(for five years of operation)		Required		
19.9	**11 kV Auto Switched Capacitor Bank**				
19.9.1	General Arrangement	Required	Required		
19.9.2	Sectional Layout		Required		
19.9.3	Door Layout		Required		
19.9.4	SLD	Required	Required		
19.9.5	Schematic Circuit diagram and Scheme		Required		
19.9.6	Bus Bar Arrangement		Required		
19.9.7	QAP		Required		
19.9.8	BOQ		Required		
19.9.9	Logic Operation Diagram		Required		
19.9.10	Plan		Required		
19.9.11	Interlock Diagram		Required		
19.9.12	Foundation Diagram		Required		
19.9.13	DI sheet		Required		
19.9.14	DO Sheet		Required		
19.9.15	TB Details		Required		
19.9.16	Make of all Component as per specification		Required		

19.9.17	Drawing of Outdoor yard providing Position of Capacitor Bank		Required		
19.10	Installation, erection and commissioning manual for Bank		Required		
19.11	Inspection Reports			Required	
19.12	As manufacturing Drawings			Required	
19.13	Operation and Maintenance Manual			Required	Required
19.14	Trouble shooting manual			Required	Required
19.15	As built Drawings				Required
19.16	Test Report				Required
19.17	Weekly progress report				Required

20.0 GUARANTEED TECHNICAL PARTICULARS

S. No	Description	Specification Requirement	Bidder's Data
20.1	**General**		
20.1.1	Reference Standard	IS-13925,Part 1,2012	
20.1.2	Capacitor Scheme	3 Phase, 7.2 MVAR @ 12.65KV,Single Star with RVT protection.	
20.1.3	Switching	Auto switched in three steps of 1.8 MVAR with one fixed step of 1.8 MVAR	
20.1.4	Service location	Outdoor	
20.1.5	Connection	Single star for individual steps	
20.1.6	HT capacitor bank assembly	a. Individual single phase capacitor units mounted on steel stand / rack & connected externally by sleeved flexible copper connectors	
		b. Sleeves to be Red, Yellow, Blue, & Black in colour.	
20.1.7	Capacitor bank enclosure	No component shall be outside the enclosure	
20.1.8	Enclosure size	Max 6m X 1.5m	
20.1.9	Enclosure mounting	Panel mounted	
20.1.10	Degree of Ingress Protection for Bank Enclosure	IP55	
20.1.11	Enclosure side walls	CRCA metal with thickness of loaded parts-2mm and unloaded	

		parts-1.5mm	
20.1.12	Enclosure doors	Hinged, center opening, double leaf type, two doors provided on adjacent side walls with bolting as well as padlocking and interlocking facility.	
20.1.13	Peek hole	Peek hole shall be provided in each door to see the status of fuse of Capacitor Bank	
20.1.14	Exhaust Fan with Air filter And Canopy	Exhaust fan must ON when that particular bank is in ON condition	
20.1.15	Enclosure top cover	CRCA sheet metal 2mm thick with stiffeners	
20.1.16	Door Interlock	Solenoid type lock to avoid door opening (after tripping of breaker) for a minimum of 10 minutes.	
20.1.17	Earth Connection	All wire CRCA Sheet metal side walls/, doors & top cover shall be connected to each other by metallic jumper links, two earth studs with hole size for M10 bolt to be provided on enclosure frame bottom	
20.1.18	Bus bar for HV cable termination	One for each phase mounted on porcelain or epoxy insulators	
20.1.19	Bus bar material	Tinned copper, sized for 425 A rated current and Fault Current 26.3 kA for 3 Sec	
20.1.20	Bus bar arrangement	Suitable for outdoor termination of HT cable size up to 2 x 3C x 300sqmm for each phase	
20.1.21	Cutout space for Power Cable Entry	400x400 mm^2	
20.1.22	External hardware for HT capacitor bank enclosure (nuts/bolts/handles)	Stainless steel	
20.1.23	Power Frequency Withstand Voltage	28kVrms	
20.1.24	Impulse Withstand Voltage	75kVp	
20.2	**Capacitor Unit**		
20.2.1	Make		
20.2.2	Continuous operating current	Continuous operating current shall be minimum 1.43 times to max. 1.65 times as per clause 6.2 of IS 13925.	
20.2.3	Capacitor unit size	Preferred size is 200kVAR, however higher unit sizes may be considered if the space availability at site is scarce	
20.2.4	Capacitor element	Developed from alternate layers of conducting metal foil & dielectric film	
20.2.5	Conducting layer material	Aluminum foil	

20.2.6	Dielectric material	Hazy Poly Propylene (APP), Double layer minimum	
20.2.7	Cooling	Natural air	
20.2.8	Impregnating liquid	Non PCB(Poly chlorinated Biphenyl), less toxic, with low bio-accumulation and bio-degradable liquid filled under vacuum	
20.2.9	Capacitor unit enclosure	CRCA steel of thickness 2mm minimum, hermetically sealed & hydraulically tested	
20.2.10	Discharge device	For each single phase capacitor unit	
20.2.11	Fuse	External HRC Fuse	
20.2.12	Surge arrestor	Gap less metal oxide type	
20.2.13	Rated voltage	9kV	
20.2.14	Maximum continuous operating voltage	7.65kV	
20.2.15	Discharge current	10 kA	
20.2.16	Losses	≤0.2 Watts/kVAR	
20.2.17	Power Frequency Withstand Voltage	28 kVrms(As per IS 13925 Part 1 Table 3A)	
20.2.18	Impulse Withstand Voltage	75 kV Peak(As per IS 13925 Part 1 Table 3A)	
20.2.19	Discharging Values	Less than 50 V in 10 Minutes	
20.3	**VACUUM CONTACTOR**		
20.3.1	Make	ABB/EPCOS/SHREEM	
20.3.2	Reference Standard	IEC 62271-103/IS 9920 (Part IV)	
20.3.3	Rated Voltages	12 KV	
20.3.4	Rated Continuous Current	≥164 A	
20.3.5	Rated Capacitor Switching Current	≥124 A	
20.3.6	Short Time withstand current for 1 sec		
20.3.7	Power Frequency Withstand Voltage	28 kVrms(As per IS 13925 Part 1 Table 3A)	
20.3.8	Impulse Withstand Voltage	75 kV Peak(As per IS 13925 Part 1 Table 3A)	
20.3.9	Opening Time(lower and Upper limit)	35/60 ms	
20.3.10	Closing Time(lower and Upper limit)	60/90 ms	
20.3.11	Frequency	50 Hz	
20.3.12	Control supply	230 V Single phase AC supply	
20.3.13	Type	Vacuum	
20.3.14	Installation	Inside Enclosure	
20.3.15	Mechanical Endurance	10000 operations (minimum)	
20.3.16	Electrical Endurance	10000 electrical operations at rated capacitive switching current (minimum)	

20.3.17	Indicator	To show number of operations	
20.3.18	Trip lever	For emergency tripping operation	
20.3.19	Closing lever	For capacitor bank discharging	
20.4	**Series Reactor**		
20.4.1	Make		
20.4.2	Reference Standard	IS:5553 (Part 3)	
20.4.3	Series Reactor	Submission of Suitable design Calculation	
20.4.4	Series reactor continuous rating	1.2 kVAR	
20.4.5	Series reactor rated voltage	Same as capacitor bank rated voltage	
20.4.6	Series reactor rated frequency	50Hz	
20.4.7	Series reactor single phase unit connections	Connected between single phase capacitor units and neutral star point	
20.4.8	Series reactor type	Dry type with air natural cooling	
20.4.9	Series reactor power frequency withstand voltage	28 kVrms(As per IS 13925 Part 1 Table 3A)	
20.4.10	Series reactor lightening impulse withstand voltage	75 kV Peak(As per IS 13925 Part 1 Table 3A)	
20.4.11	Rated Current	82.15A	
20.4.12	Series reactor short time withstand current rating for 3 seconds	16 times capacitor rated current at 130% rated voltage	
20.4.13	Class of Insulation	F	
20.5	**RVT**		
20.5.1	Make		
20.5.2	Reference Standard	IS 3156	
20.5.3	Application	Indoor inside the outdoor panel	
20.5.4	Type	Resin cast suitable for Panel Mounting	
20.5.5	Connection	Star/Star-Open delta winding(11KV/Sqrt 3:110 V/Sqrt 3: 190 V)	
20.5.6	Accuracy Class	0.5/ 3 PR	
20.5.7	Nominal System Voltage	11 kV	
20.5.8	Highest System Voltage	12 kV	
20.5.9	Power frequency withstand voltage	28 kVrms(As per IS 13925 Part 1 Table 3A)	
20.5.10	Lightning impulse withstand voltage	75 kV Peak(As per IS 13925 Part 1 Table 3A)	
20.5.11	Winding	Three winding Star/Star –Open Delta. Secondary winding in Star shall be for Metering and secondary winding for open delta	

		shall be for Residual/ Unbalance voltage Protection.	
20.5.12	Protection	One RVT for All banks' protection	
20.6	**APFC**		
20.6.1	Make	Beluk/ABB/EPCOS/Shreem	
20.6.2	Reference Standard		
20.6.3	Installation	Indoor Type and To be fitted on VCB Panel	
20.6.4	Power Factor Setting Range	0.7 Inductive to 0.7 Capacitive	
20.6.5	DIs and Dos	4 Dis and 4 Dos shall be spare for future use	
20.6.6	Interface	Scada Compatible with RS-485 communication port and Modbus protocol. In case of any other port, suitable convertor shall be provided by the vendor) . Integration of APFC with RTU and Capacitor bank shall be in bidder's scope.	
20.6.7	Operation	Both Automatic and Manual Mode	
20.6.8	Ingress Protection	IP 54	
20.6.9	Auxilliary Supply	48-250 VDC	
20.6.10	Current Measuring	0 - 5A, suitable for CT x/1A and x/5A	
20.6.11	Display	Power, Energy, Voltage, Current, Average PF, Missing Reactive Power, Supplied Reactive Power,Total no of switching of each vaccum contactor/isolator , ON and OFF indication of Vaccum contactor/switch, THD measurement with odd harmonics coefficient	
20.6.12	Size	Maximum 150x150 mm2	
20.6.13	Logging	Recording of Electrical Data upto last 2 months in the form of Hourly Records, Fault Records anmd Daily Records	
20.6.14	Protection	Over/Under Load, Over/Under Frequency, Load Unbalance, Over Current, Over Temperature	
20.6.15	Space Required in Switchgear Panel for APFC		
20.6.16	NDR Relay offered	No	
20.6.17	Number of LED required on APFC for Cap bank ON and OFF status of	8	

	each stage		
20.7	**ISOLATOR**		
20.7.1	Make		
20.7.2	Reference Standard		
20.7.3	Installation	Outdoor	
20.7.4	Rated Voltage	11 KV	
20.7.5	Type	Single throw double break off, off load type ,triple pole horizontal gang operated with earth switch. Mechanical Interlock should be provided between isolator and Earth Switch	
20.7.6	Operation Type	Manual	
20.8	**Lightning Arrestor**		
20.8.1	Reference Standard	IS 3070-1993(Part-3)	
20.8.2	Voltage Rating	9 kV	
20.8.3	Type	Gapless ZnO type	
20.8.4	Discharge Class	III	
20.8.5	Nominal Discharge Current	10 kA	
20.8.6	Power frequency withstand voltage	28 kVrms(As per IS 13925 Part 1 Table 3A)	
20.8.7	Lightning impulse withstand voltage	75 kV Peak(As per IS 13925 Part 1 Table 3A)	
20.9	**Labels and Finish**		
20.9.1	Rating plate for HT Capacitor bank		
20.9.2	Material	Anodized aluminum 16SWG	
20.9.3	Background	Satin silver	
20.9.4	Letters, diagram & border	Black	
20.9.5	Process	etching	
20.9.6	Bank Name plate details	Mfg name, Mfg Sr. No., Month & year of Mfg, equipment type, total output rating, Bank Capacitance in µF, Bank watt losses, Owner name & order number, Temp. category, connection diagram, Warranty period, Customer care Number	
20.9.7	Rating plate for each single phase capacitor unit	Anodized aluminum with white character on black background and details as per clause no 10.1 of IS 13925	
20.9.8	Unit Name plate details	Mfg name, Mfg Sr. No., Month & year of Mfg, equipment type, total output rating, unit Capacitance in µF, unit watt losses, Temp. category, Discharge device rating, connection	

		diagram, Owner name & order number, Guarantee period, unit wt. in kG,	
20.9.9	Danger plate on front & rear side of wired mesh enclosure	Anodized aluminum with white letters on red background	
20.9.10	Painting - Capacitor single phase unit		
20.9.11	Surface preparation	Shot blasting or chemical 7 tank process	
20.9.12	External finish	Powder coated pure-polyester base Mat finish, shade– Siemens Gray RAL 7032, uniform thickness 50 microns minimum	
20.9.13	Painting–frame enclosure	a. Chemical 7 tank process for surface	
		b. Hot dipped Galvanized with uniform thickness 65 microns minimum as per IS 2629 and 4759.	
20.9.14	SLD	SLD of Approved drawing must be engraved in inside the enclosure door	

TECHNICAL SPECIFICATION

FOR FIRE PROTECTION SYSTEM

For BYPL GRID S/STN.

Prepared by		Reviewed by		Approved by		Rev	00
Name	Sign	Name	Sign	Name	Sign	Date	2 May 2019
GG		JN		RK			

1 Automatic fire detection system

The new panel room / Switch gear room and cable galleries/ cable cellar to be installed with the fully addressable smoke detectors compactable to the existing panel and the smoke aspiration system.

Details of the panel and the detectors are as follows.

SNO	ITEM	SPECIFICATION	MAKE
1	Digital addressable fire alarm panel (PX-16E/32E)	2-32 zone digitally addressable zones with each zone support 20 addressable devices, Network able, PC based graphic software for easy monitoring, support ASES addressable MCP.	ASES
2	PA console	Keypad with feather touch switch for zone selection, gooseneck mike attached for announcement, main, Ac fail, fuse blown LED indication, inbuilt battery charger and battery upto 25AH.	ASES
3	Aspirating smoke detector system (ASD 531)	Alarm sensitivity range of 0.02%/m to 10%/m.	SECURITON
4	Photoelectric smoke detector	Tested and approved to EN54-7:2000, Bi-color LED detector status indicator. The distance between two detectors shall not be more than 6 meters	SYSTEM SENSOR
5	Rate of rise and fixed temperature thermal detector	Tested and approved to EN54-5:2000 class A1R	SYSTEM SENSOR
6	Digital addressable monitor module (PX-DA-MM)	Digital addressable communications, DIP switch for addressing of module,	ASES
7	Digital addressable manual call point	The points shall be so located to ensure that one or other call box is in approach of 22.5 meters.	ASES
8	Conventional Sounder		ASES
9	Talk Back unit	Compatibility with any make conventional two way communication system, integrated alarm test key features.	ASES
10	Sinages	At all exits, fire fighting equipments, evacuation signs, etc. auto glow type	Reputed

2 First Aid Fire Extinguishers

The first aid fire extinguishers are already place in the conspicuous places in the existing installations. The vendor has to provide the following quantity of first aid fire extinguishers of make Ceasefire or Minimax only.

Minimum Quantity of F.E for 33kV grid:

4.5 kg CO2	----	3 nos
22.5 kg CO2	----	4 nos
6 kg ABC (MAP 90)	----	3 nos
75kg ABC (MAP 90)	----	1 nos

Minimum Quantity of F.E for 66kV grid:

4.5 kg CO2	----	3 nos
22.5 kg CO2	----	8 nos
6 kg ABC (MAP 90)	----	3 nos
75kg ABC (MAP 90)	----	2 nos

3 Fire Bucket with Stand

Fire bucket stand having provision to hang 4 fire buckets with dry sand filled and a suitable top cover to avoid the ingression of water during rain. The fire bucket must comply with the IS 2546.

For 33 kv two stand, 8 buckets with dry sand filled.

For 66 kv Three stand, 12 buckets with dry sand filled

4 Fire Hydrant System

For outdoor grid S/Stn. Fire hydrant system to be installed in loop to cover the entire grid area. All the component of hydrant system to be provided in Red colour and rust free material as per relevant Indian standards.

S.NO.	ITEM	SPECIFICATION
1	Hydrant point	Hydrant point to be installed to cover whole area. The distance between two hydrant points shall not be more than 30 meters.
2	Water Storage Tank	Minimum storage capacity of 15000 Ltr.
3	Pump	An electric/diesel pump installed at static water tank to charge the wet-riser systems 280 LPM
4	Pump panel	Panel comprising starting, stopping and indicating devices of fire pump.
5	Hose Box with RRL hose pipe (15meter)	With every hydrant point
6	Pressure Switch	A switch connected on delivery line of fire pump, tank at pre-set pressure level so designed to automatically start the fire pump
7	Pressure Gauge	
8	Signage	

5 10 KG Modular fire extinguishers

Modular fire extinguisher (MAP 90) extinguishers serving an area of 100 sq. meter to be installed above the oil type distribution transformer and in cable cellar room/ cable gallery so as to cover whole area. The Portable modular FE, ABC (Stored Pressure) shall conform IS 13849. The Dry powder used in FE shall conform IS 4308

6 Fire Stops

Fire resistive stops to be provided at the locations where the trenches enter the S/stn., cable penetration as per IS12459.

7 Fire Wall

As per IEC/IS/CBIP/IEEE/CEA Guideline.

8 Nitrogen injection fire protection system / High velocity Spray system

For transformer of 10 MVA and above rating to be provided with Nitrogen injection fire protection system or with automatic high velocity spray system designed and installed as per IS15325

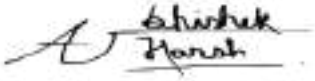
Note: The power supply to fire protection systems like fire pumps, fire alarm system, PA system, exit signage lighting, emergency lighting shall be from normal and emergency power sources with changeover facility (Ref.CEA guideline 2010).

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	 3267d7e3-82b5-46eb-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

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

FOR

SF6 GAS HANDLING KIT

Contents

1.0 SCOPE

- This specification covers design, manufacture, testing at manufacturer's works, packing and delivery of SF6 Gas Handling Kit.
- The SF6 Gas Handling kit 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. Such parts that may have not been specifically included, but otherwise form part of the kit as per standard trade and/or professional practice and/or are necessary for proper operation of Gas Handling kit, will be deemed to be included in this specification.

2.0 SERVICE CONDITIONS

2.1	Max Ambient Temperature	50 deg C
2.2	Max Daily average ambient temp	40 deg C
2.3	Min Ambient Temp	0 deg C
2.4	Maximum Humidity	95%
2.5	Minimum Humidity	10%
2.6	Maximum annual rainfall	750 mm
2.7	Average no of rainy days per annum	60
2.8	Rainy months	June to Oct
2.9	Altitude above MSL	300 M
2.10	Seismic Zone	IV

3.0 PARTICULARS

S. No	Parameter	BYPL Requirement	Vendor Data
3.1	Operating Voltage	230 VAC	
3.2	Operating Frequency	50 Hz	
3.3	SF6 Gas Recovery	Required	
3.4	Evacuation of SF6 gas from breaker into cylinder and refilling into the breaker	Required	
3.5	Residual gas recovery during filter change	Required	
3.6	Vacuum compressor for SF6 gas recovery	Required	
3.7	Vacuum pump for air	Required	

S. No	Parameter	BYPL Requirement	Vendor Data
3.8	Dry filter	Required	
3.9	Particle filter	Required	
3.10	Pressure reducer	Required	
3.11	Weighing scales for SF6 bottles	Digital	
3.12	Indication	In bar / mbar, Pa, psi / torr	
3.13	Dew Point Meter	Required	
3.14	SF6 bottle connection	Required	
3.15	Connecting Cable	3m	
3.16	Storage Device	Separately Required	
3.17	Hose	Two pipes of 5m each	
3.18	Breaker side coupling	Required	
3.19	Optional accessories	Required	
3.20	Recommended Spares	Required	
3.21	Make	Dillo,WIKA	

- Note- Any make other than specified in table above shall be subject to BSES Yamuna Power Limited Approval.

4.0 INSPECTION AND TESTING

4.1	Type test	Equipment of type tested quality only, type test certificate to be submitted along with offer.
4.2	Routine test	As per relevant Indian standard
4.3	Acceptance test as per IS	To be performed in presence of Owner at manufacturer works, as per relevant Indian standard along with BOM.

5.0 DEVIATION

Deviations from this Specification shall be stated in writing with the tender by reference to the Specification clause/GTP/Drawing and a description of the alternative offer. In absence of such a statement, it will be assumed that the bidder complies fully with this specification. No deviation will be acceptable post order.

6.0 GAURANTEED TECHNICAL PARTICLUARS

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

7.0 DRAWINGS AND DATA SUBMISSION MATRIX

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
7.1	Contact Person Name, Email ID and Mobile Number	Required	Required		
7.2	Deviation Sheet (as per “Deviations” Clause)	Required			
7.3	GTP		Required		
7.4	Relevant Type Test as per IS/IEC/UL	Required	Required		
7.5	Manufacturer's quality assurance plan and certification for quality standards		Required		
7.6	Sizing Calculation of Associated Equipment		Required		
7.7	Recommended Spares for five years of operation)		Required		
7.7.1	General Arrangement	Required	Required		
7.7.2	Sectional Layout		Required		
7.7.3	SLD	Required	Required		
7.7.4	Schematic Circuit diagram and Scheme		Required		
7.7.5	QAP		Required		
7.7.6	BOQ		Required		
7.8	Installation, erection and commissioning manual		Required		
7.9	Inspection Reports			Required	
7.10	As manufacturing Drawings			Required	
7.11	Operation and Maintenance Manual			Required	

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
7.12	Trouble shooting manual			Required	
7.13	As built Drawings				Required

8.0 PACKING

8.1	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.
8.2	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection & identification Label
8.3	Packing Identification Label to be provided on each packing case with the following details	
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	Project Details	
8.3.7	Manufacturer / Supplier's name	
8.3.8	Address of Manufacturer / Supplier / it's agent	
8.3.9	Description and Quantity	
8.3.10	Country of origin	
8.3.11	Month & year of Manufacturing	
8.3.12	Case measurements	
8.3.13	Gross and net weights in kilograms	
8.3.14	All necessary slinging and stacking instructions	
8.4	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.
8.5	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection & identification Label
8.6	Packing Identification Label to be provided on each packing case with the following details	
8.6.1	Individual serial number	
8.6.2	Purchaser's name	
8.6.3	PO number (along with SAP item code, if any) & date	

8.6.4	Equipment Tag no. (if any)
8.6.5	Destination
8.6.6	Project Details
8.6.7	Manufacturer / Supplier's name
8.6.8	Address of Manufacturer / Supplier / it's agent
8.6.9	Description and Quantity
8.6.10	Country of origin
8.6.11	Month & year of Manufacturing
8.6.12	Case measurements
8.6.13	Gross and net weights in kilograms
8.6.14	All necessary slinging and stacking instructions

9.0 SHIPPING

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

10.0 HANDLING AND STORAGE

10.1	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

SCADA NETWORK & INTEGRATION

PREPARED BY	APPROVED BY	REV	01
		DATE	26th Oct 2021
RK	AV	PAGE	1 OF 15

Rajeev Kr. Vishnoi
Dy. General Manager
SCADA, Distribution Automation
Emp. No. 41008983
BSES Yamuna Power Limited
A Joint Venture with Govt. of NCT of Delhi

ANIL VAISHY
Addl. Vice President
SCADA / DMS
Emp. No. 41002184
BSES Yamuna Power Ltd.
A Joint Venture with Govt. of NCT of Delhi

INDEX

1.0 SCOPE

A. This specification is intended to cover the supply, erection, testing and commissioning of SCADA Network and Integration associated hardware/software (like protocol converters), cables, accessories and other material required for interfacing of all electrical equipments with existing ABB RTU560 for efficient and trouble free operation.

A.1. ABB RTU panel is multi processor CMU05/CMR02 based having required nos. of co processor and main processor and having redundant power supply. Main processor is having Ethernet ports and serial ports. Ethernet port of main processor is connected to LAN Switch (to be provided by BSES) for communication with Master Control Centre on IEC 104 Protocol.

A.2. The co processors are having Ethernet ports which are responsible to communicate to all numerical relays and Digital RTCC on IEC 61850 protocol.

A.3. The co processors are having serial ports which are responsible to communicate to all multifunction meters (MFMs) and battery charger on Modbus protocol through RS485 network.

A.4. The main processors and co processors are having the licenses of IEC61850, MODBUS RTU MASTER & PLC, Archive, HMI, IEC 103 and IEC 104.

B. The devices i.e. Numerical relays, digital RTCC, MFMs, battery charger etc. on serial and LAN should have redundant media and redundant co processor connectivity.

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

2.0 SCADA NETWORK

2.1	INFRASTRUCTURE	i. All numerical relays & transformer monitoring units shall be connected to RTU in parallel redundancy protocol (PRP). ii. The communication shall be made in 1+1 mode, including the links between numerical relays & TMUs to switch and up to RTU, such that failure of one set of communication shall not affect the normal operation of system. However it shall be alarmed in RTU. iii. Data exchange is to be realized on dual star Bus topology using IEC 61850 protocol with a redundant managed switched on Ethernet communication infrastructure. iv. MFMs shall be connected to RTU through RS485 network with SPD so loop shall be prepared in daisy chain fashion. v. Devices connected to single loop shall not be more than 10 IEDs.

		vi. Network architecture shall be approved by BYPL SCADA team.
2.2	SCOPE OF WORK	i. Laying and termination of cat 6 cables from CRP switch to RTU Switch shall be done in suitable size of PVC Pipe. ii. Laying and termination of RS 485 cables shall be done in PVC Pipe of minimum 2 inch. iii. Laying and termination of FO patch cord from IEDs to CRP LAN Switch through suitable size PVC conduit.
2.3	SCOPE OF SUPPLY	i. All the hardware required to extend the relay signals to the RTU shall be supplied along with the switchboards. ii. Aux supply of these hardware devices shall be same as grid control voltage having wide range (-20% to +20%). iii. All communication hardware or protocol converters required for compatibility with existing RTU system shall be in bidder's scope.
2.3.1	Ethernet switches	The IEC 61850 compliant Managed Ethernet switch shall meet the demand of power system automation systems (IEC 61850-3, IEEE 1613 compliance). i. Ethernet switch shall be layer 2 industrial grade. ii. Ethernet switch shall be modular with SFP for copper and fiber port. iii. Ethernet switch port shall be approve by engineering in charge of SCADA. iv. Ethernet switch shall be 19" rack mounted. v. Ethernet switch shall operate at grid supply voltage with range +20% to -20% VDC. vi. Operating Temperature: -40°C to +85°C. vii. All port shall be user configurable with minimum configuration of 100Mbps. viii. Communication type: Fiber Optics media and ST/LC Connector compatible with IEDs supplied with CRP, As Per Site and Ethernet copper CAT6 OR above cable. Further approval at the time of final engineering approval. ix. LED indicators on all ports shall be blinking with data transfer. x. The switch should have a diagnostic/ error/ warning LED.

		xi. It should support remote user setting configuration. xii. It should own separate maintenance/ console port. xiii. Latency shall be not more than 10ms. xiv. Should be KEMA, CE and FCC Certified. xv. Switch should be extendable for future expansion. xvi. Minimum 20% spares of utilized hardware and accessories to be provided by the supplier/ BA. xvii. 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. xviii. Shall be suitably mounted in CRP/switchgear panel. xix. 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. xx. Power Supply of EFS shall be Dual redundant with pluggable terminal block. xxi. 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 xxii. Shall have Features: • Management through Web-based, Telnet, CLI • SNMP supported • Remote Monitoring • Diagnostics with logging and alarms • Console ports xxiii. 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.toIEEE802.3ad-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 serviceYes • acc. to IEEE 802.1Q-VLAN tagging Yes • acc. to IEEE 802.1Q-2005 (formerly IEEE 802.1s) MSTP Yes • acc. to IEEE 802.1w-RRS Yes • acc. to IEEE 802.1x-port based Network Access Control xxiv. Shall have Mode Store and Forward xxv. Shall have Protection class IP4X,Conformal Coating,IPV6 xxvi. Shall have Authorized Repair center of original Ethernet switch manufacture in India. xxvii. Shall have Uplink Rate 1 GBPS and Downlink Rate 100 MBPS BYPL approved Makes Make 1 Ruggedcom 2 Hirschmann The specified makes are to be strictly adhered to and no change will be considered hereto.
2.3.2	Interface between Numerical Relay and switch	LC/ ST multimode duplex fibre optic patch cords connecting the numerical relay to switch shall be supplied by the bidder.. Make- Preston or equivalent
2.3.3	Interface between RTU and Ethernet switch	CAT 6 STP Cable shall be in bidder scope. Make- D-link, Belden or equivalent
2.3.4	Interface between MFM and RTU	RS485 Belden class cable shall be provided by bidder. Make- Belden or equivalent
2.3.5	Communication hardware	All hardware like LAN Switch, FO cables, protocol converters required for interfacing IEDs like protection relays, multifunction meters, transformer monitoring relays, battery charger controllers etc. to RTU should be included in scope of supply.

3.0 SCADA INTEGRATION

3.1	INFRASTRUCTURE	Numerical relays should be IEC 61850 compatible having dual fibre PRP optic ports. Through these ports relays shall be connected to CRP switches that further extended to existing RTU system through CAT6 LAN cable.
3.2	SCOPE OF WORK	i. Configuration of IEDs (primary, backup) and multifunction meters for SCADA signals as per Annexure 1: Signals related with 11KV panels and Annexure 2: Signals Related with MFM to communication the same in existing RTU 560A Co Processor CMU05/CMR02. ii. For communication configuration and troubleshooting of Relays and MFM, required software, ICD file (IED configuration description file), SCD file (substation configuration description file), communication cables and documents to be handed over to team SCADA BYPL. iii. Providing protocol mapping/node details for signals listed in Annexure 1: Signals related with 11KV panels and Annexure 2: Signals Related with MFM and communication configuration details for RTU configuration. iv. Simulation of all configured signals (Annexure 1: Signals related with 11KV panels and Annexure 2: Signals Related with MFM) over LAN on IEC 61850 and over RS 485 on modbus on separate terminal with same configuration settings. v. Testing & commissioning of Numerical relays, and Multifunction meters for all related signals upto RTU. vi. Testing of Indications, Command, Interlocks as per scheme, Relay soft interlock testing from Relay HMI as well as simulation of SCADA command through configured output of Relay. vii. Downloading of Disturbance records and uploading/downloading of configuration file to and from IEDs facility from remote through switches at pre decided IPs shall be provided. viii. Demonstration of operational compatibility with SCADA. ix. Point to Point testing all signals to BYPL SCADA at MCC and BCC.

3.3	SCOPE OF SUPPLY	
3.3.1	Configuration Software and Tools	All software and configuration tools required for configuration of SCADA Network should be included in scope of supply.

4.0 SPARES

4.1		i. Bidder shall submit list of recommended spares for BSES BYPL SCADA approval. ii. Recommended minimum 20% spares of supplied SCADA accessories for SCADA interface to be supplied by bidder. Price for spares shall be included in CRP package. All spares shall be tested in our premises

5.0 DOCUMENTATION

5.1	Documents for approval	i. The bidder shall ensure that all necessary drawings, write-up, information, etc required to fully describe the equipment are to be submitted for approval. ii. The manual shall clearly indicate in English the installation and connection method. Check up, maintenance and calibration method shall also be provided in the manuals.

6.0 TRAINING

5.1	Training at site	Training to BYPL SCADA's engineers at site by domain expert (two day training- one day in classroom and one day on site) with hands on.

7.0 DEVIATIONS

6.1	Deviation	Deviations from this Specification shall be stated in writing with the tender by reference to the Specification clause/GTP/Drawing and a description of the alternative offer. In absence of such a statement, it will be assumed that the bidder complies fully with this specification. No deviation will be acceptable post order.

Annexure 1 (Signal List- 11kV)

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	✓		SPI
4.	Spring Charge	✓		SPI
5.	Breaker in Service	✓		SPI
6.	Breaker in Test	✓		SPI
7.	Auto Trip (86) Operated	✓		SPI
8.	Panel DC Fail	✓		SPI
9.	L/R switch in SCADA	✓		SPI
10.	Relay Int Fault	✓		SPI
11.	Over Current Operated	✓		SPI
12.	Earth Fault Operated	✓		SPI
13.	BKR Close COMMAND		✓	DCO
14.	BKR Open COMMAND			
15.	Auto Trip (86) relay reset from Remote		✓	SCO
16.	3Phase R, Y, B- Current & Voltage, Active Power, Reactive Power, Power factor, Max. Demand, Neu. Current	✓		AI/ MV
17.	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

Note: Signals like Panel DC Fail and Relay Int Fault to be taken from adjacent panel

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	✓		SPI
4.	Spring Charge	✓		SPI
5.	Breaker in Service	✓		SPI
6.	Breaker in Test	✓		SPI
7.	Auto trp (86) Operated	✓		SPI
8.	VT fuse Blown- Metering	✓		SPI
9.	VT fuse Blown- Protection	✓		SPI
10.	Panel DC 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.	Under Voltage Prot. Operated	✓		SPI
16.	Over Voltage Prot. Operated	✓		
17.	REF Operated	✓		SPI
18.	BKR Close COMMAND		✓	DCO
19.	BKR Open COMMAND			
20.	Auto trip (86) relay reset from Remote		✓	SCO
21.	3Phase R, Y, B- Current & Voltage, Active Power, Reactive Power, Power factor, Max. Demand, Neu. Current	✓		AI/ MV
22.	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

Note: Signals like Panel DC Fail and Relay Int Fault to be taken from adjacent panel

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	✓		SPI
4.	Spring Charge	✓		SPI
5.	Breaker in Service	✓		SPI
6.	Breaker in Test			SPI
7.	Auto trip (86) Operated	✓		SPI
8.	Panel DC Fail	✓		SPI
9.	L/R Switch in SCADA			SPI
10.	Relay Int. Fault	✓		SPI
11.	PT MCB- Metering operated	✓		SPI
12.	PT MCB- Protection operated	✓		SPI
13.	Over Current Operated	✓		SPI
14.	Earth Fault Operated	✓		SPI
15.	BKR Close COMMAND		✓	DCO
16.	BKR Open COMMAND			
17.	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

Note: Signals like Panel DC Fail and Relay Int Fault to be taken from adjacent panel

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	✓		SPI
6.	Spring Charge	✓		SPI
7.	Breaker in Service	✓		SPI
8.	Breaker in Test	✓		SPI
9.	Master Trip (86) Operated	✓		SPI
10.	Bus PT fuse Blown-Metering	✓		SPI
11.	Bus PT fuse Blown-Protection	✓		SPI
12.	Panel DC Fail	✓		SPI
13.	L/R Switch in SCADA	✓		SPI
14.	Over Current Operated	✓		SPI
15.	Earth Fault Operated	✓		SPI
16.	Under Volt. Prot. Operated	✓		SPI
17.	Over Volt. Prot. Operated	✓		SPI
18.	Neg. Phase sequence Operated	✓		SPI
19.	Timer Relay operated/ Normal	✓		DPI
20.	Relay Int. Fault	✓		SPI
21.	BKR Close COMMAND		✓	DCO
22.	BKR Open COMMAND			
23.	BANK ISO OPN		✓	DCO
24.	BANK ISO CLS			
25.	Master trip (86) reset from remote		✓	SCO
26.	3phase R, Y, B- Curr & Volt, React. Pow, Neu. Curr	✓		AI/ MV
27.	Fault current and phase indication of faulty phase viz. R, Y, B, Earth, Unbalance (O/C & E/F Relay), Disturbance	✓		AI

	Records, Fault Graphs for Remote diagnosis purpose			

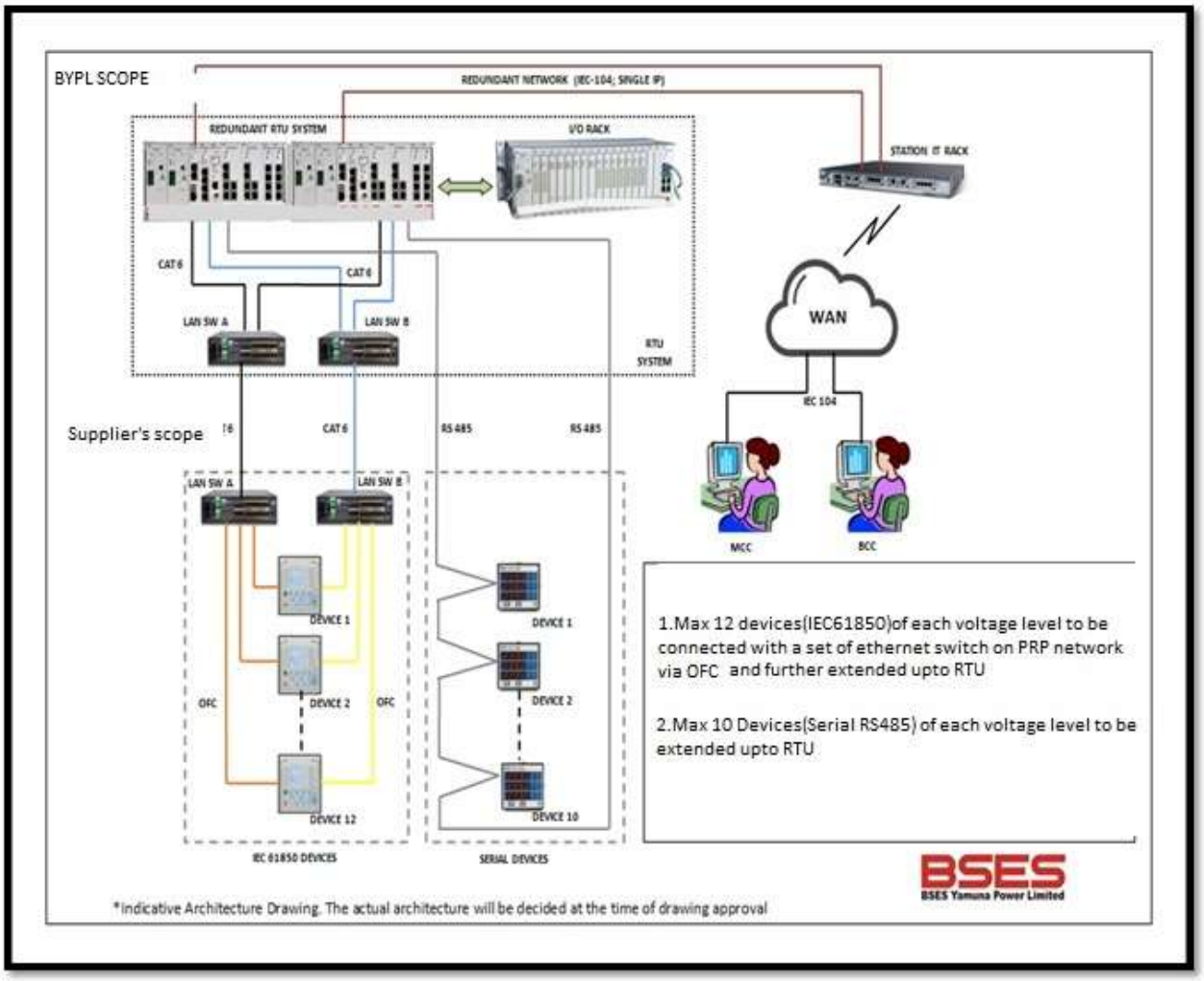
Annexure 2: Signals Related with MFM

Sr. No.	Signal Detail	Type of Signal on Modbus
	Measurement Signals	
1	Active Power	Measured Float
2	Current Bph	Measured Float
3	Current Rph	Measured Float
4	Current Yph	Measured Float
5	Frequency	Measured Float
6	Power Factor	Measured Float
7	Reactive Power	Measured Float
8	Voltage BR	Measured Float
9	Voltage RY	Measured Float
10	Voltage YB	Measured Float
11	Neutral Current	Measured Float
12	THD	Measured Float
13	Max Demand	Measured Float
14	Apparent power	Measured Float

(This is the indicative IO list, however the signal list may vary during the engineering time)

Annexure 4:

SCADA Network Architecture



Annexure 5: (List of Abbreviations)

1. SCADA: Supervisory Control and Data Acquisition
2. RTU: Remote Terminal Unit
3. C&R: Control and Relay
4. MFM: Multi Function Meter
5. BYPL: BSES Yamuna Power Ltd.
6. MCC: Master Control Center
7. BCC: Business Continuity Center
8. IED: Intelligent Electronic Devices
9. IEC: International Electrotechnical Commisssion
10. KEMA: Keuring van Elektrotechnische Materialen te Arnhem
11. CE: Conformité Européene
12. FCC: Federal Communications Commission
13. PRP: Parallel Redundancy Protocol
14. LAN: Local Area Network
15. NIFPS: Nitrogen Injection Fire Protection System
16. APFC: Automatic Power factor Controller
17. HMI: Human Machine Interface
18. PVC: Polyvinyl Chloride
19. OFC: Optical Fiber Cable
20. MV: Measured Value
21. SPD: Surge Protection Device
22. DCO: Double Command Input
23. DPI: Double Point Indication
24. MV: Measured Value
25. SCO: Single Command Input
26. SPI: Single Point Indication

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		

TECHNICAL SPECIFICATION

FOR

SPLIT AND WINDOW AC(1.5 TON)

Prepared by	Reviewed by	Approved by	Rev	00
AH	GS	AA	Date	11th Jan 2019

INDEX

1.0 SCOPE OF SUPPLY

a. This specification covers the design, manufacturing, testing, supply, erection and commissioning of Inverter based Split and Window AC of 1.5 Ton Capacity operating on Voltage 240 ± 10% volts as per specification. Accessories shall also be included in scope of supply.
b. This specification shall be used in conjunction with all specifications, data sheets, Scope of Work Document and other drawings attached to the tender.

2.0 CODES & STANDARDS

Indian Electricity Rules	
Indian electricity act	
CBIP manual	
IS 659 : 1964 (reaffirmed 1991)	Safety code for air-conditioning (revised) amendment 1
IS 660 : 1963 (reaffirmed 1991)	Safety code for mechanical Refrigeration
IS 11338 : 1965 (reaffirmed 1991)	Thermostats for use in refrigeration etc.
IS 2062 : 1992	Steel for general structural purpose
As per ASHRAE / ISI Air conditioning & Refrigeration Air-conditioning institute Standards.	Refrigeration
IS 4736 : 1968	Hot Dip Zinc Coated Steel Tubes
IS 638 : 1979 (reaffirmed 1993)	Gaskets
IS 4821	Specification for cables glands
IS 12065 : 1987	Permissible limits of noise level for rotating electrical machines

3.0 SERVICE CONDITIONS

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

4.0 WINDOW AC (1.5 TON)

Sr.No.	Specification	Description	Unit	Requirement
4.1	Capacity	Cooling	BTU/Hr.	18000
		Compressor	Type	Rotary
4.2	Coil			Copper
4.3	Coolant			R410A/RS32
4.4	Temperature Range	Cooling	Degree C	18 to 30^0C
4.5	Electricity Rating	Power Supply	Volt/Ph/Hz	230/Single/50
		Power Input(Cooling)	Watts	1850
		Running Current	Amps	8.5/7.5
4.6	Performance	BEE Star		5
		Air Circulation(Indoor/Outdoor)	CFM	480
		Moisture Removal	Lt/hr	2.3
		Noise Level (Indoor/Outdoor)	db	Less Than 46 db
4.7	Operation	Panel Display	Type	Twin/Dual LCD
		Remote Controller	Operation	LCD
4.8	Features	Auto Air Swing		Required
		Speed Setting	Cooling/Fan	3/3
		Operation Control		Electronic
		Auto Restart		Required
		Sleep Mode		Required
		On Timer		Required
		Off Timer		Required
		Dehumidification		Required

		Fuzzy Logic		Required
		Energy Saver		Required
		Child Lock		Required
		Filter Cleaning Indicator		Required
		Jet cool		Required
		Night Glow Buttons on Remote		Required
		Evaporator Type		
		Evaporator Fin Type		
		Condenser Fin Type		
4.9	Filters	Restriction of particles more than 1 Micron		Required
4.10	Filter Cleaning			Automatic
4.11	Dimensions	Width x Height x Depth	mm	
4.12	Net Weight		Kg	
4.13	Digital Stabilizer			Required
4.14	Accessories			Required

5.0 SPLIT AC (1.5 TON)

Sr.No.	Specification	Description	Unit	Requirement
5.1	Type			Inverter Based
5.2	Capacity	Cooling	BTU/Hr.	18000
		Compressor	Type	Rotary
5.3	Coils			Copper
5.4	Coolant			R410A/RS32
5.5	Temperature Range	Cooling	Degree C	18 to 30^0C
5.6	Electricity Rating	Power Supply	Volt/Ph/Hz	230/Single/50

		Power Input(Cooling)	Watts	1800
		Running Current	Amps	8.5/9
5.7	Performance	BEE Star		5
		Air Circulation(Indoor/Outdoor)	CFM	460/1485
		Moisture Removal	Lt/hr	2.5
		Noise Level (Indoor/Outdoor)	db	Less Than 36 db
5.8	Operation	Panel Display	Type	LCD
		Remote Controller	Operation	LCD
5.9	Features	Auto Air Swing		Required
		Speed Setting	Cooling/Fan	3/3
		Operation Control		Electronic
		Auto Restart		Required
		Sleep Mode		Required
		On Timer		Required
		Off Timer		Required
		Dehumidification		Required
		Chaos Logic		Required
		Fuzzy Logic		Required
		Jet cool		Required
		Evaporator Type		
		Evaporator Fin Type		
		Condenser Fin Type		
5.10	Filters	Restriction of particles more than 1 Micron		Required

5.11	Filter Cleaning			Automatic
5.12	Dimensions	Width x Height x Depth	Indoor(mm)	
			Outdoor(mm)	
5.13	Net Weight	Indoor	Kg	
		Outdoor		
5.14	Digital Stabilizer			Required
5.15	Accessories			Required

6.0 LABELS & FINISH

6.1	Name Plate Detail at Indoor and Outdoor Unit	
6.1.1	Material	Anodized aluminum 16SWG
6.1.2	Background	Satin silver
6.1.3	Letters, diagram & border	Black
6.1.4	Process	Etching
6.1.5	Name plate details	Mfg name, Mfg Sr. No., Month & year of Mfg, equipment type, total output rating, Owner name & order number, connection diagram, Warranty period, Customer care Number, Guarantee period, unit wt. in kG
6.1.6	Danger plate on front & rear side of wired mesh enclosure	Anodized aluminum with white letters on red background

7.0 APPROVED MAKES

7.1	Split and Window AC	Hitachi, OGeneral, Mitsubishi, Daikin,LG

.

8.0 SERVICES

Vendor shall submit the offer including 5 year comprehensive Warranty. This also replacement of any defective part, gas leakage, gas refilling etc. Vendor shall have after shall sale service in India.

9.0 INSPECTION & TESTING

9.1	Type test	Equipment of type tested quality only, type test certificate to be submitted along with offer.
9.2	Routine test	As per relevant Indian standard

9.3	Acceptance test as per IS	To be performed in presence of Owner at manufacturer works, as per relevant Indian standard along with BOM.

10.0 DRAWING AND DATA SUBMISSION MATRIX

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

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
10.1	Contact Person Name, Email ID and Mobile Number	Required			
10.2	Consolidated Deviation Sheet	Required	Required		
10.3	GTP	Required	Required		
10.4	Relevant Type Test as per IS/IEC	Required			
10.5	Manufacturer's quality assurance plan and certification for quality standards		Required		
10.6	Sizing Calculation of All Equipment		Required		
10.7	General Arrangement	Required	Required		
10.8	SLD	Required	Required		
10.9	Circuit diagram, Piping Diagram		Required		
10.10	QAP		Required		
10.11	BOQ		Required		
10.12	Plan		Required		
10.13	Make of all Component		Required		
10.14	Inspection Reports			Required	
10.15	As manufacturing Drawings			Required	
10.16	Operation and Maintenance Manual			Required	Required
10.17	Trouble shooting manual			Required	Required
10.18	As built Drawings				Required
10.19	Test Report				Required

11.0 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.

Technical Specification

For

High Voltage Test set

Specification No. SP-HVTS-26-R0

INDEX

Record of Revision

Clause No.	Change in Specification	Approved by	Rev

1.0 SCOPE OF SUPPLY

This specification covers the general requirements of design, manufacture, testing at manufacturer's works, packing and delivery at site of the **High voltage test set** along with necessary accessories, demonstration and training of use of the equipment at site.

2.0 STANDARDS & CODES

The manufacturing, rating & performance of **High voltage test set** shall conform to the latest edition of following standards:-

S No.	STANDARD	TITLE OF THE STANDARD
2.1	Latest Edition	Indian Electricity Rules 1956
2.2	Latest Edition	Indian Electricity Act 1910
2.3	IEC 61010	Safety requirements for electrical equipments for measurement, control & laboratory use
2.4	IS:2071 (part 1) / IEC:60060-1	High voltage test techniques Part 1 : General definitions & test requirements
2.5	IS 2071 (Part 3)	Methods of High voltage testing Part 3 : Measuring devices

3.0 SERVICE CONDITIONS

High voltage testing kit to be supplied against this specification shall be suitable for satisfactory operation under the following conditions:-

S No.	ENVIRONMENTAL CONDITION	REQUIREMENT
3.1	Ambient air temperature	0 deg C to 50 deg C
3.2	Relative Humidity	100%

4.0 DESIGN FEATURES

Sl. No.	Specifications	BSES Requirements
4.1	Application	Field testing of equipment
4.2	Make	Required
4.3	Type / Model No	Required
4.4	Rating	0-80kVdc, 5 mA continuous / 0-20kV dc, 10mA continuousm
4.5	Control	i. Continuously variable output with manual / microprocessor control based
		ii. Inbuilt dwell timer and preset timer functions
		iii. Backlit LCD panel to display all the test parameters and error messages
		iv. Voltage display: Accuracy 1.0%, resolution 0.1kV
		v. Current display: Accuracy 1.0%, resolution 0.1mA
4.6	Design	i. Rugged portable wheel mounted design
		ii. No assembly at site, except plugging of one control and one HV cable
		iii. HV transformer shall be air cooled & dry type.
		iv. HV terminals shall be corona free
		v. Protections like AC backfeed, return wave, transient and surge protection shall be provided
		vi. Indications like Mains On/Off and HV On/Off shall be provided
4.7	Metering	i. Digital output voltmeter with metering from HT side
		ii. Digital leakage ammeter with metering from the return leg
4.8	Safety provisions	i. Zero-start interlock and Safety interlock switch (hand-held)
		ii. Auto discharge facility
		iii. Earth connection open interlock with indication
		iv. Steel covers to be provided on the meters for protection
4.9	Power supply	240V AC±10%, 50Hz+3% / -5%
4.10	Ripple	HV DC output in full waves with less than 3% ripple
4.11	Essential Accessories	i. Water proof carry case
		ii. Flexible, screened HV cable, 15 meters
		iii. Power supply cable, 10 meters
		iv. Grounding cable, 10 meters

		v. Discharge rod with cable and earth-end clamp
		vi. Covers for HV male & female socket
		vii. Anodized aluminium instruction plate to be provided on equipment. Details to be mentioned on instruction plate will be provided post order.
4.12	Electromagnetic Compatibility (EMC)	Shall be suitable for 66kV substations
4.13	Safety category for the instrument	CAT IV as per IEC 61010
4.14	Valid calibration certificate	Shall be submitted
4.15	Other included features	
4.16	Warranty period	Shall be specified by the manufacturer
4.17	Weight	i. Specify the weight of test set
		ii. Specify the weight of complete package i.e test set and accessories along with carry case
4.18	Dimensions	i. Specify the dimensions of test set (L x W x H)
		ii. Specify the dimensions of carry case (L x W x H)
4.19	Type test reports	Shall be submitted
4.20	Demonstration of the test set	Shall be provided
4.21	Training for use of the equipment at site	Required

5.0 PACKING, SHIPPING, HANDLING & SITE SUPPORT

5.1	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.
5.2	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.
5.3	Packing Identification Label	On each packing case, following details are required:
5.3.1	Individual serial number	
5.3.2	Purchaser's name	
5.3.3	PO number (along with SAP item code, if any) & date	
5.3.4	Equipment Tag no. (if any)	

5.3.5	Destination	
5.3.6	Manufacturer / Supplier's name	
5.3.7	Address of Manufacturer / Supplier / it's agent	
5.3.8	Description	
5.3.9	Country of origin	
5.3.10	Month & year of Manufacturing	
5.3.11	Case measurements	
5.3.12	Gross and net weight	
5.3.13	All necessary slinging and stacking instructions	
5.4	Shipping	The seller shall be responsible for all transit damage due to improper packing.
5.5	Handling and Storage	Manufacturer instruction shall be followed.
5.6	Detail handling & storage instruction sheet / manual to be furnished before commencement of supply.	

6.0 DEVIATIONS

List of deviations shall be stated in writing with the tender by reference to the Specification clause / GTP/ Drawing. In absence of such a statement, requirements of the Specification shall be assumed to be met without exception by the bidder.

7.0 DOCUMENT SUBMISSION

The bidder has to submit the following documents along with bid:-

7.1	List of major customers using the offered product from last 5 years specifying details like customer name, PO no. and PO date, year of supply and supply quantity
7.2	Completely filled compliance GTP sheet as per clause 4.0 of this specification
7.3	Complete product catalogue, Manual and calibration certificate of the equipment
7.4	Type test reports
7.5	Deviation Sheet (if any)

TECHNICAL SPECIFICATION

FOR

INSULATION RESISTANCE TESTER

INDEX

Record of Revision

Clause No.	Change in Specification	Approved by	Rev

1.0. SCOPE OF SUPPLY

This specification covers the general requirements of design, manufacture, testing at manufacturer's works, packing and delivery at site of the **Insulation Resistance Tester** along with necessary accessories.

2.0. STANDARDS & CODES

The manufacturing, rating & performance of the Insulation Tester shall conform to the latest edition of following standards:-

S No.	STANDARD	TITLE OF THE STANDARD
2.1	Latest Edition	Indian Electricity Rules 1956
2.2	Latest Edition	Indian Electricity Act 1910
2.3	IEC : 61326	Electromagnetic Compatibility Requirement
2.4	IEC : 61010	Safety Requirement

3.0. SERVICE CONDITIONS

Insulation Tester to be supplied against this specification shall be suitable for satisfactory operation under the following conditions:-

S No.	ENVIRONMENTAL CONDITION	REQUIREMENT
3.1	Ambient air temperature	Highest 50Deg C Average 40Deg C
3.2	Minimum ambient air temperature	0 Deg C
3.3	Relative Humidity	100%

4.0. DESIGN FEATURES

S No.	SPECIFICATION	REQUIREMENT
4.1	Construction	Rugged fire retardant casing
4.2	Display	3 ½ Digital Backlit LCD type
4.3	Power supply	Line supply & Battery operated
4.4	Battery Type	To be specified by manufacturer

4.5	Battery Life	To be specified by manufacturer
4.6	Test Voltage Range	Adjustable from 500V - 5 KV (500,1000,2500 & 5000V range)
4.6.1	Resolution	To be specified by manufacturer
4.6.2	Voltage output accuracy	To be specified by manufacturer
4.7	Insulation Resistance Range	Upto 10TΩ
4.7.1	Resolution	To be specified by manufacturer
4.7.2	Accuracy	±1%
4.8	Timer	0 – 20 minutes
4.9	Facility for Polarisation Index measurement	Required (Applicable for EHV measurement)
4.10	Suitable for operations in 66KV switchyard	Required
4.11	Power Consumption	To be specified by manufacturer
4.12	Interference Rejection	2mA rms at 200V and above
4.13	Operating Temperature	-10 to 50 Deg C
4.14	Low Battery indication	Required
4.15	Size (Dimensions)	To be specified by manufacturer
4.16	Weight	To be specified by manufacturer
4.17	Ingress Protection	To be specified by manufacturer
4.18	Overload Protection	Required
4.19	Warranty	To be specified by manufacturer
4.20	Special Features (if any)	To be specified by manufacturer
4.21	Equipment Demonstration	Required
4.22	Training of use of equipment to be provided	Required
4.23	Standard Accessories with device	Required
4.23.1	Carry case	Required
4.23.2	Testing leads (15m)	Required
4.23.3	Test Probes & Alligator Clips	Required
4.23.4	Operating Manual / Catalogue	Required

5.0. PACKING, SHIPPING, HANDLING & SITE SUPPORT

5.1	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.
5.2	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.
5.3	Packing Identification Label	On each packing case, following details are required:
5.3.1	Individual serial number	
5.3.2	Purchaser's name	
5.3.3	PO number (along with SAP item code, if any) & date	
5.3.4	Equipment Tag no. (if any)	
5.3.5	Destination	
5.3.6	Manufacturer / Supplier's name	
5.3.7	Address of Manufacturer / Supplier / it's agent	
5.3.8	Description	
5.3.9	Month & year of Manufacturing	
5.3.10	Case measurements	
5.3.11	Gross and net weight	
5.3.12	All necessary slinging and stacking instructions	
5.4	Shipping	The seller shall be responsible for all transit damage due to improper packing.
5.5	Handling and Storage	Manufacturer instruction shall be followed.
5.6	Detail handling & storage instruction sheet / manual to be furnished before commencement of supply.	

6.0. DOCUMENT SUBMISSION

The bidder has to submit the following documents along with bid:-

6.1	Detailed list (clearly specifying PO No. with date, PO Quantity & Year of supply) of your major customer utilities like NTPC, Power Grid, State Electricity Boards, etc. for last five years. Provide performance certificates also.
6.2	Completely filled compliance GTP sheet as per clause 4.0 of this specification
6.3	Complete product catalogue and Manual
6.4	Relevant type test report/certificate (not more than 5 years old) from CPRI/ERDA.
6.5	Deviation Sheet (if any) List of deviations shall be stated in writing with the tender by reference to the Specification clause / GTP/ Drawing. In absence of such a statement, requirements of the Specification shall be assumed to be met without exception by the bidder.

TECHNICAL SPECIFICATION

FOR

CIVIL WORKS

Revision		1
Date		30.05.2022
Pages		Page 1 of 16
Prepared by	Akhilesh Chaudhary	Akhilesh chaudhary e51a1fdc-f95c-4395-a2f0-6f6296b356df
Reviewed by	Srinivas Gopu	5d32525e-ed3a-4f41-b1c7-b8a5e77d1519
Approved by	Gaurav Sharma	23dc2de2-95de-4472-99a7-dea873f472b6

Index

DocUUID : f1a119e1-aa1e-4223-a5f6-135a53c8b618

1 SCOPE

Specification covers design, engineering, material supply and civil works for new grid substations. All civil works shall satisfy the general technical requirements specified in other Sections of this Specification and as detailed below. They shall be designed to the required service condition / loads as specified elsewhere in this Specification or implied as per National and International Standards. Items/components of site not explicitly covered in the specification but required for completion of the project shall be deemed to be included in the scope.

2 CODES & STANDARDS

The following Indian Codes and Standards shall generally be used for design of civil and structural works. In all cases, the latest revisions with amendments, if any, shall be followed.

a. National Building Code of India

b. SP: 6 ISI handbooks for structural engineers.

c. IS: 2062 Specification for Structural Steel (Standard quality).

d. IS: 456 Code of practice for plain and reinforced concrete.

e. IS: 800 Code of practice for general construction in steel.

f. IS: 806 Code of practice for use of steel tubes in general building construction

g. IS: 808 Rolled steel beam, channel & angle sections

h. IS: 813 Scheme of symbols for welding.

i. IS: 816 Code of practice for use of metal arc welding for general construction in mild steel.

j. IS: 1080 Code of practice for design and construction of shallow foundations in soils (other than raft, ring and shell).

k. IS: 875 Code of practice for design loads (other than earthquake) for buildings and structures.

l. IS: 1893 Criteria for earthquake resistant design of structure

m. IS: 1904 Code of practice for foundations in soil:-General requirements

n. IS: 1905 Code of practice for structural safety of buildings

o. IS: 2074 Ready mixed paint, air drying, red oxide chrome, priming

p. IS: 2212 Code of practice for brick work

q. IS: 2911 Code of practice for design & construction of pile foundation

r. IS: 2950 Code of Practice for design and construction of raft foundations

s. IS: 2974 Code of Practice for design and construction of machine foundations

t. IS: 4326 Code of Practice for earthquake resistant design and construction of Buildings

u. IS: 8009 Code of Practice for calculation of settlement of foundations: (parts 1& 2)

v. IS: 1829 Code practice for protection of iron and steel (Part I to III) structures for atmosphere corrosion

w. IS: 13920 Code practice for ductile detailing of reinforced concrete structure subjected to seismic force

3 GENERAL GUIDELINES

a. Building Design shall be in accordance with National Building code of India and other relevant Indian Standards.
b. All civil works shall be carried out as per applicable Indian Laws, Standards and Codes. All materials shall be of best quality conforming to this specification, relevant Indian Standards and Codes.
c. The specifications are intended for general description of work, quality and workmanship. The Specifications are not however exhaustive to cover minute details and the work shall be executed according to relevant latest Indian Standards/IRC specifications/CPWD specifications. In the absence of the above, the work shall be executed according to the best prevailing practices in the trade, recommendations of relevant American or British Standards or to the instructions of BSES Project Manager. The IS standards/IRC specifications/CPWD specifications to be followed are mentioned in the technical specifications attached hereto. They shall be latest edition/version of the same issued 15 days prior to the date of opening of this tender. The Contractor is expected to get himself clarified on any doubts about the specifications, etc. before bidding and the discussions recorded in writing with BYPL in respect of interpretation of any portion of this document.
d. The Contractor shall furnish all design, drawings, labor, tools, equipment, materials, temporary works, constructional plant and machinery, fuel supply, transportation and all other incidental items not shown or specified but as may be required for complete performance of the Works in accordance with approved drawings, specifications and direction of BYPL
e. The work shall be carried out according to the design/drawings to be developed by the bidder and approved by BYPL. Bidder shall develop design/repair work keeping in view the functional requirement of the substation facilities and providing enough space and access for operation, use and maintenance based on the input provided by BYPL. Certain minimum requirements are indicated in this specification for guidance purposes only.
f. BYPL shall provide the land on as is basis; the bidder shall visit the substation site to ascertain the quantum of work, present condition of the land before submitting the offer. No request for commercial changes will be entertained post award of work due to any

DocUUID : f1a119e1-aa1e-4223-a5f6-135a53c8b618

claim related to site condition / plot condition. The layout and levels of all structure etc shall be made by the bidder at his own cost from the general grids of the plot and benchmarks set by the bidder and approved by BYPL in presence of engineer in charge.

g. The bidder shall provide all instruments, materials and personnel to BYPL for checking the detailed layout and shall be solely responsible for the correctness of the layout and levels. The contractor shall make his own arrangements for water and electricity.

h. The work shall be carried out according to the design / drawings to be developed by the Contractor and approved by BYPL. For all buildings, structures, foundations etc. necessary layout and details shall be developed by the Contractor keeping in view the functional requirement of the Sub-Station facilities and providing enough space and access for operation, use and maintenance based on the input provided by BYPL. Certain minimum requirements are indicated in this specification for guidance purposes only. However, the Contractor shall quote according to the complete requirements.

i. The Contractor shall take all necessary precautions to protect all the existing equipment's, structures, facilities & buildings, etc. from damage. In case any damage occurs due to the activities of the Contractor on account of negligence, ignorance, accidental or any other reason whatsoever, the damage shall be made good by the Contractor at his own cost to the satisfaction of the Engineer. The Contractor shall also take all necessary safety measures, at his own cost, to avoid any harm / injury to his workers and staff from the equipment & facilities of the power station.

j. During the progress of work, the Engineer will exercise supervision of the work to ensure that the technical provisions of the contract are being followed and the work is being executed accurately and properly. However, such supervision shall in no way relieve the Contractor of the responsibility for executing the work in accordance with the specifications.

k. Before submitting the bid, the Contractor shall inspect and examine the site and its surroundings and shall satisfy himself as to the nature of the ground and subsoil, the availability of materials necessary for completion of the work, means of access to site and in general shall himself obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect his offer. No extra claim consequent on any misunderstanding or otherwise shall be allowed.

4 SCOPE OF SUPPLY AND WORK

All material required for civil work mentioned in this specification is included in scope of supply of the bidder. For Major Works, kindly refer Scope of Supply and Scope of Work of tender document.

5 DESIGN AND EXECUTION CRITERIA

5.1 Design Criteria

a. The minimum grade of concrete shall be M-25 & Grade of Steel FY-415.

b. Limit state method of design shall be adopted unless specified otherwise in the specification.

c. For detailing of reinforcement IS: 2502 and SP: 16 shall be followed. Cold twisted deformed bars conforming to IS: 1786 shall be used as reinforcement. However, in specific areas mild steel (Grade I) conforming to IS:432 can also be used. Two layers of reinforcement (on inner and outer face) shall be provided for wall & slab sections having thickness of 150 mm and above. Clear cover to reinforcement towards the earth face shall be minimum 40 mm.

d. The procedure used for the design of the foundations shall be the most critical loading combination of the steel structure and or equipment and/or superstructure and other conditions, which produces the maximum stresses in the foundation or the foundation component and as per the relevant IS Codes of foundation design. Detailed design calculations shall be submitted by the bidder showing complete details of work proposed to be used.

e. Design shall consider any sub-soil water pressure that may be encountered following relevant standard strictly.

f. Necessary protection to the foundation work. If required shall be provided to take care of any special requirements for aggressive alkaline soil. Black cotton soil or any other type of soil, which is detrimental / harmful to the concrete foundations.

g. Foundation system adopted by Bidder shall ensure that relative settlement.

5.2 Design Loads for Equipment

Design criteria shall comprise the codes and standards used. Applicable climatic data including wind loads, earthquake factors maximum and minimum temperatures applicable to the building locations, assumptions of dead and live loads, including equipment loads, impact factors, Safety factors and other relevant information.

a. Loads of equipment shall be considered as per manufacturer's certified drawings.

b. The foundation shall be designed considering the net allowable bearing pressure of 200KN/m^2 at the depth of 2.0m from ground level.

c. Foundations shall be analyzed for all possible load combinations as per the relevant IS codes.

d. Minimum reinforcement shall be governed by IS: 2974 and IS: 456.

5.3 Cement

a. Unless otherwise specified or called for by Engineer, the fresh ordinary Portland cement conforming to IS-8112 of 1976 (latest revision) i.e. 43 grade shall be used for the works.

b. The record of cement shall be maintained in M.A.S register by the contractor and verified by engineer of the BYPL.

c. Cement shall be stored in a perfectly water-tight and well ventilated site store capable of accommodating cement to ensure continuity of the work and having a raised and perfect dry floor. Each parcel or consignment of cement shall be stacked separately therein to permit easy access for inspection and a record shall be kept so that each parcel or consignment may be identified. Cement which has become stale or otherwise unsuitable and any bags or the like containing hardened lumps or cakes of cement, consequent to storage at Contractor's site stores will be rejected and shall be removed from the site and disposed of as directed by the Engineer. The cost of such rejected quantities shall be borne by the Contractor.

5.4 Concrete

a. Design Mix of M-25 grades of concrete as per provisions of IS: 456 and other applicable codes shall generally be used for civil work. RMC must be of ACC/Ultratech/Shree cement.

b. The curing period shall commence immediately after the concrete is finally screened and continued a period of 21 days all civil works. The top and side surfaces of concrete shall be kept moist and be protected from the direct rays of the sun during the period. The Contractor shall submit to the Engineer's proposals for ensuring continuous protection of the concrete during the curing period.

5.5 Steel

The reinforcing bars shall be Fe-415 generally conform to various requirements of IS: 1786 (for High Strength deformed steel bars and wires for concrete reinforcement).

5.6 Aggregates

a. Aggregates shall consist of natural sand, crushed stone and gravel and shall be chemically inert, strong, hard, clean, durable against weathering of limited porosity, free from deleterious materials and shall conform to the applicable standards. If so desired by the Engineer, they shall be washed and screened.

b. Sampling and testing shall be as per the applicable standards and shall be carried out under the supervision of Engineer. The cost of all test, sampling, etc. shall be borne by the Contractor.

c. All coarse and fine aggregates shall be stacked separately and shall avoid contamination with foreign materials. Segregates aggregates shall be rejected.

d. The necessary arrangements for field test shall be done at site. The material testing register and weighing material register shall be maintained for field and lab mandatory test by the contractor's authorized site engineer, having degree in Civil Engineering or

DocUUID : f1a119e1-aa1e-4223-a5f6-135a53c8b618

minimum three year experience with diploma in civil egg. The copy of all the certificates shall be submitted to BSES officials.

5.7 Water

a. Water used for both mixing and curing shall be as per applicable standards.

b. Potable waters are generally satisfactory. Where water can be shown to contain an excess acid, alkali, sugar or salt, Engineer may refuse to permit its use.

c. Water test certificate provide by the vendor.

5.8 Bricks

a. Bricks having minimum 75kg/cm^2 compressive strength can only be used for masonry work. Contractor shall ascertain himself at site regarding the availability of bricks of minimum 75 kg/cm^2 compressive strength before submitting his offer.

b. Ensure that the bricks are free from cracks, war page and of uniform colour.

c. Manufacturer's test report & Material Test reports for all the materials shall be submitted for approval prior to the utilization for work.

d. Contractor shall make his own arrangements for the storage of adequate quantity of material.

5.9 Levelling, Excavation, Backfill & Compaction

a. Area shall be properly leveled before construction. If fill material is required, the fill material shall be suitable as per the requirement & level. The fill shall be such a material and the site so designed as to prevent the erosion by wind and water of material from its final compacted position or the in-situ position of undisturbed soil. Backfill material around foundations or other works shall be suitable for the purpose for which it is used and compacted to the density described under Compaction. If rocky strata available at site then bidder have to do all the necessary arrangements for rock cutting & its disposal.

b. The thickness of fill material under the foundations shall be such that the maximum pressure from the footing, transferred through the fill material and distributed onto the original undisturbed soil will not exceed the allowable soil bearing pressure of the original undisturbed soil. For expansive soils the fill materials and other protections etc. to be used under the foundation is to be got approved by BYPL. All the area excavated in due course of construction must be filled by vendor. The area of future bay must be filled by vendor up to the proper level of yard.

c. Whenever water table is met during the excavation, it shall be dewatered and water table shall be maintained below the bottom of the excavation level during excavation, concreting and backfilling.

d. Material unsuitable for founding of foundations shall be removed and replaced by suitable fill material and to be approved by BYPL. Excavated material not suitable or not required for backfill shall be disposed off in areas as directed by BYPL. Excavation and backfill for foundations shall be in accordance with the relevant IS code.

e. The density to which fill materials shall be compacted shall be as per, relevant IS and as per direction of BYPL. All compacted sand filling shall be confined as far as practicable. Backfilled earth shall be compacted to minimum 95% of the Standard Proctor's density at OMC. The sub grade for the roads and embankment filling shall be compacted to minimum 95% of the Standard Proctor's density at OMC. Cohesion less material sub grade shall be compacted to 70% relative density (minimum).

f. Anti termite chemical treatment shall be given to foundations of Enclosure, filling below the Enclosure floor etc. as per IS: 6313 and other relevant Indian Standards.

5.10 General Requirement Site Surfacing/Stone Filling

The material required for site surfacing/stone filling shall be free from all types of organic materials and shall be of standard quality, and as approved by BYPL. The material to be used for stone filling/site surfacing shall be uncrushed/crushed/broken stone of 20 mm nominal size (ungraded single size) conforming to Table 2 of IS:383 - 1970. Hardness, Flakiness shall be as required for wearing courses are given below:

a. Sieve Analysis limits (Gradation)
(IS: 383 - Table - 2)

Sieve Size	% passing by weight
40mm	100
20mm	85 – 100
10mm	0 – 20
	0 – 5

'One Test' shall be conducted for every 500 Cu.m.

b. Hardness

Abrasion value (IS: 2386 Part-IV) - not more than 40%
Impact value (IS: 2386 Part-IV) - not *more* than 30% and frequency shall be one test per 500 cum with a minimum of one test per source

c. Flakiness Index

One test shall be conducted per *500* cum of aggregate as per IS:2386 Part-I and maximum value is 25%

5.11 Admixtures & Additives

a. Only approved admixtures shall be used in the concrete for the Works. When more than one admixture is to be used, each admixture shall be batched in its own batch and added to the mixing water separately before discharging into the mixer. Admixtures shall be delivered in suitably labeled containers to enable identification.

b. Admixtures in concrete shall conform to IS: 9103. The waterproofing cement additives shall conform to IS: 2645. BYPL shall approve concrete Admixtures/ Additives.

c. The contractor shall use water-reducing set-retarding admixture in some of the concrete. The use of such an admixture will not be approved to overcome problems associated with inadequate concrete plant capacity or improperly planned placing operations and shall only be approved as an aid to overcoming unusual circumstances and placing conditions.

d. The water-reducing set-retarding admixture shall be an approved brand of Ligno-sulphonate type admixture.

5.12 Anti weed Treatment, Stone Spreading & PCC

a. The Contractor shall furnish all labour, equipment and materials required for complete performance of the work in accordance with the drawings specification and as per the direction of BYPL.

b. The contractor shall prepare the specified area before stone spreading. PCC must be carried out in two layers. First layer of 75 mm thickness nominal of grade 1:4:8 concreting and second layer of 75 mm thickness of grade 1:2:4 cement concrete.

c. Along with PCC Stone spreading of 100cm thickness shall be done.

d. Before taking up stone filling, anti weed treatment shall be applied in the specified area wherever gravel filling is to be done, and the area shall be thoroughly de-weeded including removal of roots. The recommendation of local agriculture or horticulture department shall be sought wherever feasible while choosing the type of chemical to be used. Nevertheless the effectiveness of the chemical shall be demonstrated by the contractor and monitored over a period of two to three weeks by the Engineer-in-Charge. The final approval shall be given. by Engineer-in-Charge and final approval given based in the results.

e. The anti weed chemical shall be procured from reputed manufacturers. The dosage and application of chemical shall be strictly followed as per manufacturer's recommendation. The contractor shall be required to maintain the area free of weeds for a period of 1 year from the date of application of 1st dose of anti weed chemicals.

f. In yard area red sand stone of 50 mm thickness must be laid above nominal PCC. Above sand stone gavel spreading of specified size must be laid.

5.13 Trench

a. Trench shall be of RCC type.

b. All the material wherever required for trenches shall be supplied by bidder.

c. Power Cable trench and Control cable trench shall be separate

d. The precast removable RCC covers (with lifting arrangement) as per the layout drawing shall be provided. The precast covers shall be constructed using RCC of M35 grade. Trench cover must be of pre-cast concrete of grade not less than M-35 of appropriate load bearing capacity.

e. Cable trench RCC covers shall be designed for self weight of top slab + UDL of 2000 Kg/m2 + concentrated load of 200 kg at centre of span on each panel.

f. Paved portion of cable trenches shall be repaired to withstand class AA Loading of IRC/relevant IS Code

g. The top of trenches shall be kept at least 100 mm above the finished ground level. The top of cable trench shall be such that the surface rain water do not enter the trench.

h. All metal parts inside the trench shall be connected to the earthing system at regular intervals.

i. Wherever required, all the construction joints of cable trenches i.e. between base slab to base slab and the junction of vertical wall to base slab as well as from vertical wall to wall and all the expansion, joints shall be provided with approved quality PVC water stops of approx. 230 x 5 mm size for those sections where the ground water table is expected to rise above the junction of base slab and vertical wall of cable trenches.

j. The repaired Cable trenches shall be blocked at the ends if required with brick masonry in cement sand mortar 1:6 and plaster with 15mm thick 1:6 cement and mortar.

k. Angles 50x50x6 mm (minimum) with lugs shall be provided for edge protection all round edges of repaired RCC cable/pipe trenches supporting covers.

l. Sealing of repaired cable trench must be made in such a manner that no rain water can accumulate in it.

m. If trench passes through road/load bearing path then Box Culvert of Appropriate load bearing shall be used.

n. All the floor openings in building shall be covered with 6mm thick Checkered plates

o. Trench in existing control room may be used for control cable/LT Power Cable laying but repairing and modification of the same shall be in vendor's scope. If new trench is required in control room then the same shall also be in vendor's scope.

5.14 Substation Building

a. Building Shall comply fire safety norms as per relevant IS.

b. Ground floor of the building shall be made for cable cellar

c. First floor of the building shall accommodate 11 kV and 33 kV Switchgear.

DocUUID : f1a119e1-aa1e-4223-a5f6-135a53c8b618

d. Second floor of the building, if applicable, shall accommodate auxiliary equipment as per scope of work of tender document.

e. Height of 3.5 meter is recommended for cable cellar. However, height of cable cellar room shall be finalized during detailed engineering based on functional requirements of switchgear. Operation and maintenance considerations shall also be taken into account.

f. Height of 4.5 meter is recommended for other floors, however it will be finalized during detailed engineering based on functional requirements of switchgear. Operation and maintenance considerations shall also be taken into account.

g. Clear space of 1m at the rear and 2.5 m in front is mandatory for all equipment to ensure ease of operation and maintenance. However, clearances shall be optimized subject to functional requirements of equipment during detailed engineering.

h. The minimum height of substation room/HV switch room/MV switch room shall be arrived at considering 1200 mm clearance requirement from top of the equipment to the below of the soffit of the beam.

i. There shall be two entries and two exits for each floor and room.

j. Motorized shutter shall be provided for entry and exit of switchgears.

k. Doors and windows shall be provided in Building wherever required.

l. Two staircases shall be provided in substation building with granite finish and SS Railing of 304 grade.

m. Kota stone shall be provided in cable cellar and switchgear room for flooring purpose.

n. Finishing of walls shall be with three coats of Plastic Paint i.e. two coats during installation and one coat at the time of handover.

o. Plaster work, putty and painting all around the building and common area with plastic paint

p. Epoxy flooring after installation of equipment on kota stone shall be provided in Switchgear room.

q. Level of cable cellar room shall be above 1200 mm from FGL.

r. Provision for Cable Entry and Exit in Switchgear room, Cable Cellar Room and capacitor bank room.

s. Provision of Lighting, Exhaust Fan, Ceiling Fan, Power Points For Cable Cellar and Switchgear Room shall be provided.

t. Water proofing in three layers shall be done in roof slab and ground floor trench. Proofing shall be done by using Dr Fixit chemical

DocUUID : f1a119e1-aa1e-4223-a5f6-135a53c8b618

u. In case the building height requires the fire safety norms to be followed then properly designed firefighting system must be installed as per the norms of Delhi fire Service Department. All necessary clearance and certificate required from Delhi fire department must be in the scope of bidder.

v. Green Building concept must be implemented in Substation Building design for maximum day lighting and ventilation.

5.15 Substation Road

a. Inside substation roads to be provided for access along with car parking for three cars and two Wheeler parking for three vehicles. Building and parking are in the scope of bidder. Layout of the roads shall be based on layout drawing for the substation. Parking areas shall be provided for Site personnel and visitors as per layout drawing. Adequate turning space for vehicles shall be provided and bend radius shall be set accordingly. It has to be connected suitably with roads.
b. All substation roads shall be constructed so as to permit transportation of all heavy equipment up to 60MT. The main approach roads upto Control Room Building and other relevant roads will be RCC/Cement Concrete Roads. The other connecting roads and pathways shall be of Paver blocks/ CC Road as per site requirement. The pavers blocks used for the roads shall be minimum 80mm thick with compressive strength not less than 450Kg/cm2.
c. Road construction shall be as per IRC standard.
d. Adequate provision shall be made for road drainage.
e. All the culverts and its allied structure (required for road/rail, drain, trench crossings, etc.) shall be designed for class AA loading as per IRC standard/IS code. All trenches inside the substation shall cross the road through culverts.

6 INTERFACING

The proper coordination & execution of all interfacing civil works activities shall plan in advance and execute in such a manner that interfacing activities do not become bottlenecks and dismantling, breakage etc. is reduced to minimum.

7 INSPECTION, TESTING & QUALITY CONTROL

a. Detailed field quality plan shall be submitted for approval.
b. Construction Quality shall be properly controlled by the bidder. Bidder shall work as per the Field Quality Plan provided by BYPL. All the Tests specified in the Field Quality Plan shall be done by bidder.

c. Weekly construction status will be updated by the bidder to BYPL to assure the work progress & the construction quality.

d. A Civil Engineer shall be deployed by the bidder for construction quality control. Civil Engineer has to review ongoing construction work, check materials and workmanship.

e. Necessary arrangements for field tests shall be done at site. Bidder has to do the following tests from NABL accredited labs:
   - Raw material test : For Cement, sand , aggregates, water, brick, Steel

- Cube Test for compressive strength of concrete

8 STATUTORY RULES

a. Contractor shall comply with all the applicable statutory rules pertaining to factories act (as applicable far the State). Fire Safety Rules of Tariff Advisory Committee. Water Act for pollution control and coordinate with forest department for necessary approval prior to tree cutting.
b. Plastering on structural members (in fire prone areas) etc. shall be made according to the recommendations of Tariff Advisory Committee.
c. Statutory clearance and norms of State Pollution Control Board shall be followed as per Water Act for effluent quality from plant.
d. Use of C&D waste material as per Order DPCC/EC/9311/WMC-11/2014-15/3044-3068 dt. 14.01.2020

9 DEVIATIONS

Deviations from this Specification shall be stated in writing with the tender by reference to the Specification clause/GTP/Drawing and a description of the alternative offer. In absence of such a statement, it will be assumed that the bidder complies fully with this specification. No deviation will be acceptable post order.

10 DOCUMENTATION

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

b. This list is not exhaustive but indicative of minimum requirement only. Final list of drawings shall be prepared by successful bidder during detailed engineering.

S. No	Detail of Document	Bid	Drawing Approval	Pre construction	Post construction
1	Design calculation, general arrangement drawings, foundation drawing & detailed erection / Construction drawings including R/F drawings for Sub-Station Control Room Building		Required		Required
2	Field quality plan		Required	Required	
3	Foundation design & drawing of all equipment foundations		Required		Required
4	Structural steel fabrication drawings for equipment support structure		Required		Required

S. No	Detail of Document	Bid	Drawing Approval	Pre construction	Post construction
5	Foundation design & drawing of Power Transformer		Required		Required
6	Design & drawing of transformer grating, firewall & burnt oil tank		Required		Required
7	Foundation design & drawing for lighting pole		Required		Required
8	Foundation design & drawing for Capacitor Bank, Auxiliary Transformer and design of fencing For both.		Required		Required
9	Complete fencing along with gate for the Sub-Station yard		Required		Required
10	Details of Indoor and Outdoor Cable Trenches with cable tray supports and trench covers		Required		Required
11	Design & drawing of Rainwater Harvesting System, sewerage system including septic tank, Water supply arrangement, landscaping, etc		Required		Required
12	Design & drawing of roads and complete drainage system (with final connection to Rain Water Harvesting recharge pit) within Sub-Station including crossings		Required	Required	Required
13	Design & drawing Security room		Required	Required	Required
14	Design & drawing NIFPS system & underground water tank		Required	Required	Required

11 APPROVED MAKES

S No	Item Detail	Approved make	Remarks
1	Exhaust fan	Crompton/Havells/Bajaj	
2	Lighting fixture	Havells/Crompton/Philips	
3	Air conditioning System	Voltas/carrier/Hitachi	
4	Structural Steel Built up Section	Tata/SAIL/Jindal	

DocUUID : f1a119e1-aa1e-4223-a5f6-135a53c8b618

S No	Item Detail	Approved make	Remarks
5	Ceramic tiles	Kajaria	Size not less than 600mm X 300 mm
6	Toilets fittings	Jaquar/Hindware make	
7	Toilet door	Green ply	Both Side laminated
8	Toilet Flooring	Kajaria	Anti skid tiles of Size 600 mm X 600 mm
9	Grid building floor	Kota Stone	
10	Glass door fittings	Ozone make	As per approved Drawings
11	Mortise Lock and Door closer	Dorset make	
12	Doors and Windows	Hindalco/Jindal	Aluminium powder coated
13	Electrical cable	Havells/Polycab/Finolex/KEI	
14	Electrical conduit	Setia	Heavy Duty
15	Switch socket	Anchor/Havells/Legrand	
16	Cement	ACC/Ultratech/J K Laxmi	
17	TMT Bar	Tata/Jindal/SAIL	
18	Plastic Paint	Asian/Nerolack/Berger	Three or more coat.
19	Sanitary pipes	Astral/Skipper/Ashirwad	Ring fitted
20	Almirah	Godrej/Tata	

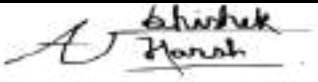
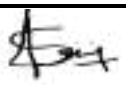
DocUUID : f1a119e1-aa1e-4223-a5f6-135a53c8b618

Technical Specification

of

Exhaust and Ventilation System

Specification no – BSES-TS-79-EAV-R0

Rev		0
Page		1 of 4
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 : 126a52a5-5e7f-412d-8626-971839cb2393

1. INTENT OF SPECIFICATION

This specification is intended to cover the design, manufacture, assembly, testing at manufacturer's works, supply & delivery, properly packed for transport at site of Air Conditioning system and Ventilation system for substation control room building complete with all materials and accessories for efficient and trouble free operation.

In the event of any discrepancy with the listed documents, the stipulation of this specification shall govern.

2. SCOPE OF SUPPLY

The following equipment shall be furnished with all accessories: -

2.1. Exhaust and supply air fans for ventilation
2.2. 5 star rated split air-conditioner for control room only
2.3. All necessary components for operation of the above equipment.
2.4. All wiring & accessories to complete the installation.
2.5. All relevant drawings, data & instruction manuals.

3. GENERAL REQUIREMENT

3.1. All equipment and material shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards except where modified and/or supplemented by this specification.

3.2. Equipment and materials conforming to any other standard, which ensures equal or greater quality, may be accepted. In such case copies of the English version of the standard adopted shall be submitted along with the bid.

4. DESIGN CRITERIA

4.1. Exhaust system

Industrial type Axial Exhaust fan of propeller type / axial type shall be provided for rooms with suitable drive motor, DOL starter, rain protection cowl with screen, grouting bolts etc. Fan for battery room shall be bifurcated type spark proof construction. The quantity shall be based on calculation. Minimum requirement is given in the subsequent sections.

4.2. Exhaust fan shall be supplied in:

a. Switchgear room – 3 no's heavy duty with sweep of 600mm
b. Battery Room – 2 no's with sweep of 600mm
c. Toilet – 1 no (200mm domestic exhaust fan)

4.3. Industrial type fan shall be provided as follows

a. Battery room – 1 No, air circulator 600mm
b. Control room – 3 No's, domestic 450mm sweep
c. Switchgear Room – 4 No's, air circulator 600mm

4.4. Air Conditioning

5 star Split air conditioners shall be provided in control room building of to maintain the temperature at 25 degrees Celsius. N-1 redundancy shall be provided for air-conditioning system. Make of air conditioners shall be Daikin / Hitachi/ O-General make.

4.5. All equipment, accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion.

5. DEVIATION

Deviations from this Specification shall be stated in writing with the tender by reference to the Specification clause/GTP/Drawing and a description of the alternative offer. In absence of such a statement, it will be assumed that the bidder complies fully with this specification. No deviation will be acceptable post order.

DocUUID : 126a52a5-5e7f-412d-8626-971839cb2393